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MIGRATION AND ECONOMIC DEVELOPMENT: A COMPUTABLE GENERAL EQUILIBRIUM APPROACH OF THE MOROCCAN CASE

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Résumé

En 2005, 191 millions de personnes, soit 3 pour cent de la population mondiale, vivent dans des pays où ils ne sont pas nés (Organisation des Nations Unies, 2006). Ce chiffre a augmenté de 155 millions par rapport à 1990, et est près de 2.5 fois plus élevé que le chiffre de 1965, révélant la croissance rapide des flux migratoires. Le taux de croissance de la migration internationale est bien plus élevé que le taux de croissance de la population mondiale au cours de la même période. Le nombre de migrants est susceptible d'être supérieur à 200 millions aujourd'hui (IOM, 2008).

Les pays développés ont absorbé 33 des 36 millions d'augmentation du nombre de migrants internationaux entre 1990 et 2005 (Organisation des Nations Unies, 2006). En outre, ces migrants sont souvent originaires des pays en développement. Selon Winters (2007), la migration Sud-Nord constitue 37% de l'émigration totale tandis que les parts de la migration Sud-Sud et Nord-Nord ne représentent que 24% et 16% respectivemt[1]. Concernant la migration de travail, trois principaux facteurs continuent d'alimenter ce mouvement du Sud vers le Nord: le "pull" du changement démographique et des besoins du marché du travail dans de nombreux pays industrialisés, le "push" de la croissance démographique, du chômage et de la crise dans les pays en développement, ainsi que la mise en place de réseaux inter-pays fondés sur la famille, la culture et l'histoire.

L'intérêt croissant des économistes dans la migration Sud-Nord a donné au Sud le statut de pays d'émigration et au Nord le statut de pays d'immigration. Toutefois,

[1] En tant qu'un seul pays, l'ex-Union soviétique (FSU) était marquée par des vagues de mobilité interne. Ainsi, une fois dissociée, de nombreuses personnes se retrouvent vivant dans un pays autre que celui de leur naissance. Le pourcentage restant concerne la migration FSU-FSU, Nord-FSU et Sud-FSU.

lorsque l'on regarde de près les données de migrations internationales, la migration Sud-Sud se trouve aussi importante que la migration Sud-Nord. Elle représente 47% de l'émigration totale des pays en développement contre 53% pour la migration Sud-Nord. La migration Sud-Sud l'emporte même dans certaines régions telles que l'Afrique subsaharienne (72%), l'Europe et l'Asie centrale (64%), et l'Asie du Sud (54%), d'après Ratha et Shaw (2007). L'ampleur des migrations Sud-Sud a fait de certains pays en développement des pays d'origine, de transit et de destination, à des degrés divers.

Imaginez un monde où les pays en développement ont à la fois le statut de pays d'émigration et d'immigration. Les flux de travailleurs augmentent la pression sur le marché du travail alors que les sorties de travailleurs allègent cette pression. Si les caractéristiques du marché du travail national sont prises en considération dans la décision d'émigration, la pression exercée par l'afflux de travailleurs augmente, d'une part, l'incitation à émigrer. La pression sur le marché du travail peut être encore aggravée par des flux migratoires internes entre régions à l'intérieur des pays en développement. La migration interne a été largement documentée (voir par exemple Saith (1997) pour les Philippines, Zacharia et al. (1999) pour l'Inde). D'autre part, l'émigration peut servir soit à augmenter les salaires, soit à réduire le chômage dans les régions d'origine des migrants, et par la suite renforce la migration interne et l'immigration. En d'autres termes, une interdépendance intéressante existe entre les différents flux migratoires qui touchent un même pays. Alors que la plupart des économistes ont particulièrement négligé cet aspect, cette thèse cherche, en premier lieu, à illustrer cette interdépendance entre les flux migratoires.

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La migration est un processus complexe et dynamique qui change le pays d'origine et le pays de destination, ainsi que les migrants eux-mêmes. Ainsi, elle

n'est pas sans conséquences économiques, sociales et culturelles sur les pays d'origine et d'accueil. La littérature s'est principalement interessée à l'impact de la migration sur le pays d'accueil, en particulier sur le marché de la main-d'œuvre non qualifiée (Borjas, 1999). Cependant, l'impact de la migration sur le pays d'origine a été quelque peu négligé, surtout pour manque de données fiables sur la migration internationale et les caractéristiques des migrants au niveau agrégé et au niveau des ménages. Heureusement, ces données sont devenues enfin disponibles, tels que les travaux de Docquier et Marfouk (2004) sur la fuite des cerveaux, et la littérature empirique est de plus en plus intéressée par l'effet de la migration sur le pays d'origine. Traditionnellement traités comme des questions séparées de politique économique, la migration et le développement sont aujourd'hui considérés comme très connectés. Si les politiques de développement permettent de s'attaquer aux causes profondes des flux migratoires, les migrations peuvent, à leur tour, contribuer positivement au développement, par la croissance économique, le progrès social et technologique.

La littérature permet d'identifier six principaux aspects de l'impact de la migration sur le pays d'origine: les effets sur le marché du travail, la conséquence de la migration du personnel hautement qualifié et l'effet induit sur l'éducation de ceux restés dans le pays d'origine, les transferts des migrants, l'importance du retour des migrants, la relation entre migration, investissement et commerce, et les effets sociaux de la migration.

La littérature, bien que rare, est d'accord sur le fait que la migration internationale réduit le chômage et/ou augmente le salaire dans le pays d'origine. Par exemple, Lucas (2005a) montre qu'au Bangladesh, en Inde, en Indonésie et au Sri Lanka, la migration des travailleurs n'a pas induit une baisse de la production ou une augmentation du salaire. Il donne différentes explications à ce fait stylisé comme la possibilité que ceux qui ont migré n'avait pas d'emploi avant leur départ. Par conséquent, leur migration a généré une baisse du chômage. En revanche, l'émigration de travailleurs pakistanais aux pays du Golfe a exercé une pression à la

hausse sur les salaires au Pakistan. Une augmentation des salaires a également été remarquée aux Philippines. Lucas (1987) arrive à la même conclusion au Mozambique et au Malawi après l'émigration des travailleurs aux mines d'Afrique du Sud.

La perte de travailleurs hautement qualifiés, connue sous le nom de "brain drain", a fait l'objet de nombreux travaux. L'exode des cerveaux est considéré comme l'un des aspects les plus négatifs de la migration pour plusieurs raisons: premièrement, les personnes très cultivées peuvent avoir des retombées positives sur les autres, contribuer à l'innovation, l'adaptation et l'adoption technologique, et augmenter la productivité à travers l'interaction mutuelle. Ils ont également le potentiel d'améliorer la gouvernance et la performance de la société. Deuxièmement, une partie importante des coûts de l'éducation est financée par les recettes fiscales. Dans ce cas, la migration d'individus hautement qualifiés représente une exportation de capital humain dans lequel la nation a investi. En outre, il y a une perte de potentiel de recettes fiscales qui auraient pu être recueillies des revenus des migrants, même si celles-ci peuvent être compensées par une diminution des dépenses publiques sur l'émigrant et sa famille. Troisièmement, la perte de personnel peut rendre plus difficile la prestation de certains services sociaux, tels que les soins de santé et d'éducation. Alors que l'intensité de la fuite des cerveaux fait peur aux décideurs politiques, un nouveau volet de la littérature met de plus en plus en avant un aspect positif des migrations de personnes hautement qualifiées sur l'éducation: la sortie d'individus hautement qualifiés peut induire une augmentation de l'éducation dans le pays d'origine, connue sous le nom de "brain gain". Si seulement une partie de ceux qui sont motivés à poursuivre leurs études émigrent, le stock d'individus hautement qualifiés peut augmenter et induire une amélioration de la croissance économique dans le pays d'origine (Mountford, 1997; Stark et Wang, 2002). "Brain drain" contre "brain gain": qu'est-ce qui prévaut? Les preuves empiriques sont mitigées. Beine et al. (2001) montrent par exemple que le stock de capital humain à travers les pays est positivement corrélé avec une mesure du taux d'émigration vers les pays de l'Organisation de Coopération et de Développement Economique (OCDE). En revanche, certaines études plus récentes montrent que les effectifs de l'enseignement supérieur sont négativement corrélés avec le taux de fuite des cerveaux (Faini, 2002; Lucas, 2005b). En outre, McKenzie (2005) et McKenzie et Rapoport (2005) montrent que la migration vers les États-Unis (US) diminue l'éducation dans les zones rurales du Mexique.

L'ampleur et la croissance des transferts vers les pays en développement ont attiré l'attention en ce qui concerne leur impact sur le développement. Selon les estimations de la Banque mondiale (2005), les pays en développement ont reçu 126 milliards de dollars de transferts officiels en 2004. Il s'agit de 10 milliards de plus par rapport à ceux recus en 2003, et 27 milliards de dollars de plus par rapport à 2002. En 1995, les transferts officiels aux pays en développement ont totalisé 57 milliards de dollars. De plus, chaque région contribue différemment à ces chiffres. Alors que les migrants de l'Amérique latine et des Caraïbes et de l'Asie du Sud ont envoyé respectivement 37 et 33 milliards de dollars à leur régions d'origine, les migrants subsahariens ont officiellement transféré 6 milliards de dollars seulement. Cependant, ces chiffres ne prennent pas en compte les transferts informels. L'argent peut également être envoyé à travers des amis ou en famille. Le montant de transferts informels peut excéder celui des transferts officiels (Voir par exemple de Bruyn et Kuddus (2005) sur le Bangladesh ainsi que Pieke et al. (2005) sur l'Afrique, les pays des Caraïbes et du Pacifique). Selon Ratha (2005), les transferts officiels sont devenus la deuxième source de financement pour les pays en développement, dépassant l'aide publique au développement (APD), mais restant inférieurs aux investissements directs à l'étranger (IDE). En raison de ces tendances, les questions de migration ont de plus en plus capté l'attention, tant parmi les gouvernements d'origine et de destination, qu'au sein de la communauté du développement. De surcroît, les décideurs politiques et le monde académique considèrent les transferts comme un outil de développement pour les pays d'origine.

Beaucoup d'études ont été concernées par l'impact des transferts sur le pays d'origine. Différents sujets ont été traités, tels que leurs effets sur la pauvreté et les inégalités, sur la balance des paiements (BoP), ainsi que l'utilisation des transferts à des fins de consommation et d'investissement. A part l'effet des transferts sur la réduction de la pauvreté sur lequel les différentes études s'accordent (Adams (2006) sur le Guatemala et Yang et Martinez (2006) sur les Philippines), les résultats sont mitigés. Premièrement, les travaux empiriques sur l'effet des transferts sur les inégalités ne sont pas concluants: Ahlburg (1996) et Taylor et Wyatt (1996) constatent que les transferts ont un effet égalisateur sur la disribution des revenus au Tonga et au Mexique. En revanche, les études sur l'Égypte (Adams, 1991), le Pakistan (Adams, 1998) et les Philippines (Rodriguez, 1998) montrent que les transferts ont augmenté la distribution inégalitaire des revenus. Adams (2006) montre que les transferts internes et internationaux ont peu d'impact sur l'inégalité des revenus au Guatemala. Le cas du Mexique semble supporter la forme en U inversé de la relation entre les migrations et les inégalités (McKenzie et Rapoport, 2005). Deuxièmement, s'ils sont investis, les transferts affectent le chômage, la productivité et la croissance, et donc permettent de financer la consommation future de manière soutenue. Par ailleurs, s'ils sont dépensés uniquement sur les biens de consommation, alors la consommation future doit être financée par des transferts futurs. Toutefois, le travail de Glytsos sur la Grèce en 1993 montre que les transferts, même quand ils ne sont pas investis, peuvent avoir un effet multiplicateur important, parce que la consommation stimule la demande de biens et de services, qui encourage, à son tour, la production et l'emploi. Troisièmement, les transferts influent sur la balance des paiements et ils ont un impact plus positif que d'autres flux monétaires tels que l'aide, les investissements directs à l'étranger et les prêts, car ils sont une source plus stable de devises étrangères, ne supportent pas d'intérêt et n'ont pas à être remboursés. Cependant, ils peuvent également avoir des effets inflationnistes s'ils stimulent la demande plus que l'offre et si cette demande tombe sur les biens non échangeables. Enfin, ils peuvent induire un risque d'aléa moral où les gens choisissent de travailler moins en raison de l'effet positif des transferts sur le revenu

(Chami, Fullenkamp et Jahjah, 2005).

Le retour des migrants est considéré comme avantageux pour le pays d'origine, non seulement lorsque les individus hautement qualifiés sont concernés, mais aussi lorsqu'il s'agit des travailleurs peu qualifiés dont les compétences acquises dans les pays développés sont en mesure d'augmenter la productivité nationale à leur retour. Par exemple, le retour des scientifiques et des ingénieurs, après l'obtention du diplôme ou après quelques années d'expérience de travail aux États-Unis, a joué un rôle crucial dans l'évolution des industries de haute technologie au Chinese Taipei et en Corée du Sud (Saxenian, 1999). Toutefois, si l'écart technologique entre les pays d'origine et de destination est grand, les compétences acquises à l'étranger peuvent être d'un intérêt limité dans le pays d'origine. En outre, le taux de chômage des rapatriés peut rester élevé, indépendamment des qualifications acquises à l'étranger, en raison du salaire de réserve élevé, l'inexistence d'emplois vacants ou l'inadéquation des compétences disponibles dans le pays de départ. Cela a été largement documenté dans le cas du retour des migrants de l'Allemagne vers les pays de l'Europe du Sud, principalement la Grèce, au cours des années 1980 (Glytsos et Katseli, 2006).

Même sans retour, les migrants peuvent jouer un rôle majeur dans le développement de l'économie du pays d'origine, en encourageant le commerce et les flux de capitaux. Toutefois, contrairement à ce que la théorie traditionnelle le suggère sur la substituabilité entre commerce et migration, les inégalités de revenus persistent de nos jours en dépit du processus de mondialisation. Les données actuelles laissent croire que le commerce et la migration sont plus des compléments que des substituts (Voir par exemple Bouzahzah et al. (2007) et Denis Cogneau (1995) sur le Maroc; Melchor del Rio et Thorwarth (2006) et Robinson et al. (1993) sur le Mexique). En tant qu'intermédiaires commerciaux, les migrants jouent un rôle crucial dans le renforcement des échanges entre les deux pays. Le premier canal concerne l'accès à l'information sur les débouchés, les marchés potentiels, les canaux de distribution, la langue, les coutumes, les lois et les pratiques des entreprises dans les deux pays (Voir par exemple Head et Ries (1998) et Wagner et al. (2002) sur le Canada).

En outre, des réseaux de migrants sont créés afin de maintenir des liens avec le pays d'origine. L'adhésion à ces réseaux joue un rôle important dans l'exécution des contrats. Ce canal d'information implique que les migrations ont un effet à la fois sur les exportations et les importations. Le second canal implique que les migrants ont des préférences pour les produits d'origine, soit par habitude ou par attachement au pays d'origine (Wagner et al., 2002). Ce canal ne devrait affecter que les importations du pays de destination et non pas les exportations.

Bien que les effets sociaux de la migration aient reçu moins d'attention que ses effets économiques, ils sont importants et souvent étroitement liés aux effets économiques de la migration. La migration affecte la vie sociale, en modifiant la composition de la famille, le rôle des femmes, les résultats des enfants en termes de travail, de culture, de santé et d'éducation. D'une part, la migration, à travers les transferts, augmente le revenu des ménages qui peut conduire à la réduction du travail des enfants et à l'augmentation du niveau de scolarité. En outre, la migration peut renforcer la motivation, en ce sens que les enfants peuvent considérer la migration comme leur but ultime et décider de poursuivre leurs études afin d'accroître leur probabilité de migrer (Mountford, 1997; Beine, Docquier et Rapoport, 2001). D'autre part, l'absence de parents peut conduire à une moindre surveillance des enfants, et par la suite à un faible taux de réussite à l'école ainsi qu'à d'éventuels effets néfastes dus à la désintégration de la famille (McKenzie (2005) sur le Mexique). Hildebrandt et McKenzie (2004) identifient deux canaux par lesquels la migration peut avoir un impact sur la santé des enfants au Mexique. Le premier est à travers l'impact des transferts sur le revenu. Le second canal est indirect et suppose d'avoir des connaissances sur les pratiques étrangères en matière de santé qui conduisent à une meilleure santé des enfants, pour le même niveau de revenu. Les résultats montrent que les taux de mortalité infantile et le poids de naissance sont meilleurs dans les familles où l'un des membres a déjà migré vers les États-Unis, ce résultat étant principalement dû au premier canal.

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Cette thèse tente de donner des réponses à certaines questions sur le thème “Migration et Développement”, omises ou mal traitées dans la littérature. Le premier point présenté ici est lié à l’impact direct des migrations sur le marché du travail dans le pays d’origine. La littérature existante en conclut que la migration internationale réduit le chômage et/ou augmente le taux de salaire dans le pays de départ. Ce résultat est principalement dû au fait que la littérature ne traite que les effets d’un seul type de flux migratoires, principalement les migrations internationales. Toutefois, il est courant de trouver des marchés de travail simultanément affectés par des entrées et des sorties de travailleurs. Par exemple, une migration transitoire Sud-Sud à partir d’un pays en développement vers un autre, avant de migrer vers un pays développé, peut coexister avec la migration interne des zones rurales vers les zones urbaines, ou l’émigration vers des pays plus développés. Si tous ces flux sont simultanément pris en compte, l’impact final sur le chômage et les salaires est ambigu. En effet, une analyse rudimentaire suggère que, d’une part, l’émigration urbaine réduit le chômage urbain et augmente les salaires, alors que la migration interne et l’immigration Sud-Sud vers les villes augmentent la pression sur le marché du travail urbain. L’impact simultané de ces différentes forces sur le marché du travail urbain ne peut être prédit sans ambiguïté car il dépend de l’ampleur de chacun des flux migratoires. En vue de prendre simultanément en compte les forces existantes, un modèle d’équilibre général calculable (MEGC) est nécessaire. Cet outil permet d’endogénéiser les déterminants des flux migratoires et de capter leurs effets directs sur le marché du travail urbain, en particulier sur le chômage, et leurs effets directs et indirects sur le reste de l’économie. Le deuxième chapitre de cette thèse est consacré à cette question.

Le deuxième problème proposé dans cette thèse concerne l’utilisation spécifique des transferts dans les pays en développement. La littérature existante sur les transferts se concentre principalement sur les ménages, ignorant les liens qui transmettent l'influence des migrations et des transferts à d'autres ménages et aux secteurs économiques. Toutefois, un choc sur les transferts concerne tous les agents et secteurs économiques: il a l'impact le plus direct sur le revenu des ménages. Mais puisque les transferts sont également investis, le choc affecte aussi les secteurs économiques, et par conséquent, la demande de facteurs de production et leur prix correspondant. En retour, le revenu des ménages varie en raison de la modification du salaire. En outre, les transferts contribuent aux recettes de la balance des paiements, et peuvent donc induire une appréciation ou une dépréciation du taux de change réel. La variation du taux de change affecte à son tour, la valeur en monnaie nationale du salaire international, et donc, la décision de migrer et de transférer de l'argent. En somme, il s'agit d'un problème d'équilibre général, qui nécessite un MEGC dynamique pour illustrer les liens entre les transferts et les agents et secteurs économiques. L'innovation à l'égard des MEGC dynamiques traditionnels, et en particulier les très peu qui s'intéressent à l'impact des transferts, consiste en une segmentation du marché de l'épargne. En d'autres termes, les transferts ne sont pas investis de la même façon que les autres sources d'épargne. Ils financent principalement le secteur immobilier. Au contraire, la proportion de l'épargne intérieure et étrangère qui ne finance pas la dette publique est investie dans les secteurs productifs, principalement dans l'industrie et les services. Le problème avec le secteur immobilier est que les services de construction sont offerts au niveau national, contrairement à d'autres secteurs qui sont en concurrence avec les exportations. La concurrence à l'exportation a un effet positif sur la croissance de la productivité totale des facteurs, par exemple grâce au transfert technologique afin de satisfaire les normes mondiales de qualité. Ne pas tenir compte du fait que les différentes sources d'épargne financent des secteurs différents modifie la part de l'investissement allant aux secteurs productifs et, par conséquent, fausse les résultats. C'est l'objet du chapitre 3.

Le chapitre 4 est intéressé par l'impact de la libéralisation des échanges sur la

migration des travailleurs qualifiés et non qualifiés dans le pays d'origine. Ce sujet a été principalement étudié sur un plan théorique, à partir du modèle Hecksher-Ohlin (HO). Dans un cadre HO standard, la libéralisation du commerce devrait être un substitut pour la migration des travailleurs non qualifiés dans un pays riche en main-d'oeuvre non qualifiée, et un complément pour la migration des travailleurs qualifiés. En effet, dans un pays abondant en main-d'œuvre non qualifiée, les secteurs intensifs en travailleurs non qualifiés sont avantagés. La libéralisation des échanges devraient augmenter les exportations de ces secteurs et donc la demande de travail non qualifié. Le salaire des travailleurs non qualifiés augmente, réduisant ainsi les incitations des non qualifiés à migrer. L'inverse est vrai pour la main-d'œuvre qualifiée. Mais la littérature théorique fait valoir que les conclusions du modèle HO peuvent être renversées simplement en utilisant des hypothèses plus réalistes. Alors que de nombreux modèles théoriques ont été construits, les travaux empiriques sur la relation entre commerce et migration sont rares. Ils concernent principalement le cas du Mexique/États-Unis (Hill et Mendez, 1984; Melchor del Rio et de Thorwarth, 2006; Robinson et al., 1993) ou le cas du Maroc (Bouzahzah et al., 2007; Cogneau et Tapinos, 1995). Mais aucun ne s'est intéressé, à ma connaissance, par l'impact différent de la libéralisation des échanges sur la migration des travailleurs qualifiés et non qualifiés dans le pays d'origine. Ceci est important dans la mesure où la migration des qualifiés est moins acceptée dans un pays où ceux-ci sont rares. De surcroît, puisque les accords commerciaux affectent l'évolution des prix et l'allocation des ressources, l'analyse est faite avec un MEGC dynamique. Basés sur une modélisation solide et largement acceptée du comportement des agents, les MEGC sont en mesure de fournir une description détaillée de l'impact de ces chocs sur l'économie.

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La littérature sur le thème "Migration et Développement", conclut que les

résultats de l'impact de la migration sur l'économie d'origine sont souvent spécifiques à chaque pays. Dans ce contexte, il convient de mentionner que la région du Moyen-Orient et de l'Afrique du Nord (MENA) a été largement négligée dans la littérature et que l'intérêt pour les migrants de ces pays vers l'Union européenne (UE) vient de commencer. Le Maroc est le premier pays MENA en termes de migrants vers l'UE (OCDE, 2006), et en termes de transferts des migrants (Fonds monétaire international (FMI), Annuaire de la balance des paiements). Par conséquent, le Maroc est un cas intéressant pour examiner l'impact des migrations sur les pays en développement. En outre, il est l'exemple typique d'un pays en développement combinant des entrées et des sorties de travailleurs et, comme il sera démontré ci-dessous, présente un cas intéressant pour étudier les questions présentées dans cette thèse. Plus important encore, les données sont disponibles pour le cas marocain, en particulier la matrice de comptabilité sociale (SAM) pour l'analyse en MEGC.

Depuis le début des années 1960, les mouvements migratoires du Maroc vers l'Europe ont commencé à être conceptualisés en tant que migration de travailleurs. La migration marocaine vers l'Europe peut être divisée en quatre phases historiques. La première phase concerne la migration des hommes et a eu lieu à partir des années 1960 après la crise pétrolière en 1973. Jusqu'en 1965, le nombre de Marocains en Europe était encore très faible, estimé à 70-80,000 personnes (Nyberg-Sorensen, 2004). La majorité était des jeunes hommes en provenance des zones rurales, généralement mariés qui, en raison de leur intention de retour, ont quitté leurs familles et leur envoient de grandes quantités d'argent. Depuis le milieu des années 1980, le Maroc a connu une deuxième phase de migration concernant les femmes, dans le processus de regroupement familial, vers les pays européens notamment l'Espagne et l'Italie, mais aussi vers les pays arabes comme la Libye et les pays du Golfe. La troisième phase concerne la migration saisonnière, mais elle a perdu de son importance en termes numériques. La dernière phase est caractérisée par la prolifération de la migration clandestine. Le regroupement familial et l'immigration clandestine peuvent être considérés comme un résultat de la politique migratoire

restrictive adoptée par les pays européens, surtout après la conclusion de l'accord de Schengen en 1990 et le traité de Maastricht en 1991 qui a introduit les visas et un plafond sélectif pour les permis de travail. D'ailleurs, un mur défensif de huit kilomètres a été construit en 1993 autour de Ceuta, l'enclave espagnole dans le nord du Maroc, pour une surveillance stricte des frontières.

Aujourd'hui, environ 10% de la population marocaine réside à l'étranger. En 2003, les migrants marocains ont été estimés à 2,5 millions, soit environ huit pour cent de la population totale du Maroc et affectent peut-être la moitié des familles marocaines (Nyberg-Sorensen, 2004). La migration marocaine contemporaine est orientée vers l'UE, vers des destinations traditionnelles comme la la Belgique, la France, l'Allemagne et les Pays-Bas, mais aussi de plus en plus vers de nouvelles destinations comme l'Italie et l'Espagne (Nyberg-Sorensen, 2004).

Selon les données du FMI, le Maroc est le quatrième plus grand bénéficiaire de transferts de fonds officiels parmi les pays en développement, avec 3,3 milliards de dollars en 2001, après l'Inde, le Mexique et les Philippines. Après leur hausse en 2001, le niveau des transferts est resté élevé par rapport à d'autres pays en développement, environ de 9% du PIB et 25% des exportations. Par exemple, ils ne représentaient que 3% du PIB et 16% des exportations en Egypte, 5% du PIB et 13% des exportations en Tunisie (Bouhga-Hagbe, 2004). Depuis le début des années 70, ils sont devenus de plus en plus importants pour la balance des paiements du Maroc. En 2001, ils étaient six fois plus élevés que l'APD et cinq fois plus élevés que les IDE (de Haas, 2007). Ils représentent la principale source de devises étrangères et excèdent les recettes de phosphate et de tourisme (Nyberg-Sorensen, 2004).

Mais la chose la plus importante est que le Royaume a intégré la migration dans ses plans budgétaires de 1968-72 et 1973-77 en tant que contributrice au développement. En effet, le gouvernement se penche sur la migration comme une solution au problème du chômage, un moyen de résoudre les problèmes de balance des paiements et un mécanisme d'amélioration des compétences de la population, fondé sur la conviction que les migrants seront de retour. Par conséquent, la relation entre migration et développement est une question intéressante lorsqu'elle est appliquée au Maroc.

Cette thèse étudie l'impact des migrations sur le développement du Maroc, avec une attention particulière à ses conséquences en termes de chômage et à l'utilisation des transferts. Elle s'intéresse aussi à l'impact de la libéralisation des échanges marocains sur la migration des travailleurs qualifiés et non qualifiés.

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Avant de mettre en avant la contribution des différents chapitres au sujet "Migration et Développement", le **premier chapitre** fait une pause avec la littérature sur la migration pour enquêter sur la méthodologie employée dans l'évaluation de l'impact de la migration sur le Maroc. Le chapitre 1 est un exercice utile pour les débutants en MEGC pour découvrir le monde de l'équilibre général calculable. Il permet de comprendre comment la structure d'un MEGC affecte les résultats et, comment l'interprétation des résultats devrait se faire sous différentes structures. Le chapitre commence par la simulation d'un choc sur la libéralisation des échanges de l'économie marocaine représentée par la matrice de 1998. Le choc est d'abord exécuté dans un MEGC réel statique de Decaluwé et al. (2001), baptisé EXTER. Ensuite, la structure d'EXTER est modifiée de façon à intégrer les hypothèses de trois autres MEGC standards: GTAP (Brockmeier, 2001), IFPRI (Lofgren et al., 2002) et MIRAGE (Bchir et al., 2002). Les formes fonctionnelles d'EXTER sont d'abord modifiées pour la production, la consommation intermédiaire, la valeur ajoutée, l'investissement et l'utilité des ménages. Le chapitre examine comment les résultats de la libéralisation commerciale varient entre la fonction de production ou de consommation intermédiaire à la Leontief et la fonction à élasticité de substitution constante (CES), avec une discussion sur le choix des élasticités. De même pour la valeur ajoutée et le volume d'investissement total (CES contre Cobb-Douglas). Ce chapitre explique aussi comment la consommation des ménages réagit aux changements de prix dans le cas simplifié d'une fonction d'utilité Cobb-Douglas contre un système linéaire de dépenses (LES). Il donne également une discussion rapide sur les effets du choix du numéraire dans un MEGC réel. Ensuite, il explique la différence entre la fermeture "savings-driven" et "investment-driven" ainsi que leurs implications sur les résultats de la libéralisation des échanges. La structure du marché des produits est également modifiée de façon à intégrer la concurrence imparfaite. Les simulations sont exécutées avec différentes parts des profits à l'année de base et avec des horizons temporels différents. Enfin, la dimension temps est intégrée dans le modèle EXTER statique. Le chapitre conclut que les résultats concernant les gagnants et les perdants de la libéralisation du commerce sont généralement insensibles aux formes fonctionnelles adoptées et au choix du numéraire. En revanche, ils sont principalement influencés par le choix de la fermeture macroéconomique, l'introduction de la concurrence imparfaite et la structure dynamique du modèle. Il est donc crucial d'identifier précisément le problème afin de déterminer le meilleur cadre d'analyse pour l'économie. A présent, il est possible de conceptualiser le modèle adéquat pour évaluer les effets de la migration sur le Maroc.

Le **chapitre 2** évalue l'impact de tous les flux migratoires qui affectent l'économie marocaine sur le chômage en milieu urbain, par le biais d'un MEGC statique appliqué à la matrice marocaine de 1998. Le Maroc est l'exemple typique d'un pays en développement faisant l'objet d'une combinaison de différents flux migratoires: émigration des zones rurales et urbaines vers l'UE, la migration interne des zones rurales vers les zones urbaines et enfin, l'immigration subsaharienne vers le Maroc pour transiter vers l'Europe ou pour y rester définitivement. En effet, les données de l'OCDE sur les migrations montrent que les destinations traditionnelles des migrants marocains, telles que la Belgique, la France, l'Espagne, l'Italie et les Pays-Bas, continuent de recevoir des flux migratoires importants. En 2004, 8000 Marocains entrent en Belgique, 21700 en France, 24600 en Italie, 3300 aux Pays-Bas et 58800 en Espagne (OCDE, 2006). En outre, et selon un avis de l'Organisation Internationale de la Migration, les migrants marocains vers l'UE proviennent principalement des régions rurales (Erf et Heering, 2002). Concernant la migration interne, Agénor et El Aynaoui (2003) montrent qu'environ 200000 migrants migrent, chaque année, vers les zones urbaines, ce qui équivaut à 40% de l'augmentation de la population urbaine. La migration interne est motivée par les risques climatiques associés à la production agricole qui encouragent les agriculteurs à la recherche d'un emploi stable en ville. Enfin, le Maroc a commencé à recevoir, depuis le début des années 90, des flux d'immigrants subsahariens, qui fuient la pauvreté, la pénurie de ressources naturelles, les conflits et les guerres. Les immigrants subsahariens, pour la plupart clandestins, transitent par le Maroc vers l'Espagne et l'Europe ou choisissent de s'installer définitivement au Maroc. L'une des conséquences les plus importantes de l'immigration illégale vers le Maroc, est qu'un nombre de plus en plus important d'Africains subsahariens, échaudés par les difficultés qu'ils rencontrent sur leur chemin migratoire les menant à l'Europe, choisissent finalement de rester au Maroc (surtout en zones urbaines). Les données sur les immigrants subsahariens sont limitées et leur collection est difficile parce que la majorité sont clandestins. Selon Lahlou (2003), il y aurait entre 6000 et 15000 migrants clandestins au Maroc.

Le modèle de base est un MEGC statique réel pour une petite économie ouverte inspiré de Decaluwé et al. (2001). Cette structure de base est cependant profondément modifiée afin de décrire le comportement du marché du travail ainsi que les déterminants des flux migratoires. Le modèle prend en compte le chômage urbain et distingue entre différents segments des marchés du travail selon les catégories professionnelles en zones rurales et urbaines. Une telle description fine du marché du travail qui prend en compte le taux de chômage par catégorie professionnelle est justifiée par le fait que l'émigration et l'immigration n'affectent pas toutes les catégories de la même manière. L'émigration rurale et urbaine ainsi que les flux de migration interne dépendront du différentiel de salaire entre les régions de destination et d'origine, net des coûts de la migration. Seule l'immigration subsaharienne ne dépend pas du différentiel de salaires entre le Maroc et l'Afrique sub-saharienne. En effet, étant donné que l'immigration africaine ne se produit pas uniquement pour des raisons économiques et financières, mais aussi pour des raisons personnelles et de sécurité, les conditions de vie au Maroc et, en particulier la variation des salaires urbains, n'ont pas d'incidence sur l'immigration subsaharienne au Maroc. En outre, la décision de migrer vers l'Europe est prise avant l'arrivée au Maroc, et ne dépend pas du différentiel de salaires entre le Maroc et le reste du monde. Par conséquent, le stock d'Africains subsahariens au Maroc est exogénéisé.

Ensuite, trois chocs sont simulés, le premier consistant en une baisse de 10% des coûts de la migration, le deuxième en une hausse de 10% du stock d'immigrants subsahariens, et enfin, les effets simultanés des deux chocs précédents. Le premier choc peut être interprété comme une traduction d'une plus grande facilité pour les migrants de devenir opérationnels, par exemple en raison d'une baisse des coûts de la migration, une plus grande simplification et transparence des procédures administratives, ou de l'existence de réseaux de migrants qui facilitent l'intégration dans le pays d'accueil. Tout d'abord, la baisse des coûts de la migration devrait permettre d'accélérer l'émigration et de réduire, *ceteris paribus* l'offre de travail urbain, ainsi que le taux de chômage. D'autre part, la migration interne vers les villes, également facilitée par la baisse des coûts de la migration, devrait augmenter l'offre de travail et, toute chose égale par ailleurs, le taux de chômage. Si ces deux flux coexistent, l'effet final sur le taux de chômage urbain et les taux de salaire par catégorie professionnelle est ambigu. Les résultats indiquent que, dans le cas marocain, la baisse de l'offre de travail en raison de l'émigration urbaine est plus que compensée par les flux migratoires internes. Ainsi, le taux de chômage de toutes les catégories, sauf pour les "cadres supérieurs" et "intermédiaires commerciaux" qui sont absents en zones rurales, augmente. Ces résultats sont contradictoires avec la littérature. Le deuxième choc enquête sur l'impact de la migration Sud-Sud sur le marché du travail marocain. En effet, la difficulté pour les pays africains à

améliorer le bien-être de leur population et la multiplication des conflits laissent penser que les flux migratoires provenant de l'Afrique subsaharienne ne diminueront pas bientôt. La hausse du stock d'immigrants subsahariens crée une pression sur le marché du travail urbain des "manutentionnaires et travailleurs des petits métiers". Cette catégorie absorbe tous les immigrants subsahariens clandestins, qualifiés et non qualifiés. Toute chose égale par ailleurs, le taux de chômage augmente pour cette catégorie et induit une baisse de leur salaire réel, en fonction de la courbe salaire-chômage. Les travailleurs urbains marocains appartenant à la même catégorie sont donc incités à quitter le pays et les travailleurs ruraux préfèrent rester en zones rurales. Cependant, la baisse des migrations internes et la hausse de l'émigration urbaine ne permettent pas de compenser la pression exercée par l'immigration subsaharienne. En effet, le taux de chômage des manutentionnaires augmente et leur salaire réel diminue. Si l'indice des prix à la consommation urbaine reste constant, le salaire "nominal" des manutentionnaires diminue également. Le variation du salaire des manutentionnaires induit des effets indirects sur le marché du travail des autres professions. En effet, les secteurs urbains augmentent leur demande de manutentionnaires dont le salaire diminue. Par conséquent, les secteurs à forte intensité en cette catégorie de travailleurs croissent. Étant donné que le capital est spécifique par secteur, la hausse de la production devrait entraîner, à son tour, une hausse de la demande de main-d'œuvre appartenant aux autres catégories, réduire leur taux de chômage et augmenter leur taux de salaire réel. Le troisième choc est une expérience combinant les deux simulations précédentes afin de refléter la réalité des chocs sur le marché du travail marocain. Les résultats montrent que la hausse de la demande de main-d'œuvre par les secteurs en expansion et les flux d'émigration urbaine réduisent la pression exercée par les migrations internes, mais ne réussissent pas à réduire le taux de chômage par catégorie. Ce dernier croît, mais sa variation est plus faible par rapport au premier choc. Encore une fois, les résultats sont en désaccord avec la littérature sur l'impact des migrations sur le marché du travail dans le pays d'origine.

Le **chapitre 3** étudie les canaux de transmission par lesquels les transferts affectent les ménages et les secteurs, par le biais d'un MEGC dynamique appliqué à la matrice marocaine de 1998. Le modèle donne une attention particulière à l'investissement des transferts dans le secteur immobilier à travers une segmentation du marché de l'épargne. Le problème avec le secteur de l'immobilier est que la nature de ses services limite la portée de l'offre au marché local. Au contraire, les secteurs échangeables sont en concurrence avec les exportations mondiales. La concurrence à l'exportation a un effet positif sur la croissance de la productivité des facteurs, grâce à l'exploitation des économies d'échelle, le transfert de technologie afin de répondre aux normes mondiales de qualité, de distribution et de commercialisation, et permet de réduire les coûts de production. Les exportations accélèrent également la promotion des changements institutionnels qui contribuent à la croissance de la productivité en réduisant les coûts de transaction pour toutes les activités. Par conséquent, il y a une grande différence pour un pays comme le Maroc, très dépendant des transferts, s'ils sont investis dans l'immobilier ou dans les secteurs productifs. Cette question ne peut être étudiée qu'à travers une segmentation du marché de l'épargne.

Étant donné que les transferts vers le Maroc sont dictés par l'altruisme, je trouve qu'il est plausible de considérer l'investissement dans le secteur immobilier comme une part fixe de la quantité de transferts investis. Selon Hamdouch (2000), cette proportion représente 80% des investissements réalisés par les Marocains résidant à l'étranger, dans leur pays d'origine. Le reste des transferts non consommés et non investis dans l'immobilier, ainsi que l'épargne des ménages et des entreprises, financent, d'une part, l'investissement dans les secteurs productifs, en fonction de l'écart entre le taux de rendement sectoriel du capital et le prix agrégé de l'investissement et, d'autre part, la dette publique interne: lorsque l'épargne gouvernementale est négative et les sources extérieures de financement sont limitées, le gouvernement est obligé d'emprunter des agents locaux en vue de financer l'investissement public. Ce financement domestique de la dette publique dépend positivement de la prime de risque du pays. En d'autres termes, si la prime de risque interne augmente réduisant l'incitation des agents domestiques à investir, ils vont opter pour un investissement sans risque, tels que les prêts au gouvernement. L'investissement public est financé par l'épargne gouvernementale, lorsqu'elle est positive, et la dette publique. L'épargne étrangère finance la dette publique extérieure, ainsi que les investissements étrangers.

Pour commencer, j'évalue l'impact négatif des politiques d'immigration restrictives occidentales et de la migration permanente sur l'évolution des transferts futurs. Comme prévu, le ralentissement des transferts est nuisible à l'économie. Il affecte négativement le revenu des ménages et leur budget de consommation ainsi que l'investissement domestique, en particulier dans le secteur immobilier. Étant donné que ce secteur est bien intégré dans l'économie, sa contraction induit une demande plus faible d'intrants intermédiaires qui, en plus de la baisse de la consommation des ménages, a un effet négatif sur la demande adressée aux secteurs. Toute chose égale par ailleurs, les entreprises réduisent leur production, d'où la contraction de l'activité économique. Ensuite, je me demande quelles seraient les politiques à adopter afin de profiter au maximum des flux de transferts courants. Il arrive que la canalisation de l'investissement immobilier aux secteurs productifs est néfaste en termes de croissance et de bien-être. Les prédictions de ce choc sont inattendues. Les chercheurs pensent que l'investissement des transferts des migrants dans les secteurs productifs devrait favoriser la croissance économique. Toutefois, il semble qu'un effet demande entre en jeu. Cette effet demande est attribuable à une baisse de la demande de biens intermédiaires adressée aux secteurs, venant de la contraction de l'activité immobilière. En effet, cette dernière est fortement intégrée dans l'économie. La consommation de biens intermédiaires par l'activité immobilière est importante. Des effets positifs en termes de bien-être et de croissance économique ne découlent que de l'aptitude du gouvernement à attirer des investisseurs grâce à une amélioration de la prime de risque, et des efforts privés visant à réduire les coûts internationaux de transfert. Avec un meilleur climat d'investissement, les investisseurs étrangers et nationaux ont une plus grande confiance dans l'investissement ce qui se traduit par une augmentation simultanée de l'investissement domestique et étranger. Toute chose égale par ailleurs, le capital utilisé dans la production de tous les secteurs augmente et la production suit, *ceteris paribus*, l'évolution du volume de capital. Cela se traduit par une croissance économique plus forte. De même, lorsque les coûts de transfert diminuent, les ménages reçoivent davantage de transferts, qui augmentent leur revenu, leur budget de consommation et leur bien-être. En outre, tant qu'une fraction des transferts est investie, la baisse des coûts de transfert devrait, *ceteris paribus*, stimuler l'investissement intérieur dans tous les secteurs, et surtout dans l'immobilier, d'où l'amélioration de la croissance économique.

Le **chapitre 4** explore le lien entre la libéralisation commerciale et la composition des flux migratoires quittant le Maroc. Le pays est en plein processus de libéralisation commerciale. Il est sur le point de créer une zone de libre-échange avec l'UE et a signé des accords de libre-échange (ALE) avec les États-Unis, la Turquie et d'autres pays arabes, en même temps qu'il règle ses politiques pour se conformer aux normes de l'Organisation Mondiale du Commerce (OMC). La préoccupation majeure provient du potentiel du marché du travail et des effets de l'intégration et de l'élargissement. Une analyse rudimentaire suggère que la libéralisation commerciale devrait promouvoir les secteurs faiblement protégés et contracter les secteurs hautement protégés. En fonction de l'intensité du travail des secteurs faiblement protégés, la libéralisation commerciale peut freiner le taux de chômage. Étant donné que le chômage est la cause d'émigration la plus importante au Maroc (Hamdouch, 2000), il est vrai de penser que la libéralisation des échanges peut réduire les incitations à migrer. Cette question est primordiale à une époque où les pays du Nord ont fermé leurs portes aux travailleurs du Sud pour des raisons sociales et de sécurité. Du côté des pays d'origine, la pression migratoire est en mesure de diminuer lorsque le chômage diminue et/ou le taux de salaire augmente. Une autre préoccupation est de savoir dans quelle mesure, le Maroc doit poursuivre la libéralisation des échanges: est-ce qu'une élimination bilatérale ou multilatérale des tarifs contriburait plus à la baisse de la pression migratoire?

Par rapport aux autres études empiriques sur la question, une distinction est faite entre travailleurs qualifiés et non qualifiés, car la relation entre la mobilité du travail et le commerce est différente pour les deux types de travailleurs. Dans le modèle HO standard, et sachant que le Maroc est riche en main-d'œuvre non qualifiée, il exporte les biens intensifs en travail non qualifié et importe les biens intensifs en travail qualifié. Afin de répondre à l'augmentation des exportations, la demande de travail des travailleurs non qualifiés doit augmenter et leur salaire doit s'ajuster à la hausse afin d'équilibrer le marché du travail. Inversement, la demande de travail des travailleurs non qualifiés diminue dans les pays qui importent des biens intensifs en travail peu qualifié. Cette évolution des salaires des travailleurs non qualifiés à l'intérieur et à l'extérieur du Maroc réduit les incitations des travailleurs non qualifiés à migrer. Dans ce contexte, migration et commerce sont des substituts. Au contraire, si les importations marocaines sont intensives en travailleurs qualifiés et lorsque les importations remplacent la production nationale, la demande de main-d'œuvre qualifiée diminue, de même que le salaire marocain des travailleurs qualifiés. Par conséquent, les travailleurs qualifiés choisissent de quitter le pays. Dans ce contexte, migration et commerce sont des compléments. Puisque les principaux partenaires commerciaux du Maroc sont abondants en main-d'oeuvre qualifiée (France, Espagne, Italie, Allemagne) et que les importations marocaines sont principalement des biens de capital et de technologie, il est vrai de penser qu'elles sont intensives en travailleurs qualifiés. L'analyse est effectuée avec un MEGC dynamique de l'économie marocaine représentée par la matrice de 2003, permettant de capter les gains dynamiques de la libéralisation commerciale.

Les résultats dépendent de l'avantage comparatif du Maroc ainsi que de la structure de protection. Selon le modèle HO standard, la libéralisation commerciale devrait stimuler les exportations des produits à forte intensité en travail non qualifié, ceux où le Maroc a un avantage comparatif. En revanche, les importations doivent augmenter dans les secteurs défavorisés intensifs en travailleurs qualifiés et, toute chose égale par ailleurs, la production de ces secteurs devrait baisser. Tel est le cas, par exemple, des biens de capital et de technologie. Toutefois, les résultats montrent aussi une contraction de certains secteurs intensifs en travailleurs non qualifiés tels que l'agriculture et l'agroalimentaire. En effet, cela est dû à la structure de protection initiale. Après la libéralisation commerciale, les secteurs très protégés ne sont pas en mesure de faire face à la concurrence des importations. Les résultats de l'accord de libre-échange avec l'UE montrent que l'effet de la structure de protection initiale domine dans les zones rurales, ce qui induit une faible demande de travailleurs non qualifiés. Le salaire rural baisse alors, afin d'équilibrer le marché. Dans les zones urbaines, la demande des travailleurs qualifiés et non qualifiés diminue à long terme, avec l'accroissement de la concurrence étrangère, induisant un taux de chômage plus élevé. La courbe salaire-chômage implique que le salaire réel urbain des travailleurs qualifiés et non qualifiés baisse à long terme. La demande de main-d'œuvre qualifiée augmente de manière inattendue dans le court terme, car les secteurs intensifs en main-d'œuvre qualifiée sont en expansion, vendant sur les marchés étrangers grâce à la dépréciation du taux de change réel. En conséquence, le chômage des travailleurs qualifiés diminue, ce qui implique une hausse de leur salaire réel. En d'autres termes, la création progressive de l'ALE donne lieu à un facteur “push” pour la migration en zones rurales, et seulement à long terme en zones urbaines. Malgré la baisse du chômage à court terme, les travailleurs qualifiés et non qualifiés urbains choisissent de migrer, motivés par la dépréciation du taux de change qui augmente la valeur du salaire étranger en monnaie nationale. En d'autres termes, il existe un facteur “pull” pour l'émigration urbaine. Lorsque le choc de libre-échange avec l'UE est mené dans un cadre de concurrence imparfaite, les flux migratoires de travailleurs qualifiés et non qualifiés baissent, même en zones rurales à long terme. En effet, avec la concurrence imparfaite, l'effet pro-concurrentiel de la libéralisation commerciale induit une plus forte expansion de l'activité économique, et donc une plus grande demande de main-d'œuvre qui permet de réduire le chômage et d'augmenter les salaires. La libéralisation multilatérale progressive renforce les effets de l'ALE. Dans le modèle de concurrence parfaite, l'expansion des secteurs faiblement protégés augmente la demande de travailleurs qualifiés urbains à long terme. Même la demande de main-d'œuvre non qualifiée augmente à long terme, contrairement à l'accord de libre-échange, parce que l'activité globale croît davantage à présent et les travailleurs non qualifiés libérés des secteurs contractés sont employés dans les secteurs en expansion. Toutefois, la migration urbaine est motivée par la dépréciation du taux de change, qui peut être considérée comme un facteur "pull" pour la migration. Dans le modèle de concurrence imparfaite, les flux d'émigration baissent, plus que dans le cas de l'ALE, ce qui signifie que la libéralisation commerciale et la migration des travailleurs qualifiés et non qualifiés sont des substituts. Ainsi, plus l'économie croît, plus les flux migratoires dimininuent. Les résultats de ce chapitre sont en contradiction avec les travaux de Bouzahzah et al. (2007) et Cogneau et Tapinos (1995) sur le Maroc: les auteurs constatent que la migration et le commerce sont complémentaires, et que cette complémentarité est due à des facteurs "push".

General Introduction

In 2005, 191 million people, or 3 percent of the world's population, were living in countries in which they were not born (United Nations, 2006). This figure is up from 155 millions in 1990 and, nearly two and a half times the figure in 1965, revealing the rapid growth of immigration flows. Migration growth rate is well greater than the global population growth rate over the same period. The number of migrants is likely to be higher than 200 millions today (IOM, 2008).

Developed countries absorbed 33 out of the 36 million increase in the number of international migrants between 1990 and 2005 (United Nations, 2006). More importantly, these migrants were often originated from developing countries. According to Winters (2007), South-North emigration constitutes 37% of total emigration while South-South and North-North emigration only account for for 24% and 16%[2]. As far as labour migration is concerned, three key determining factors fuel this kind of movement from the South to the North: the "pull" of changing demographics and labour market needs in many industrialised countries, the "push" of population growth, unemployment and crisis pressures in developing countries, as well as established inter-country networks based on family, culture and history.

The special interest of economists in South-North migration gave the South the status of emigration countries and the North the status of immigration countries. However, when one looks closely to international migration data, South-South migration is found to be nearly as large as South-North migration. It accounts

[2] As a single country, the Former Soviet Union (FSU) had considerable internal mobility, so when it split up, many of the people found themselves living in a country other than that of their birth. The remaining percentage relates to FSU-FSU, North-FSU and South-FSU migration.

for 47% of total emigration from developing countries while South-North migration accounts for 53%. More importantly, South-South migration outweighs South-North migration in some regions such as Sub-Saharan Africa (72%), Europe and Central Asia (64%), and South Asia (54%), according to Ratha and Shaw (2007). The magnitude of South-South migration made some developing countries, countries of origin, of transit and of destination, although to varying degrees.

Imagine a world where developing countries have both the status of emigration and immigration countries. Inflows of workers increase the pressure on domestic labour market whereas outflows alleviate this pressure. If the characteristics of domestic labour market are taken into consideration in the emigration decision, the pressure exerted by inflows of workers increases, on the one hand, emigration incentives. The pressure on labour market may be further exacerbated by potential internal migration flows between regions inside the developing country. Internal migration has been largely documented (See for example Saith (1997) for the Philippines, Zacharia et al. (1999) for India). On the other hand, emigration may serve either to raise wages or to diminish unemployment in the vicinity from which the migrant departs, further enhancing internal migration and immigration. In other words, an interesting interdependency exists between the different migration flows affecting a single country. While most economists have particularly neglected this facet, this thesis tries to shed the light on the interdependency between migration flows.

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Migration is a complex and dynamic process that changes migrants' home and destination countries, as well as migrants themselves. Therefore, it is not without economic, social, and cultural implications on both sending and receiving countries. There has been extensive analysis of the impact of migration on receiving countries, especially on markets of unskilled labour (Borjas, 1999). However, the impact of migration on sending countries has been somewhat neglected, mainly for lack of reliable data on international migration patterns and migrant characteristics at the aggregate and household levels. Fortunately, such data are finally becoming available, such as the work of Docquier and Marfouk (2004) on brain drain, and the empirical literature is increasingly interested by the effect of migration on home countries. Traditionally being treated as separate policy issues, migration and development are today viewed through the prism of the many links that combine them. If development-oriented actions help tackle the root causes of migratory flows, migration can, in turn, positively contribute to development, by economic growth, social and technological progress.

The existing literature helps identify six key aspects of the impact of migration on sending countries: the effects on labour market, the consequences of highly skilled migration and the education induced effect on those left behind, the contributions of remittances, the importance of return migration, the inter-linkages between migration, investment and trade, and the social effects of migration.

The literature, although scarce, agrees on the fact that international migration reduces unemployment and/or increases wages in the country of origin. For instance, Lucas (2005a) shows that, in Bangladesh, India, Indonesia and Sri Lanka, workers migration has not induced production loss or wage increase. He gives different explanations to this stylised fact such as the possibility that those who have migrated did not have a job before leaving. Therefore, their departure generated a fall in unemployment. By contrast, Pakistani workers emigration to Gulf countries has exerted an upper pressure on wages in Pakistan. A wage increase has also been noticed in the Philippines. Lucas (1987) arrives to the same conclusion in Mozambique and Malawi after worker emigration to South African mines.

The loss of highly skilled workers, commonly known as the "brain drain" process, has been the subject of many works. Brain drain is considered as one of the most negative aspects of international migration for several reasons: first, highly educated people may generate spillover benefits to others, contribute to innovation, technological adaptation and adoption, and can raise productivity through mutual interaction. They also have the potential to improve governance and civic performance of society. Secondly, a significant part of education cost may be financed by fiscal revenues. In this case, migration of highly skilled individuals represents an export of human capital in which the nation has invested. Besides, there is a loss of potential tax revenues that might have been collected from the income of the migrant, though this may be compensated by diminished public spending on the emigrant and his family. Thirdly, the loss of key personnel can make more difficult the delivery of critical social services, such as health care and education. While the intensity of brain drain scares policy-makers, a new strand of the literature increasingly puts forward a positive facet of highly skilled migration: outflows of highly skilled individuals may induce expanded education at home, commonly known as "brain gain". If only a fraction of those who were motivated to continue their education emigrate, then the stock of highly educated individuals left behind may even expand, enhancing economic growth in the home country (Mountford, 1997; Stark and Wang, 2002). Brain drain vs. brain gain: what prevails? Empirical evidence are mixed. Beine et al. (2001) show for example that the stock of human capital across countries is positively correlated with a measure of the overall rate of outflows to Organisation for Economic Co-operation and Development (OECD) countries. By contrast, some of the more recent studies show that tertiary enrolment levels are negatively correlated with the brain drain rate (Faini, 2002; Lucas, 2005b). As well, McKenzie (2005) and McKenzie and Rapoport (2005) show that migration to the United States (US) diminishes educational attainment amongst rural Mexican.

The scale and growth of remittances by destination of developing countries have attracted increased attention regarding their development impact. According to the World Bank estimates (2005), developing countries received USD 126 billion of official remittances in 2004. This is USD 10 billion more than that received in 2003, and USD 27 billion more than that in 2002. In 1995, total official remittances to developing countries totalled USD 57 billion. Moreover, not every region contributes equally to these figures. While Latin American and Caribbean as well as South Asian migrants sent respectively USD 37 and 33 billion to their regions of origin, Sub-Saharan migrants officially transferred USD 6 billion only. These figures, however, do not take into account unrecorded remittances. Money can also be sent through informal channels, for example carried by friends or family. Informal remittances could amount to more than the volume of officially recorded remittances (See for example de Bruyn and Kuddus (2005) on Bangladesh and Pieke et al. (2005) on Africa, Caribbean and Pacific Countries). According to Ratha (2005), officially recorded remittances have become the second highest source of external funding for developing countries, exceeding official development assistance (ODA), but following foreign direct investments (FDI). As a result of these trends, migration issues have increasingly become the focus of attention, both among governments of origin and destination, and within the development community. Not surprisingly, policy makers and academicians are looking at remittances as a development tool for developing countries.

Many studies were concerned by the impact of remittances on sending countries. Different topics were treated, such as the effect on poverty and inequality, on the balance of payments (BoP), as well as the use of remittances for consumption and investment needs. Putting aside the poverty reducing effect of remittances on which the different studies agree (Adams (2006) on Guatemala and Yang and Martinez (2006) on the Philippines), the results are mixed. To begin with, empirical works on the income distribution effects of remittances are not conclusive: for instance, Ahlburg (1996) and Taylor and Wyatt (1996) find that remittances have an equalising effect on income distribution in Tonga and Mexico. By contrast, evidence from Egypt (Adams, 1991), Pakistan (Adams, 1998) and the Philippines (Rodriguez, 1998) show that remittances induced a higher income inequality. Adams (2006) shows that internal and international remittances have little impact on income inequality in Guatemala. The evidence from the Mexican case found support for an inverse U-shape relationship between migration and inequality (McKenzie and Rapoport, 2005). Secondly, if they are invested, remittances affect unemployment, productivity and growth, and thereby finance future consumption in a sustainable way. Alternatively, if they are spent only on current consumption goods, then future consumption has to be financed by future remittances. However, Glytsos's work on Greece in 1993 shows that remittances, even when not invested, can have an important multiplier effect, because consumption stimulates the demand of goods and services, which promotes, in turn, output and employment. Thirdly, remittances affect the BoP and they have a more positive impact than other monetary flows such as financial aid, FDI and loans because they are a more stable source of foreign currency, bear no interest and do not have to be repaid. However, they can also have negative inflationary effects if they stimulate demand more than supply and this demand falls on non-tradable goods. Finally, they can induce a moral hazard problem where people choose to work less due to the positive income effect of remittances (Chami, Fullenkamp and Jahjah, 2005).

Return migration is viewed as advantageous to sending countries, not only when highly skilled individuals are concerned, but also the low-skilled ones that acquired skills in developed countries and are thus able to raise domestic productivity upon return. For instance, the return of scientists and engineers, after graduation or after some work experience in the US, has played a crucial role in the evolution of high-tech industries for Chinese Taipei and South Korea (Saxenian, 1999). However, if the technological gap between the sending and receiving countries is large, the skills learned overseas may be of limited relevance in the country of origin. Furthermore, unemployment among repatriates can remain high, regardless of the qualifications acquired abroad, due to high reservation wages, skill mismatches or job availability back home. This has been largely documented in the case of return migration from Germany to Southern European countries mainly Greece, during the 1980s (Glytsos and Katseli, 2006).

Even without return, the diaspora abroad can play a major role in helping the development of the home economy, by encouraging trade and capital flows. However, in contrast to what traditional trade theory suggests about the substitutability between trade and migration, nowadays income disparities persist despite the globalisation process. Current evidence suggests that trade and migration are more complements than substitutes (See for example Bouzahzah et al. (2007) and Denis and Cogneau (1995) on Morocco; Melchor del Rio and Thorwarth (2006) and Robinson et al. (1993) on Mexico). As trade intermediaries, the diaspora abroad plays a crucial role in enhancing trade between two countries. The first channel runs through the access to information on opportunities, potential markets, distribution channels, contacts and language, local customs, laws and business practices in both sending and receiving countries (See for example Head and Ries (1998) and Wagner et al. (2002) on Canada). Moreover, migrant networks are created in order to maintain links with the home country. Membership in such networks may play an important part in contract enforcement. This information channel implies that migration may actually have an impact both on exports and imports. The second channel arises when migrants have a preference for home produced goods either because of habit or home sickness (Wagner et al., 2002). This channel however is only expected to affect imports of the destination country and not exports.

Although the social effects of migration have received less attention than its economic effects, they are important and often closely linked to the economic effects of migration. Migration affects social life by altering family composition, gender roles, child outcomes in terms of labour, culture, health and education. On the one hand, migration, through remittances, increases household income which may lead to reduced child labour and increased educational attainment. Moreover, migration may enhance motivation, in the sense that children may consider migration as their ultimate goal and decide to pursue further education in order to increase their migration probability (Mountford, 1997; Beine et al., 2001). On the other hand, the absence of migrant parents may lead to less child supervision, inducing lower attendance and success at school as well as possible adverse effects due to family disintegration (McKenzie (2005) on Mexico). Hildebrandt and McKenzie (2004) identify two channels through which migration may have an impact on children health in Mexico. The first is through the impact of remittances on income and wealth. The second channel is indirect and consists of gaining knowledge of foreign health practice which may lead to better children health even for the same income level. The results show that both infant mortality and birth weight are better in families from which a member has ever migrated to the US, mostly due to the first channel.

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This thesis tries to give answers to some questions about "Migration and Development" omitted or not properly handled in the literature. The first issue put forward here is related to the direct impact of migration on labour market in sending countries. The existing literature concludes that international migration reduces unemployment and/or increases the wage rate in the home country. This result is mainly due to the fact that the literature only deals with the effects of one kind of migration flows, mainly international migration. However, it is common to find labour markets simultaneously affected by inflows and outflows of workers. For instance, a transitory South-South migration from a developing country towards another one, before migrating to a developed country, can coexist with internal migration from rural to urban areas, or emigration to more developed countries. If all previous flows are simultaneously taken into account, the overall impact on unemployment and wages is ambiguous. Indeed, a sketchy analysis suggests that on the one hand, urban emigration reduces urban unemployment and increases wages, whereas internal migration and South-South immigration to the cities raise the pressure on urban labour market. The simultaneous impact of these different forces on labour market cannot be predicted without ambiguity since it depends on the magnitude of each migratory flow. In order to take simultaneously into account the existing forces, a computable general equilibrium (CGE) model is needed. This tool allows to endogenise the determinants of migratory flows and to capture their coexisting direct effects on urban labour market, particularly on unemployment, and their direct and indirect effects on the remainder of the economy. The second chapter of this thesis is devoted to this question.

The second issue proposed in this thesis concerns the specific use of remittances in developing countries. The existing literature on remittances mainly focuses on households, ignoring linkages that transmit the influence of migration and remittances to other households and economic sectors. However, a shock on remittances involves all economic agents and sectors: it has its most direct impact on household income. But since remittances are also invested, the shock affects as well the economic sectors, and consequently the demand for production factors and their corresponding prices. In turn, households' income changes because of the wage variation. In addition, remittances contribute to the receipts of the BoP, and therefore induce an appreciation or a depreciation of the real exchange rate. The exchange rate variation affects, in turn, the value in domestic currency of the international wage and thus, the decision to migrate and remit. In sum, this is a general equilibrium problem, requiring a dynamic CGE approach to illustrate the linkages between remittances and economic agents and sectors. The innovation with respect to traditional dynamic CGE models, and especially the very few ones interested in the impact of remittances, consists in a segmentation of the savings market. In other words, remittances are not invested in the same way as other sources of savings. They mainly finance real estate. On the contrary, the proportion of domestic and foreign savings not funding the public debt is invested in productive sectors, mainly in industry and services. The problem with the real estate sector is that construction services are offered domestically, unlike other sectors that compete with exports. Export competition has a positive effect on total factor productivity growth, for example through technology transfer in order to meet the world market quality standards. Putting aside the fact that different sources of savings finance different sectors distort the share of investment going to the most or the least productive sectors, and consequently bias the results. This is the subject of Chapter 3.

Chapter 4 is interested by the impact of trade liberalisation on skilled and unskilled emigration in the sending country. This subject was mainly investigated on a theoretical ground, starting with the Hecksher-Ohlin (HO) model. In a standard HO framework, trade liberalisation is expected to be a substitute for unskilled migration in an unskilled-labour abundant country, and a complement for skilled workers. Indeed, in an unskilled-labour abundant country that is advantaged in unskilled-intensive sectors, trade liberalisation should raise unskilled-labour intensive exports and thus unskilled labour demand. Unskilled wage then increases, reducing migration incentives. The opposite is true for skilled labour. But the theoretical literature argues that the conclusions of the HO model can be reversed simply by using more realistic assumptions. While many theoretical models were built, empirical works on the relation between trade liberalisation and migration are scarce. They mainly deal with the Mexican-US case (Hill and Mendez, 1984; Melchor del Rio and Thorwarth, 2006; Robinson et al., 1993) or with the Moroccan case (Bouzahzah et al., 2007; Cogneau and Tapinos, 1995). But none of these was interested, to my knowledge, by the different impact of trade liberalisation on skilled and unskilled emigration in sending countries. This feature is important as soon as skilled migration is less accepted in a country where skilled labour is scarce. Furthermore, because trade agreements involve substantial changes in prices, resource allocation and income, the analysis is done with a dynamic CGE model. Based on a robust and widely accepted modelling of agents' behaviour, CGE models are able to provide a detailed description of the impact of such shocks on the economy.

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The literature on "Migration and Development" argues that the results are often country-specific. In this context, it is worth mentioning that the Middle East and North Africa (MENA) region has been largely neglected in the migration literature and that the interest for migrants from MENA countries in the European Union (EU) has just begun. Morocco is the first MENA country in terms of migrants to the EU (OECD, 2006), and in terms of remittances sent by migrants abroad (International Monetary Fund's (IMF) Balance of Payments Yearbook). Therefore, Morocco is an interesting case to examine closely the impact of migration on a developing country. Furthermore, it is the typical example of a developing country undergoing the combination of inflows and outflows of workers and, as it will be shown below, presents a suitable case to investigate the issues put forward in this thesis. More importantly, the data is available for the Moroccan case, especially the social accounting matrix (SAM) for the CGE analysis.

From the early 1960s, Moroccan movements towards Europe began to be conceptualised as labour migration. Moroccan migration to Europe can be divided into four different historical phases. The first phase concerns male migration and took place from the 1960s to the oil crisis in 1973. Until 1965, the number of Moroccans in Europe was still very low, estimated at 70-80,000 persons (Nyberg-Sorensen, 2004). The majority were young men from rural areas, generally married who, because of their intention to return, left their families behind and remitted large amounts of money back home. Since the mid-1980s, Morocco has witnessed a second phase of migration concerning women, in the process of family reunification, to European countries notably Spain and Italy, but also to Arab countries such as Libya and the Gulf States. The third phase is about seasonal migration, but it has lost its importance in numerical terms. The last phase is characterised by the proliferation of clandestine migration. Both family reunification and irregular migration can be seen as a result of the tightened policy adopted by European countries, especially after the conclusion of the Schengen Agreement in 1990 and the Maastricht Treaty of 1991 which introduced visas and a selective ceiling for work permits. Besides, an eight-kilometre defensive wall was built in 1993 around Ceuta, the Spanish enclave in northern Morocco, for strict border surveillance.

Nowadays, about 10% of the Moroccan population is residing abroad. In 2003, Moroccan migrants were estimated to 2.5 millions, representing about eight per cent of Morocco's total population and affecting maybe half of all Moroccan families (Nyberg-Sorensen, 2004). Contemporary Moroccan migration is oriented towards the EU, to traditional destinations such as Belgium, France, Germany and the Netherlands, but also more and more to new destinations like Italy and Spain (Nyberg-Sorensen, 2004).

According to data from the IMF's Balance of Payments Yearbook, Morocco is the fourth-largest recipient of official remittances among developing countries, with USD 3.3 billion in 2001, standing internationally after India, Mexico and the Philippines. After their surge in 2001, the level of remittances remained high compared to other developing countries, about 9% of GDP and 25% of exports. For instance, they amounted to only 3% of GDP and 16% of exports in Egypt, 5% of GDP and 13% of exports in Tunisia (Bouhga-Hagbe, 2004). Since the early 70s, they have become increasingly important for the Moroccan BoP. In 2001, they were six times higher than ODA and five times higher than FDI (de Haas, 2007). They represent the country's major source of foreign currency receipts and exceed receipts from phosphate and tourism (Nyberg-Sorensen, 2004).

But the most striking thing is that the Kingdom incorporated migration in its budgetary plans of 1968-72 and 1973-77 as a contributor to development. Indeed, the government looks at migration as a solution to the growing unemployment problem, a means to solve BoP problems and a convenient mechanism for upgrading the skills of the population, based on the belief that migrants would return. Therefore, migration and development is an interesting issue when applied to Morocco.

This thesis investigates the impact of migration on the development of Morocco, with a special look to its consequences in terms of unemployment and the specific use of remittances. It also investigates the ability of Moroccan trade liberalisation to reduce skilled and unskilled migratory pressures.

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Before putting forward the contribution of the different chapters to the "Migration and Development" topic, the **first chapter** gives a break from the migration literature to investigate the methodology employed in assessing the impact of migration on Morocco. Chapter 1 is a useful exercise for CGE beginners to discover the CGE world. It helps understand how a CGE model structure affects the results and more importantly, how the interpretation of the results should be done under different structures. The chapter begins by simulating a trade liberalisation shock on the Moroccan economy represented by the SAM of 1998. The shock is first run in a static real CGE model of Decaluwé et al. (2001), called EXTER. Later on, EXTER's structure is modified so that to incorporate, in turn, the assumptions of three standard CGE models: GTAP (Brockmeier, 2001), IFPRI (Löfgren et al., 2002) and MIRAGE (Bchir et al., 2002). EXTER's functional forms are first modified for production, intermediary consumption, value added, investment volume and household utility. The chapter discusses how the results of the trade liberalisation shock vary from the extreme Leontief production or intermediary consumption function to the constant elasticity of substitution (CES), with a discussion of the elasticity choice. The same is done for the value added and total investment volume (CES vs. Cobb-Douglas). The chapter also explains how household consumption reacts to price changes in the simplified case of a Cobb-Douglas utility function as against the linear expenditure system (LES). It also gives a rapid discussion about the effects of the *numéraire* choice in a real CGE model. Then, it explains the difference between the "savings-driven" and the "investment-driven" closures with their respective implications on the trade liberalisation results. The commodity market structure is also modified so that to incorporate imperfect competition. Simulations are run with different profits shares in the base year and with different time horizons. Finally, the time dimension is introduced to the EXTER static model. The chapter concludes that the results concerning winners and losers from trade liberalisation are generally insensitive to the functional forms adopted and to the *numéraire* choice. By contrast, they are mainly affected by the choice of the macroeconomic closure, the introduction of the imperfect competition market structure and the dynamic framework. Hence it is crucial to accurately identify the problem in order to determine the most appropriate analytical framework for the corresponding economy. At present, it is possible to conceptualise the adequate model to evaluate the effects of migration on Morocco.

Chapter 2 assesses the impact of all migratory flows affecting the Moroccan economy on urban unemployment, by the means of a static CGE model applied to the Moroccan SAM of 1998. Morocco is the typical example of a developing country undergoing the combination of different migratory flows: rural and urban emigration towards the EU, internal migration from rural to urban areas, and finally Sub-Saharan immigration to Morocco for transit to Europe or in order to definitely stay there. Indeed, OECD migration data show that the traditional destinations of Moroccan migrants, such as Belgium, France, Spain, Italy, and the Netherlands, continue to receive important migratory flows. In 2004, 8,000 Moroccans entered to Belgium, 21,700 to France, 24,600 to Italy, 3,300 to the Netherlands and 58,800 to Spain (OECD, 2006). Moreover, and according to an opinion of the International Organisation of Migration, Moroccan migration towards the EU is mostly originated from rural areas (Erf and Heering, 2002). Concerning internal migration, Agénor and El Aynaoui (2003) point out that about 200,000 migrants move annually into urban areas, which is equivalent to 40% of the total increase in urban population.

Massive internal migration is motivated by climatic risks associated to agricultural production that encourage farmers to look for a stable employment in urban areas. Finally, Morocco started to receive since the beginning of the 90s substantial Sub-Saharan immigration flows, fleeing poverty, natural resource shortages, conflicts and wars. Sub-Saharan immigrants, mostly clandestine, transit by Morocco to Spain and Europe or choose to settle definitely in Morocco. One of the most important consequences of illegal immigration on this country is that an increasingly significant number of Sub-Saharan immigrants, scalded by the difficulties they meet on the migratory way leading them to Europe, choose finally to stay there (mainly in urban areas). Data on Sub-Saharan immigration are scarce and their collection is difficult because the vast majority of African immigrants are clandestine. According to Lahlou (2003), there would be between 6,000 and 15,000 irregular migrants.

The benchmark CGE model is a static real one for a small open economy inspired from Decaluwé et al. (2001). This basic structure is however deeply modified in order to adequately describe the behaviour of labour market as well as the determinants of migratory flows. The model takes urban unemployment into account and distinguishes different segments of labour markets according to rural and urban professional categories. Such a fine description of the labour market that takes into account unemployment rates by professional categories is justified by the fact that emigration and immigration do not affect all categories in the same way. Rural and urban emigration flows as well as internal migration depend on the real wage differential between the receiving and sending regions, net of migration costs. Only Sub-Saharan immigration does not depend on wage differentials between Morocco and Sub-Saharan Africa. Indeed, given that African immigration does not only occur for economic and financial reasons, but also for personal and security reasons, living conditions in Morocco and, in particular, urban wage variation do not affect Sub-Saharan immigration to Morocco. In addition, the decision to migrate to Europe is taken before the arrival to Morocco, and does not depend on wage differentials between Morocco and the rest of the world. Therefore, the stock of Sub-Saharan immigrants in Morocco is exogenised.

Then, three simulations are run, the first one consisting of a 10% fall in migration costs, the second of a 10% rise of Sub-Saharan immigrant stock, and finally, the simultaneous effects of the two previous shocks. The first shock can be interpreted as a translation of a larger facility for the migrant to become operational, for example because of a fall in migration costs, a larger simplification and transparency of administrative procedures, or the existence of migrants networks that facilitate integration in the host country. First of all, lower migration costs should accelerate emigration and reduce, *ceteris paribus*, labour supply of urban workers as well as their unemployment rate. On the other hand, internal migration towards cities, also facilitated by the drop of migration costs, should increase labour supply and, given that other things are equal, unemployment rates. If these two migratory flows coexist, the final effect on unemployment and urban wage rates by professional category is ambiguous. The results indicate that in the Moroccan case, the falling labour supply due to urban emigration is more than compensated by greater internal migratory flows. Thus, unemployment rates of all categories, except "senior executive" and "commercial intermediaries" that are absent from rural areas, increase. These results are contradictory with the above-mentioned literature. The second shock investigates the impact of increasing South-South migration on the Moroccan labour market. Indeed, the difficulty for African countries to ameliorate the welfare of their populations and the multiplication of conflicts let think that migratory flows originated from Sub-Saharan Africa will not be over soon. Higher Sub-Saharan immigration creates a pressure on the urban labour market of "warehousemen and workers of small trades". This category absorbs all clandestine Sub-Saharan immigrants, skilled and unskilled. Given that other things are equal, the unemployment rate of warehousemen increases and induces a fall in their urban real wage, according to the wage curve. Moroccan urban workers belonging to the same category are thus incited to leave their country and rural workers prefer to stay in rural areas. However, lower internal migration and higher urban emigration do not compensate increasing African immigration. Indeed, the unemployment rate of warehousemen increases and their real wage decreases. If urban consumer price index remains constant, the "nominal" wage of warehousemen also decreases. The wage variation of warehousemen induces indirect effects on the labour market of the remaining professions. Indeed, urban sectors increase their demand of warehousemen whose wage falls. Consequently, sectors intensive in this category of workers expand. Given that capital is sector-specific, the increase in production should induce, in turn, a rise in labour demand of the other categories, reduce their unemployment rate and increase their real wage. The third shock is an experiment combining the two previous simulations in order to reflect the actual shocks on the Moroccan labour market. The results show that higher labour demand by expanding sectors and urban emigration flows reduce the pressure exerted by internal migration but do not succeed to reduce unemployment rates. They evolve positively but their variation is lower with respect to the first shock. Once again, the results disagree with the literature on the impact of migration on labour market in sending countries.

Chapter 3 investigates the transmission channels through which remittances affect households and activities, by the means of a dynamic CGE model applied to the Moroccan SAM of 1998. The model gives a particular attention to the investment of remittances in the real estate sector through a segmentation of the savings market. The problem with the real estate sector is that the nature of these services limits the scope of supply to local markets. On the contrary, tradable products compete with international goods. Export competition has a positive effect on total factor productivity growth, through exploiting economies of scale, technology transfer in order to meet world market standards in quality, distribution and marketing, and reducing production costs. Export promotion also accelerates institutional change which contributes to productivity growth by reducing transaction costs for all business activities. Therefore, there is a big difference for a country like Morocco, highly dependent on remittances, if these are invested in real estate or in productive sectors. This issue can only be investigated through a segmentation of the savings market.

Since remittances sent to Morocco are driven by altruism, I find it plausible to consider investment in housing as a fixed part of the amount of remittances invested. According to Hamdouch (2000), this proportion represents 80% of investments by Moroccans residing abroad in their country of origin. The remainder of remittances not consumed and not invested in real estate, together with households and firms' savings, help finance, on the one hand, investment in productive sectors, according to the differential between the sectoral rental rate of capital and the aggregate price of investment, and on the other hand, the domestic public debt: when government savings are negative and the external sources of funding are limited, the government is obliged to borrow from domestic agents in order to finance public investment. This domestic funding of the public debt is positively dependent on the country risk premium. In other words, if the country risk premium rises making domestic agents reluctant to invest, they will opt for a risk-free investment, such as lending to the government. Public investment is financed by government savings, when they are positive, and the public debt. Foreign savings finance foreign public debt, as well as foreign investment.

To begin with, I assess the negative impact of immigration restrictive policies and permanent migration on the future evolution of remittances. As expected, remittance slowdown is harmful to the economy. It affects negatively households' income and consumption as well as domestic investment, especially in the real estate sector. Since real estate is so much integrated in the economy, the contraction of this sector induces lower intermediary demand of inputs that, besides decreasing households' consumption, negatively affects the demand addressed to sectors. Given that other things are equal, firms adjust their production downward. Hence the overall activity shrinks. Then I ask what would be the appropriate policies to take the maximum profit from current flows. It turns out that channelling investment from real estate to productive sectors is harmful in terms of growth and welfare.

The predictions of this shock are unexpected. Scholars think that the allocation of migrant investment to productive sectors should promote economic growth. However, it appears that there is a strong demand effect that comes into play. This demand effect stems from lower input demand addressed to sectors, originated from the contraction of the real estate activity. Indeed, the latter is highly integrated in the economy. Intermediary consumption by the real estate activity of inputs produces by the other sectors is important. Positive effects in terms of welfare and economic growth only stem from government ability to attract investors through an improvement in the country risk premium, and private efforts to reduce international transfer costs. Indeed, with a better investment climate, foreign and domestic investors have greater confidence in investment: this is reflected by a simultaneous increase of domestic and foreign investments. Given that other things are equal, the capital used in the production of all sectors rises and the production follows, *ceteris paribus*, the evolution of the capital volume. This is translated in a higher economic growth. Similarly, when transfer costs decrease, households receive a larger value of remittances that increases their income, consumption budget and welfare. Furthermore, as long as a fraction of remittances is invested, the drop in transfer costs should, *ceteris paribus*, boost domestic investment in all sectors, and mostly in real estate, enhancing economic growth.

Chapter 4 explores the link between trade liberalisation and the skill composition of migrant flows in Morocco. The country is in the bulk of the trade liberalisation process. It is about to achieve a free trade area with the EU and has signed free trade agreements (FTA) with the US, Turkey and other Arab countries, at the same time as it adjusts its trade policies to conform to World Trade Organisation (WTO) rules. One major concern stems from the potential labour market effects of integration and enlargement. A sketchy analysis suggests that trade liberalisation should expand the low-protected sectors and contract the highly-protected ones. Depending on labour intensity of the expanding sectors, trade liberalisation could dampen unemployment rates. Given that unemployment is the most important economic cause for emigration in Morocco (Hamdouch, 2000), it is true to think that trade liberalisation may reduce migration incentives. This issue is of prime importance at a time Northern countries closed their doors to Southern workers for economic, social and security reasons. From the sending countries side, migratory pressure is able to lessen when unemployment decreases and/or the wage rate increases. Another concern is whether and to what extent Morocco should pursue additional trade liberalisation: does a bilateral or a multilateral tariff removal reduce more the migratory pressure?

By contrast to the other empirical studies on the question, a distinction is made between skilled and unskilled migration because the relation between labour mobility and trade migration is different for both kind of workers. In the standard HO model, and given that Morocco is abundant in unskilled labour, it must export unskilled-labour intensive goods and import skilled-labour intensive ones. In order to meet increasing exports, labour demand of unskilled workers must rise and unskilled wage must adjust upward to balance the labour market. Conversely, labour demand of unskilled workers must decrease in countries that import unskilled-labour intensive goods. This wage evolution of unskilled workers inside and outside Morocco reduces migration incentives of Moroccan unskilled workers. In this context, labour mobility and trade liberalisation are substitutes. On the contrary, if Moroccan imports are skilled-labour intensive and when imports replace domestic production, skilled labour demand decreases and so does the wage of Moroccan skilled workers. Consequently, skilled workers choose to leave. In this context, migration and trade liberalisation are complements. Indeed, as soon as Morocco's main trading partners are developed skilled-labour abundant countries (France, Spain, Italy, Germany) and since Moroccan imports mainly consist of capital and technology goods, it is true to think that they are skilled-labour intensive. The analysis is done with a dynamic CGE model of the Moroccan economy represented by the SAM of 2003, allowing to capture the dynamic gains from trade liberalisation.

The results depend on the comparative advantage of Morocco as well as the initial protection structure. According to the standard HO model, trade liberalisation should boost exports of unskilled-intensive products, those where Morocco has a comparative advantage. By contrast, imports must increase in skilled-intensive disadvantaged sectors and, given that other things are equal, depress local production. Such is the case for example of capital and technology goods. However, the results show also a contraction of some unskilled-labour intensive sectors such as agriculture and food. Indeed, this is due to the initial protection structure. After trade liberalisation, those highly protected sectors are not able to face import competition. The results of the FTA shock show that the effect of the initial protection structure dominates in rural areas, inducing a lower labour demand of unskilled workers. The rural wage thus adjusts downward in order to balance the market. In urban areas, skilled and unskilled labour demand only decrease in the long run with increased foreign competition, inducing a higher unemployment rate. The wage curve insures that urban skilled and unskilled real wage decrease in the long run. Skilled labour demand increases unexpectedly in the short run because skilled-intensive sectors expand, selling more on foreign markets thanks to the real exchange rate depreciation. Consequently, skilled unemployment decreases, implying a higher real wage. In other words, the gradual FTA creation gives rise to a push factor for migration in rural areas, and only in the long run in urban areas. Despite falling unemployment in the short run, unskilled and skilled urban people choose to migrate, motivated by the exchange rate depreciation that increases the value of the foreign wage in domestic currency. In other words, there is a pull factor for urban emigration. When the FTA shock is run with an imperfect competition framework, migration flows of skilled and unskilled workers decrease, even in rural areas in the long run. Indeed, with imperfect competition, the pro-competitive effect of trade liberalisation allows a greater expansion of the economic activity, and thus a greater labour demand that reduces unemployment and increases wages. Gradual multilateral liberalisation strengthens the previous effects. In the perfect competition model, the higher expansion of the low protected sectors raises the demand for skilled urban workers in the long run. Even unskilled labour demand increases in the long run, by contrast to the FTA case, because the overall activity now grows more and released unskilled workers are employed in the expanding sectors. However, migration of urban individuals is motivated by the exchange rate depreciation, which can be considered as a migration pull factor. In the imperfect competition model, all emigration flows decrease, more than the FTA shock, meaning that trade liberalisation and migration of skilled and unskilled workers are substitutes. In sum, the more the economy grows, the lower are migration flows. The results of this chapter are contradictory with the works of Bouzahzah et al. (2007) and Cogneau and Tapinos (1995) on Morocco: the authors find that tariff removal and migration are complements, and that complementarity is due to push factors.

Chapter I

Trade Liberalisation Under Different CGE Structures[1]

Economists are increasingly interested in developing methods to capture the impact of macroeconomic policies on income distribution, poverty and inequality in developing countries. Many of those policies, such as consumption subsidies, tax reforms, education and health programs, the removal of tariff and non-tariff barriers..., involve the participation of all economic agents and reveal feedback effects of agents' behaviours, as well as connections between agents and sectors. Thus, a general equilibrium context is needed, in order to describe the structure of the whole economy and the interactions between economic agents and sectors. In this context, a policy shock disturbs the overall economic balance and describes the consequences on agents and sectors directly affected by the policy, as well as indirect consequences on others.

A CGE model is a system of equations describing a specific economy or region. Prices and quantities of products and production factors are simultaneously determined on all markets so that supply equals demand. The model is calibrated on a given economy by the means of a double entry table, called Social Accounting

[1] This chapter is based on a joint paper with B. Decaluwé (Karam and Decaluwé, 2006).

Matrix (SAM), that contains the information about this economy for a given period. Most of the equations have rigorous microeconomic foundations according to the neoclassical theory of general equilibrium, specifying how demand and supply react to price changes on each market. Furthermore, agents' behaviours obey to the underlying macroeconomic framework (investment-savings balance, government and external savings) so that the functioning of the economy also allows a rigorous macroeconomic analysis. Originally developed in a competitive framework, CGE models have sometimes been modified to take into account the characteristics of the economies, among other things, market imperfections and the intertemporal behaviour of agents.

CGE models are built on the basis of relationships that ensure the consistency of the model. These are twofold: behavioural equations (production functions, utility functions,...) and accounting equations (market equilibrium, macroeconomic closures...). The arising question concerns the choice of these functions and macroeconomic closures: should the production function be a Leontief or a CES function? Should a Cobb-Douglas or a Stone-Geary function be adopted for household utility? And how the results of a policy shock change with functional forms? What about the closures related to the government account, external savings, and the savings-investment balance? For instance, a "savings-driven" closure - where savings are generated by the model while the investment volume adjusts freely to achieve the savings-investment equilibrium - should induce a different reaction to the simulated shock than an "investment-driven" one - where the investment volume remains fixed and savings adjust. The interesting question is to what extent these different specifications produce mixed results following a trade liberalisation shock: this is the subject of this chapter.

I choose the Moroccan economy as described in the SAM of 1998 in order to carry on this exercise. The SAM is built by Abdelkhalek and Zaoujal (2004) from several data sources: the input-output table of the Moroccan economy in 1998, the

National Survey on Household Living Standards in 1998-1999, documents from the Ministry of the Economy and Finance, from External Trade department, from the Ministry of Agriculture, from Foreign Exchange department, and from Bank Al-Maghrib. The SAM gathers two factors of production (labour and capital), four types of agents (households, firms, the government, the rest of the world (RoW)), 34 sectors of activity that correspond exactly to those of the input-output table of the Moroccan economy in 1998. Some functional parameters are collected from econometric studies on Morocco and others are calibrated to satisfy the initial state of equilibrium represented by the SAM. Appendix A and B give more information about the data.

The benchmark model is a static real one, called EXTER, built by Decaluwé et al. (2001) for a small open economy. I first simulate the impact of trade liberalisation on EXTER adapted to the Moroccan economy. Then, I change the assumptions of the initial model according to three other standard CGE models: GTAP (Brockmeier, 2001), IFPRI (Löfgren et al., 2002) and MIRAGE (Bchir et al., 2002), and see how the results of the trade liberalisation shock are affected by the change of EXTER structure.

The chapter is organised as follows: Section 1 provides a brief description of the EXTER model and the impact of trade liberalisation on the Moroccan economy represented by EXTER. Section 2 is devoted to the sensitivity analysis on CGE structures and Section 3 concludes.

1 EXTER

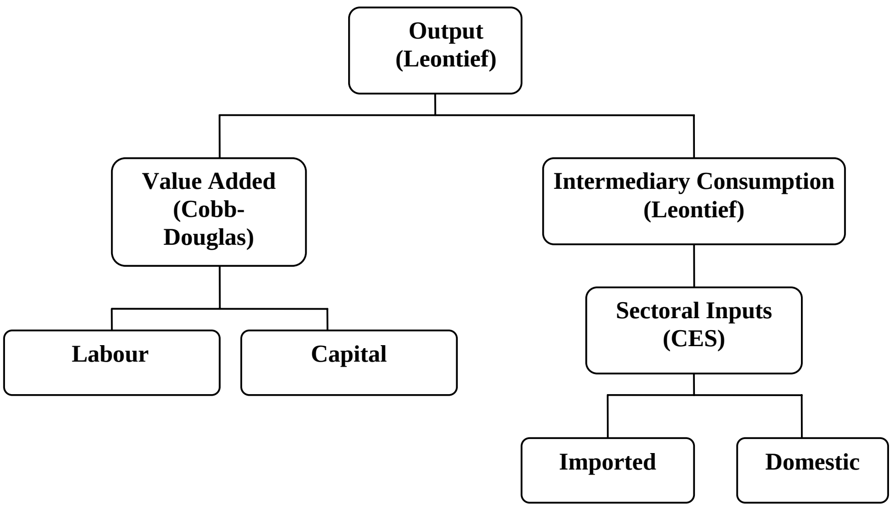
1.1 A Brief Overview of the Model

EXTER is a real static model of a small open economy that is price-taker on international markets. Activities are aggregated in four mono-productive sectors: agriculture, industry, tradable and non-tradable services. The production process makes use of two factors: labour and capital. Economic agents consist of salaried households, capitalist households, firms, the government and the RoW. The model is implemented in GAMS (Brooke et al., 1988) and solved with NLP, a non-linear programming solver. This section exhibits the structure of EXTER model without mathematical formulations. Appendix C is devoted to the mathematical statement of the model.

1.1.1 Production Activities

Producers maximise profits for a given technology, and input and output prices. The production function is described in Figure I.1. Perfect complementarity is assumed between value added and intermediate consumption. Intermediate consumption aggregate is, in turn, a Leontief function of sectoral inputs, imported or locally produced. Private value added is a Cobb-Douglas function of labour and capital. Public value added is only composed of wage payroll.

Figure I.1:
Technology for Production Activities



1.1.2 Institutions

Salaried households receive the bulk of their incomes from labour remuneration and constant transfers from the government and other agents. Capitalist households receive capital remuneration and transfers. Total household income is used to pay direct taxes and fixed amounts of transfers to other agents, to save and to consume. Direct tax rates are fixed shares of households' income. Savings are fixed shares of households' disposable income. Household utility is a Cobb-Douglas function of budgetary shares and the propensity to save. Government income consists of direct and sales taxes as well as import and export tariffs. All taxes are *ad-valorem*. Besides transfers to other agents (interests on domestic public debt to households and firms, on foreign public debt to the RoW...), the government uses its income to buy a fixed quantity of consumption goods. Firms' income is composed of capital remuneration and fixed transfers. The RoW receives import sales, a part of capital remuneration and fixed transfers (such as interests paid by firms and the government, distributed profits from local firms...), and pays exports as well as a constant amount of transfers (such as interests paid to the government and firms, distributed profits paid to local firms and aid for the government...).

1.1.3 System Constraints

System constraints or "closure rules" describe on the one hand the behaviour of labour and commodity markets, and on the other hand, the macroeconomic aggregates such as government and RoW accounts as well as savings-investment adjustment mechanisms. These constraints have to be satisfied by the economic system, but are not considered in the decisions of any microeconomic agent.

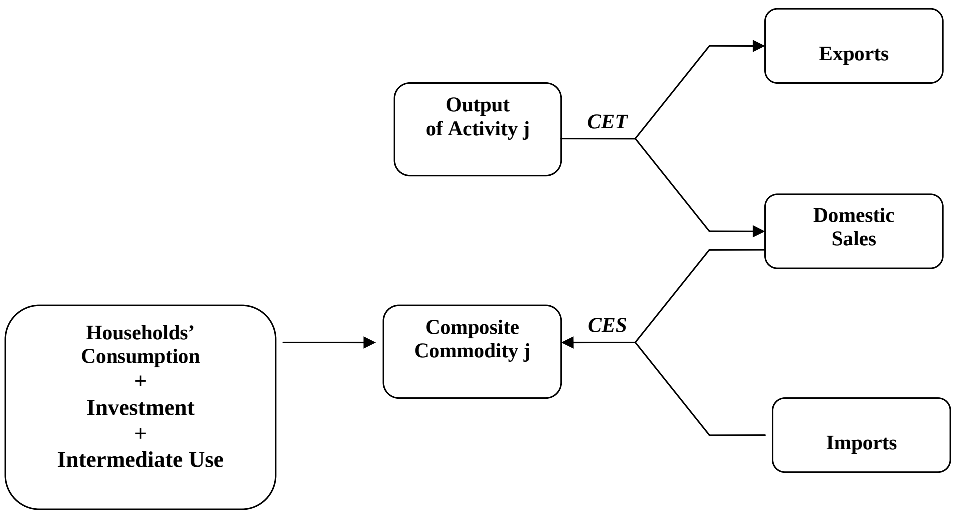
Commodity Markets:

Figure I.2 summarises the commodity flows underlying the market for a given product that is produced by a single activity and is traded with the RoW. Tradable sectors sell their production on domestic and international markets, according to a constant elasticity of transformation (CET) function. Export supply depends on domestic and international export prices, the export capacity of the firm represented by the share of production exported, and the degree of transformation of domestic sales into international exports represented by the elasticity of transformation.

Domestic demand for goods and services is satisfied by local production and imports. These are supposed to be imperfect substitutes for local products, following the Armington assumption (Armington, 1969). In other words, domestic agents make a choice between local and imported products according to a CES function. The relative demand for local and imported products depends on their relative prices, import penetration rate and the elasticity of substitution between imported and locally produced commodities.

Each type of consumption is a vertical combination of goods and services and a horizontal combination of local and imported products. Given the lack of data on the horizontal combination of commodities for different consumption types, the horizontal structure of each composite product is supposed to be identical for households' consumption, intermediary consumption and investment demand by firms. Total production of non-tradable services is devoted to public consumption.

Figure I.2:
Commodity flows



Factor Markets:

Installed capital is sector-specific, so that the rental rate of capital varies across sectors. Labour is perfectly mobile between sectors and fully employed: a market-clearing price generates demand-supply balance.

Macroeconomic Constraints:

EXTER is characterised by a savings-driven determination of investment: public consumption and government transfers are exogenous, direct and indirect tax rates are constant, limiting the possibility for public savings to adjust freely. Foreign savings are fixed. For each household, savings are a fixed share of his disposable income. Firms' savings are also determined by the model. Hence, none of savings sources is free to equilibrate the aggregate savings-investment balance. The investment volume adjusts to achieve the savings-investment equilibrium. Finally, the nominal exchange rate - the price, in local currency, of one unit of foreign currency - is the *numéraire*.

Some adjustments need to be made to EXTER in order to fit the Moroccan SAM. In particular, non-tradable services now use both labour and capital and value added of these sectors is no more reduced to the wage payroll. However, if a certain degree of substitution is tolerated between labour and capital in the value added of private sectors, this is not true for the public sector. Indeed, the government does not reduce its buildings if the price of capital increases, or reduce the number of civil servants when their wage increases. Moreover, as the number of civil servants increases, the government must enlarge its buildings to install enough offices. Consequently, a Leontief function is used for the public value added to describe the perfect complementarity between labour and capital in the public sector.

1.2 Trade Liberalisation Scenario

With the accession to the WTO, the entry into force of the European partnership and free trade agreements with the US, Turkey and other Arab countries, Morocco is in the bulk of the trade liberalisation process. Since 1985, the country experienced a gradual trade liberalisation. In less than 15 years, customs duties on some products sharply decreased, from over 100% to less than 30% (Abdelkhalek, 2005). Hereby, the results of the trade liberalisation shock on the Moroccan economy represented by the EXTER model are analysed. However, it is worth mentioning that this chapter does not deal with the magnitude of trade liberalisation impact on Morocco, but with how the results change after modifiying the structure of the benchmark model.

Given that other things are equal, tariff removal reduces the import price of all products, with the most protected sectors experiencing the higher price drop (Table 1). For instance, this is the case of food industry, non-metallic minerals, rubber and plastics, where import tariffs are particularly high (up to 46.91%, 31.79% and 25.88% respectively) and whose import price mostly decreases (by 31.93%, 24.12% and 20.56% respectively). Lower import price should stimulate, *ceteris paribus*, imports of all tradable goods. However, imports of the following products go down: oil refining, metallurgy, metal processing, machines, office machinery, other transport means, hotels and restaurants, transport, financial, and rental services. Indeed, as it will be shown below, an unexpected lower domestic demand depresses both domestic production and imports of those products. Imports of fishery and clothing products as well as radio and television decrease because local production replaces imports, as it will be shown later. Nonetheless, the aggregate import volume grows and given that foreign savings are fixed, the increase of imports can only be funded, *ceteris paribus*, by increased exports that are easily sold on international markets due to an infinite price elasticity of export demand. A depreciation of the real exchange rate is therefore necessary in order to boost exports. Indeed, export growth in all sectors (except for non-metallic minerals, machines and non-financial services) is made possible by the depreciation of the real exchange rate as well as lower imported input prices, that increase the competitiveness of local producers on international markets (Table I.2).

Trade liberalisation eradicates import tariffs received by the government. The

Table I.1: **Composite Products**

Percentage Change with Respect to the Base Year

Activities	**Initial Tariff**	**Import Price**	**Import Volume**	**Composite Price**	**Composite Supply**
Agriculture	17.04%	-14.56	33.60	-2.90	3.44
Fishing	0	0	-6.50	-3.61	0.63
Mining	11.83%	-10.58	2.24	-9.15	1.27
Food	46.91%	-31.93	26.94	-7.80	5.81
Tobacco	18.71%	-15.76	3.82	-9.24	-0.72
Textile	1.46%	-1.44	0.19	-2.62	0.91
Clothing	1.29%	-1.28	-2.22	-5.99	0.69
Leather and shoes	4.81%	-4.59	2.10	-7.18	3.80
Wood	20.62%	-17.1	2.00	-12.38	-1.33
Paper	20.62%	-17.09	14.67	-7.47	7.36
Edition	6.11%	-5.75	15.85	-2.50	13.51
Oil refining	9.03%	-8.28	-2.25	-8.57	-2.06
Chemicals	14.66%	-12.79	4.50	-9.31	2.07
Rubber and plastics	25.88%	-20.56	5.78	-13.06	0.21
Non-metallic minerals	31.79%	-24.12	2.88	-12.59	-5.49
Metallurgy	15.52%	-13.43	-3.99	-13.39	-4.02
Metal processing	13.49%	-11.89	-1.81	-9.76	-3.21
Machines	6.77%	-6.34	-8.91	-6.33	-8.91
Office machinery	10.13%	-9.2	-5.70	-10.09	-5.14
Radio and TV	3.22%	-3.12	-2.09	-5.92	-0.36
Medical instruments	3.3%	-3.2	6.23	-3.71	6.57
Cars	18.88%	-15.88	0.62	-12.52	-1.72
Other transport means	1.81%	-1.78	-4.97	-2.55	-4.51
Furniture	9.39%	-8.59	4.87	-5.27	2.65
Electricity	10.44%	-9.45	1.90	-3.72	0.65
Construction				-12.01	-6.27
Trade and repair				-3.79	0.29
Hotels and rest.	0	0	-5.04	-8.60	-3.32
Transport	0	0	-4.12	-6.16	-2.90
Financial activities	0	0	-2.46	-7.38	-0.95
Rental services	0.02%	-0.02	-1.90	-5.57	-0.77
Public Administration				-4.57	-1.28
Education and health				-3.17	0.26
Non-financial services	6.31%	-5.93	13.18	12.26	9.25

Source: Author's calculations.

latter collects a lower amount of sales taxes as well, because the sales ad-valorem tax rate equally applies to imported and domestic products, whose price falls. Consequently, government income decreases (by 20%), and so do government savings (by 163%), given that public expenditures and transfers are fixed. The drop of government savings disturbs, *ceteris paribus*, the investment-savings balance so that the value of total investment adjusts downward (18%) in order to achieve savings-investment equilibrium. Lower investment is expected to reduce investment

Table I.2: **Production**

Percentage Change with Respect to the Base Year

Activities	**Total Production**	**Producer Price**	**Domestic Production**	**Domestic Price**	**Export Volume**
Agriculture	0.13	-1.25	0.02	-1.25	1.93
Fishing	1.44	-3.63	0.68	-3.63	6.42
Mining	1.88	-7.20	-0.02	-7.20	3.79
Food	3.90	-4.52	3.61	-4.52	6.04
Tobacco	-1.17	-8.56	-1.17	-8.56	3.35
Textile	2.40	-4.15	1.87	-4.15	4.05
Clothing	3.84	-6.84	1.24	-6.84	4.89
Leather and shoes	5.94	-7.88	4.27	-7.88	8.64
Wood	-2.04	-10.68	-2.46	-10.68	3.21
Paper	4.70	-3.33	4.57	-3.33	6.36
Edition	12.98	-1.72	12.97	-1.72	13.95
Oil refining	-1.68	-8.62	-2.03	-8.62	2.49
Chemicals	1.84	-7.25	0.71	-7.25	4.57
Rubber and plastics	-3.20	-7.50	-3.46	-7.50	0.38
Non-metallic minerals	-6.17	-11.11	-6.44	-11.11	-0.77
Metallurgy	-2.71	-13.35	-4.05	-13.35	3.08
Metal processing	-3.59	-9.03	-3.68	-9.03	0.99
Machines	-8.84	-6.32	-8.92	-6.32	-5.90
Office machinery	-3.15	-10.98	-4.58	-10.98	1.14
Radio and TV	10.98	-14.17	5.29	-14.17	13.65
Medical instruments	14.21	-8.90	10.17	-8.90	15.43
Cars	-3.84	-8.98	-4.03	-8.98	0.59
Other transport means	0.18	-7.55	-1.45	-7.55	2.49
Furniture	2.06	-4.20	1.96	-4.20	4.17
Electricity	0.66	-3.50	0.61	-3.50	4.26
Construction	-6.27	-12.01	-6.27	-12.01	
Trade and repair	0.29	-3.79	0.29	-3.79	
Hotels and rest.	-2.98	-9.75	-3.08	-9.75	7.39
Transport	-1.33	-7.47	-2.62	-7.47	5.24
Financial activities	-0.91	-7.40	-0.95	-7.40	6.97
Rental services	-0.20	-6.32	-0.62	-6.32	6.09
Public administration	-1.28	-4.57	-1.28	-4.57	
Education	0.26	-3.17	0.26	-3.17	
Non-financial services	9.01	13.18	9.07	13.18	-3.63

Source: Author's calculations.

demand by firms for all products (Table I.3) and thus induce, *ceteris paribus* a drop in total demand for all composite products. If supply is kept constant, this will create a disequilibrium on the market of each product, that requires a fall in the corresponding price in order to rebalance the market. It is indeed the case of all commodities except non-financial services whose composite price increases (by 12.26%). Since the weight of investment volume in total demand is the highest for the construction sector (0.99), one could expect, *ceteris paribus*, the greatest decline in investment demand in construction. However, the results show that the volume of investment demand decreases the most for non-financial services (26.59%). The falling investment demand in non-financial services is explained by two reasons: the decline in the total investment value resulting from lower total savings, and the increase in the composite price of non-financial services.

Domestic demand has four components: private consumption, investment, intermediary demand and public consumption. Private and public consumption are hardly responsible for the drop of domestic demand (Table I.3). First, public expenditures are fixed. Secondly, household consumption of most products increases. Consumption of rubber and plastics mostly increases (11.74%) following the sharp fall of their composite price. The drop in the consumption of non-financial services (13.47%) is due to their increasing composite price (12.26%). Domestic demand decreases mainly because of the depressive effect of investment demand, the impact of lower demand for intermediary product being limited.

Recall that the composite price of tradable goods is a weighted average of domestic and import prices, the weights being respectively the share of domestic products and imports in total supply. Falling composite and import prices induce, *ceteris paribus*, a drop in domestic market prices. Radio and television, metallurgy and construction services experience the greatest drop in their market price (14.17%, 13.35% and 12.01% respectively). Given that sales tax ad-valorem rates are fixed, producer prices of goods and services decrease proportionnally to market prices. In non-financial services, the market price increases by 13.8%, more than their composite price, because their import price decreases by 5.93%. Falling producer prices of all goods and services domestically produced (except for non-financial services) also explain the decrease of sales taxes received by the government. Nonetheless, the amount of sales taxes collected on editing products, medical instruments, and agricultural products increase due to increasing imports and production for the domestic market.

The price of imports relative to domestic products declines mostly in the food

Table I.3: **Final Demand**

Percentage Change with Respect to the Base Year

Activities	**Household Consumption**	**Public Consumption**	**Investment Demand**	**Intermediary Demand**
Agriculture	0.05	0	-15.13	2.62
Fishing	0.78	0	-14.50	3.33
Mining	6.93	0	-9.29	-1.55
Food	5.36	0	-10.62	2.17
Tobacco	7.04	0	-9.19	0.00
Textile	-0.25	0	-15.37	3.39
Clothing	3.34	0	-12.33	3.47
Leather and shoes	4.66	0	-11.21	5.55
Wood	10.87	0	-5.94	-3.13
Paper	4.99	0	-10.93	3.38
Edition	-0.37	0	-15.47	0.32
Oil refining	6.25	0	-9.87	-0.91
Chemicals	7.12	0	-9.13	0.68
Rubber and plastics	11.74	0	-5.20	0.50
Non-metallic minerals	11.14	0	-5.72	-5.90
Metallurgy	0.00	0	-4.84	-4.00
Metal processing	7.65	0	-8.68	-1.50
Machines	3.71	0	-12.01	-2.25
Office machinery	8.05	0	-8.33	-2.91
Radio and TV	3.25	0	-12.40	9.36
Medical instruments	0.89	0	-14.41	1.05
Cars	11.04	0	-5.80	-2.57
Other transport means	-0.31	0	-15.43	-0.69
Furniture	2.55	0	-13.00	2.23
Electricity	0.90	0	-14.40	-0.01
Construction	10.40	0	-6.34	-1.05
Trade and repair	0.97	0	-14.34	0.38
Hotels and rest.	6.28	0	-9.84	-0.69
Transport	3.53	0	-12.17	-0.14
Financial activities	4.88	0	-11.02	-0.80
Rental services	2.88	0	-12.72	-0.58
Public Administration	1.79	0	-13.64	0.00
Education and health	0.32	0	-14.89	-0.09
Non-financial services	-13.47	0	-26.59	0.80

Source: Author's calculations.

industry, non-financial services and manufacture of other non-metallic mineral products. This should lead to a stronger import demand of the previous products. However, agricultural imports increase more than food products (33.6% against 26.94%). Even though food supply grows more than agricultural products, food imports increase at a slower pace because food supply is mainly ensured by domestic production. Why imports of some products decrease despite tariff abolition? This is explained by the increase of the relative price of imports in some sectors (fishing, clothing, oil refining, metallurgy, metal processing, office machinery, radio and television, other transport means, hotels and restaurants, transport, financial and rental services). Export increase replaces the drop of domestic production in some sectors (mining, tobacco and wood industries, rubber and plastics, metallurgy, metal processing, office machinery, car industry, other transport means, hotels and restaurants, transport, rental and financial services). This transformation of domestic sales into exports (Table I.2) is explained by lower domestic prices received by local producers and is motivated by the real exchange rate depreciation as well as lower imported input prices. Indeed, the domestic price declines with respect to the price received by producers for their sales abroad, that is kept constant[2]. Exports of other non-metallic mineral products and machines fell by 0.77% and 5.90% respectively, despite the drop of domestic prices by 11.11% and 6.32%. This is explained by the fact that producers adjust their production downward following the drop of internal demand. Exports of non-financial services decrease by 3.63% because the domestic price increases by 13.18%. Producers are thus motivated by higher domestic prices and offer their services on the domestic market.

With falling internal demand addressed to some sectors, producers reduce their production (tobacco and wood industries, oil refining, rubber and plastics, non metallic minerals, metallurgy, metal processing, machines, office machinery, cars, construction services, hotels and restaurants, transport, financial and rental services, public administration). The Leontief production function ensures a perfect complementarity between value added and intermediary consumption so that production adjustments are made possible by equal variations of value added and intermediary consumption. It will shown in the next section how the specification of the production function affects the results of trade liberalisation. All contracted

[2] This stems from the fact that Morocco is a small open economy that does not affect international prices.

sectors reduce their demand for labour (Table I.4), the capital being sector-specific[3]. Expanding sectors absorb the volume of labour released. Labour demand increases the most in medical instruments and editing sectors (by 34.20% and 27.56% respectively) because they display the highest production growth (14.21% and 12.98% respectively). Furthermore, labour demand grows strongly in non-financial services, by 33.81%, while production only rises by 9.01%. This is explained by the fact that non-financial services are more labour intensive than editing.

The increased demand for labour by the expanding sectors exceeds the amount of labour released by the contracted ones. Given that total labour supply is fixed, the wage must adjust upward in order to rebalance the market. However, the wage rate decreases by about 4%. Indeed, the wage rate in the perfect competition market is given by the product of the physical marginal productivity of labour and the value added price. In the present case, it is the drop in the average value added price that explains the declining wage. Since capital is sector-specific, the rental rate of capital rises in sectors that ask for more labour, due to higher physical marginal productivity of capital, and *vice versa*. Labour demand mostly increases in medical instrument manufacturing and non-financial services, inducing the greatest increase in the rental rate of capital (by 29.12% and 28.75% respectively). The greater decline in labour demand occurs in non-metallic mineral products and machines (-18.25% and -17.07% respectively) inducing the largest decline of capital return (-21.34% and -20.21% respectively). However, in other transport means, electricity, trade and repair, the rental rate of capital decreases (-3.39%, -1.27% and -2.23% respectively), despite higher labour demand, due to lower value added prices.

In the sector "public administration and social security", the value added is equal to the wage payroll. Therefore, the production drop by 1.28%, following lower

[3] In tradable sectors, firms maximise their profits. Then, if the capital available is sector-specific, the profit or capital remuneration is residual and varies from a sector to another. This approach is irrelevant for the public sector since the government, as a supplier of non-tradable services, does not have an optimising behaviour. The cost and thus the price of public services is the result of the combination of wage and capital costs. Consequently, the rental rate of capital in the public sector is normalised and capital demand is calculated residually (See Equation A8, Appendix C).

internal demand, leads to an equal decrease of the value added and labour demand. By contrast, the production of public sector "education and health" increases by 0.26% due to higher internal demand, causing an equal increase of the value added and the demand for production factors.

Table I.4: **Value Added**

Percentage Change with Respect to the Base Year

Activities	Value Added	Value Added Price	Labour Demand	Capital Demand	Capital Return
Agriculture	0.13	0.76	4.86	0	0.89
Fishing	1.44	-1.22	4.15	0	0.21
Mining	1.88	-0.93	4.90	0	0.93
Food	3.90	1.94	10.08	0	5.92
Tobacco	-1.17	-11.71	-9.31	0	-12.74
Textile	2.40	-0.58	5.81	0	1.81
Clothing	3.84	1.20	9.22	0	5.08
Leather and shoes	5.94	1.08	11.29	0	7.08
Wood	-2.04	-11.43	-9.82	0	-13.23
Paper	4.70	6.01	15.35	0	10.99
Edition	12.98	8.63	27.56	0	22.73
Oil refining	-1.68	-11.25	-9.31	0	-12.74
Chemicals	1.84	0.16	6.02	0	2.01
Rubber and plastics	-3.20	-5.12	-4.54	0	-8.15
Non-metallic minerals	-6.17	-16.17	-18.25	0	-21.34
Metallurgy	-2.71	-16.07	-15.14	0	-18.35
Metal processing	-3.59	-7.46	-7.28	0	-10.79
Machines	-8.84	-12.48	-17.07	0	-20.21
Office machinery	-3.15	-6.19	-5.58	0	-9.15
Radio and TV	10.98	3.33	19.19	0	14.68
Medical instruments	14.21	13.06	34.20	0	29.12
Cars	-3.84	-5.05	-5.11	0	-8.70
Other transport means	0.18	-3.56	0.41	0	-3.39
Furniture	2.06	-0.09	5.98	0	1.97
Electricity	0.66	-1.91	2.62	0	-1.27
Construction	-6.27	-14.24	-16.46	0	-19.62
Trade and repair	0.29	-2.51	1.62	0	-2.23
Hotels and rest.	-2.98	-12.72	-12.00	0	-15.33
Transport	-1.33	-6.04	-3.64	0	-7.28
Financial activities	-0.91	-8.64	-5.90	0	-9.47
Rental services	-0.20	-5.89	-2.38	0	-6.07
Public Administration	-1.28	-3.78	-1.28	0	0.00
Education and health	0.26	-2.95	0.26	0.26	0.00
Non-financial services	9.01	18.11	33.81	0	28.75

Source: Author's calculations.

Following the wage drop, household income decreases by 3%, firms' income by 2%, and government income by 20%. Given that the direct tax rate is constant, household disposable income falls by 3% and so do households' savings, the propensity to save being constant. Firms' savings also decrease (by 2.7%). Lower households and firms' income induces a fall in the amount of direct taxes collected by the government and also helps explain the drop of government income.

In sum, trade liberalisation results in lower incomes for all economic agents. However, this is not a handicap for household consumption since decreasing income is accompanied by lower composite prices. The price effect is higher than the income effect: the drop of the consumer price index more than compensates the drop of income, so that household real income increases. Similarly, household welfare given by the equivalent variation[4] increases by MAD 3.9 billion, or by 1.3% of household disposable income. Trade liberalisation has the strongest impact on public savings and economic growth. It turns public current surplus (about +3% of GDP) to a deficit (-2% of GDP) and reduces real GNP by 4.43%[5]. Moreover, when one disaggregates the absolute change of real GNP, it appears that this negative evolution is mainly driven by the contraction of the overall activity: real GDP drop explains 93% of GNP variation, it decreases by 4.11%. Medical instrument manufacturing benefits the most from tariff removal, with a 14.21% rise in production. This sector is one of the least protected ones, with an initial import tariff rate of 3.3%. Therefore, trade liberalisation is likely to channel inputs from the most protected sectors (rubber industry and other non-metallic minerals) to the least protected ones (fishing, textile and clothing, leather industry, edition, radio and TV, medical instruments, other transport means and non-financial services). All those sectors expand. Although the food industry was the most protected sector, with an initial tariff of 46.91%, it also expands after trade liberalisation by 3.9%. Note that

[4] The equivalent variation is the measure of how much more money a consumer would need before a price decrease, to be just as well off after the price decrease. It is given by Equation A45 in Appendix C).

[5] Real GNP is calculated as follows:
Real GDP at constant prices
+ Commercial surplus or deficit resulting from the change in terms of trade
= Real gross domestic income
+ Real primary income received from the RoW
- Real primary income sent to the RoW
= Real gross national income
= Real GNP.

the survival of this industry in spite of foreign competition is possible thanks to government subsidies to food consumption. The subsidy rate is about 3%, further reducing the composite price of food and maintaining domestic demand. In addition, food producers benefit from an advantageous relative export price that stimulates sales on international markets (6.04%). By contrast, the production of some sectors decreases in spite of being among the least protected ones (oil refining, machines, hotels and restaurants, transport, financial and rental services), affected by lower internal demand.

2 Sensitivity Analysis

This section deals with the sensitivity of trade liberalisation results to the specific assumptions of the EXTER model. EXTER is modified according to three standard CGE models: GTAP (Brockmeier, 2001), IFPRI (Löfgren et al., 2002) and MIRAGE (Bchir et al., 2002). The main differences between the three models allow to investigate nine scenarios summarised in Table I.5. For each scenario, I present a detailed discussion on how the results of trade liberalisation change with respect to the original model structure.

Table I.5: **Alternative Scenarios**

Item	**Scenario Definition**
SIM1	Production Function
SIM2	Intermediate Consumption Function
SIM3	Value Added Function
SIM4	Investment Volume Function
SIM5	Household Consumption Function
SIM6	Investment-driven vs. Savings-driven
SIM7	The *Numéraire*
SIM8	Imperfect vs. Perfect Competition
SIM9	Time Dimension

2.1 Functional Forms

2.1.1 CES vs. Leontief

SIM1: Production Function

The degree of substitution between intermediary consumption and production factors is inherently weak due to technical constraints. For this reason, EXTER assumes perfect complementarity between intermediate consumption and value added, by the means of a Leontief production function: changes in production XS leads to the same percentage change in value added VA and intermediary consumption CI. By contrast, GTAP and IFPRI assume a CES combination of value added and intermediary consumption in the production function[6]. Now, there is no reason for changes in the value added and intermediate consumption to be equal to changes in production. It all depends on the variation of the value added price PV relatively to the intermediate consumption price PIC, and the elasticity of substitution $0 \leq \sigma_{ps} \leq \infty$ between these two components:

$$\sigma = \frac{d(CI/VA)}{CI/VA} / \frac{d(PV/PIC)}{PV/PIC}$$

If $\sigma_{ps} \to 0$, substitutability is impossible between value added and intermediary consumption. If $\sigma_{ps} \to \infty$, value added and intermediary consumption are perfect substitutes. The production function of private sector ps in EXTER must be replaced by the following one:

$$XS_{ps} = A_{ps}[\alpha_{ps} VA_{ps}^{(\sigma_{ps}-1)/\sigma_{ps}} + (1-\alpha_{ps}) CI_{ps}^{(\sigma_{ps}-1)/\sigma_{ps}}]^{\sigma_{ps}/(\sigma_{ps}-1)}$$

and intermediary consumption demand by:

$$CI_{ps}/VA_{ps} = (\frac{1-\alpha_{ps}}{\alpha_{ps}} \frac{PV_{ps}}{PIC_{ps}})^{\sigma_{ps}}$$

[6] In MIRAGE, the production function is a also a Leontief combination of value added and intermediate consumption.

where A_{ps} is a scale parameter in the CES production function and α_{ps} a share parameter in this function. An equation for the price of intermediate consumption needs to be added to the model. The price of intermediary consumption by sector is a weighted average of input composite prices PC_i, the weights being the share of each input in total intermediary consumption of the corresponding sector aij_{ij}:

$$PIC_j = \sum_i PC_i aij_{ij}$$

This new specification only applies to the private sector. The production function in the public sector is still a Leontief: if the number of ministers increases, the government must provide additional cars.

Different values are given to the elasticity of substitution according to sectors. For example, in industry, a strong substitution between production factors and intermediate inputs is barely tolerated. For this reason, I choose an elasticity of substitution of 0.4 in industrial sectors. This relative complementarity is less true in agriculture where the elasticity is fixed to 0.7. In services, the elasticity of substitution is fixed to 1.1. At present, increasing production does not induce an equal rise of value added and intermediate consumption, independently from price changes. For the same increase in value added relative price, intermediary consumption of tradable services rises the most, due to the highest elasticity of substitution, followed by agriculture and industrial sectors.

Table I.6 shows that the intermediate consumption price of construction services mostly decreases (10.41%) because 50% of contruction intermediate consumption consist of non-metallic mineral and metal products, whose composite price decreases by 12% and 13% respectively. However, the sharp decrease of value added price more than compensates the drop of intermediary consumption price, so that intermediary consumption falls. Therefore, when production decreases with respect to the benchmark simulation, the value added decreases less (-5.18% instead of -6.27%) and intermediate consumption decreases more (-7.65% instead of -6.27%). The highest increase in the relative price of value added is recorded in non-financial services (19.47%). Consequently, relative intermediate consumption mostly grows in non-financial services (21.62%). Surprisingly, intermediary consumption in the trade sector grows more than in medical instrument sector, despite a lower increase in the relative price of value added. This is explained by the higher elasticity of substitution in the service sector (1.1) compared to industry (0.4).

Table I.6: **SIM1: The CES Production Function, Some Selected Results**
Percentage Change with Respect to the Base Year

Private Sectors	**PV**	**PCI**	**PV/PCI**	**CI/VA**
Agriculture	-0.03	-4.72	4.91	3.42
Fishing	-1.96	-5.29	3.52	2.45
Mining	-1.08	-6.96	6.31	2.48
Food	0	-5.27	5.55	2.19
Tobacco	-10.08	-3.68	-6.64	-2.71
Textile	-0.4	-4.35	4.14	1.63
Clothing	0.75	-3.46	4.36	1.72
Leather and shoes	0.06	-6.6	7.14	2.79
Wood	-10.92	-8.77	-2.36	-0.95
Paper	3.87	-7.33	12.08	4.67
Edition	5.9	-6.79	13.62	5.23
Oil refining	-7.62	-7.3	-0.34	-0.14
Chemicals	-0.39	-7.51	7.7	3.01
Rubber and plastics	-4.59	-7.49	3.13	1.23
Non-metallic minerals	-14.76	-6.98	-8.37	-3.43
Metallurgy	-12.86	-8.34	-4.93	-2.01
Metal processing	-7.74	-9.03	1.41	0.56
Machines	-10.58	-4.98	-5.89	-2.4
Office machinery	-6.58	-8.79	2.42	0.96
Radio and TV	2.43	-5.48	8.37	3.27
Medical instruments	9.79	-4.54	15.01	5.72
Cars	-5.35	-9.02	4.03	1.59
Other transport means	-3.74	-4.8	1.11	0.45
Furniture	-1.47	-5.41	4.16	1.65
Electricity	-2.72	-7.4	5.04	5.57
Construction	-12.53	-10.41	-2.36	-2.6
Trade and repair	-2.41	-7.65	5.67	6.25
Hotels and rest.	-9.95	-6.88	-3.29	-3.61
Transport	-5.79	-5.92	0.13	0.15
Financial activities	-5.9	-5.92	0.02	0.02
Rental services	-4.75	-5.65	0.95	1.05
Non-financial services	13.77	-4.77	19.47	21.62

Source: Author's calculations.

Table I.7 compares the main results of SIM1 to the benchmark simulation. Production, value added and intermediary consumption change in the same direction as before. However, the magnitude of the change is different now because, as pointed out earlier, value added and intermediary consumption are affected by the relative price change and the elasticity of substitution. In this context, the only exceptions are rental services whose intermediary consumption increases now by 0.96%, while it decreases at the benchmark simulation by the same amount of production and value added (-0.2%). Indeed, production decreases less than before (-0.01% instead of -0.2%) due to higher internal demand, and consequently, value added and intermediate consumption increase with respect to the EXTER simulation. The rising relative value added price results in a higher intermediate consumption level. This price effect, combined to a lesser drop of production, explains the increase of intermediate consumption by 0.96%.

When intermediary consumption varies with respect to the EXTER simulation, input demand is affected as well as internal demand addressed to sectors. The effect of intermediary consumption change on input demand is not reported here for the sake of brevity, but still some points need to be clarified. To begin with, oil refining products constitute 15% of intermediate consumption of the transport sector, 22% of intermediate consumption of the electricity sector and 13% of intermediate consumption of the fishing sector. The higher relative price of value added in these sectors induces greater intermediary consumption, and consequently increased consumption of all intermediate inputs, particularly oil refining products. This is why the demand for oil refining inputs increases by 0.56% now while it previously decreased by 0.91%. In the same way, it is possible to explain why total intermediary demand of inputs from the electricity and transport sectors, financial activities, construction, hotels and restaurants now rises, in contrast to the EXTER simulation.

Increasing internal demand addressed to some sectors can also boost imports as well as internal production and have indirect effects on other variables in the model. This is case for example of paper industry. Rising internal demand of paper products stimulates imports and production for the local market (+17% instead of +15% for imports and +7% instead of +5% for domestic production). Higher imports and domestic production explain why indirect taxes increase now by 0.61%

while they were decreasing by 0.67% before. Rising demand for mining products also explains the higher volume of imports (+3% against +2%) and production for the local market (+1% against a 0.2% drop previously).

Finally, it is worth mentioning that the CES production function is hardly used in the short run. A production function putty-clay[7] would be better suited. The new specification of the production function does not alter, once again, winners and losers from trade liberalisation. Only the magnitude of variable changes is modified: for example, the medical instrument sector expands more (+17.01% instead of +14.21%). The greater expansion of production is made possible by higher intermediate consumption, in comparison with the benchmark simulation, due to the fall in the relative price of intermediary consumption. The classification of winners and losers is also affected, albeit marginally. For example, non-metallic mineral industry is henceforth the second loser, replacing the construction sector that is now ranked third. Moreover, household welfare increases compared to the benchmark simulation (by 1.7% against 1.3% of his disposable income) and the economic contraction is slightly reduced (-4.02% instead of 4.11%).

SIM2: Intermediate Consumption Function

In the static EXTER model, intermediary consumption CI by sector ps is a Leontief combination of intermediate inputs. Such formulation reflects the rigidity of the production function in the short run: changes in input relative price is unlikely to affect the structure of sectoral intermediary consumption. However, in the medium and long run, as it is the case in the dynamic model MIRAGE, changes in input relative price is able to affect, to some extent, the choice of intermediate goods. A CES function is adopted in order to reflect the imperfect substitutability between

[7] A putty-clay technology distinguishes between *ex ante* (or "putty") and *ex post* (or "clay") technology. *Ex ante* production technology will tend to have high substitution possibilities, and thus is probably closer to the smooth production functions of conventional Neoclassical models. However, *ex post* production technology has far fewer substitution possibilities, and thus is closer to the Leontief case.

Table I.7: **SIM1: Comparing CES and Leontief Production Functions, Some Selected Results**

Percentage Change with Respect to the Base Year

Private Sectors	**XS;VA;CI EXTER**	**XS SIM1**	**VA SIM1**	**CI SIM1**
Agriculture	0.13	1.35	0.11	3.53
Fishing	1.44	2.16	1.08	3.56
Mining	1.88	2.93	1.84	4.37
Food	3.90	4.59	2.65	4.89
Tobacco	-1.17	-1.97	-0.91	-3.6
Textile	2.40	3.76	2.6	4.27
Clothing	3.84	4.79	3.57	5.36
Leather and shoes	5.94	7.13	4.81	7.74
Wood	-2.04	-2.44	-1.88	-2.81
Paper	4.70	7.09	3.74	8.59
Edition	12.98	14.11	10.23	16
Oil refining	-1.68	-0.95	-0.83	-0.97
Chemicals	1.84	3.72	1.63	4.69
Rubber and plastics	-3.20	-0.74	-1.73	-0.51
Non-metallic minerals	-6.17	-7.43	-5.4	-8.64
Metallurgy	-2.71	-3.32	-1.96	-3.92
Metal processing	-3.59	-3.38	-3.78	-3.24
Machines	-8.84	-8.75	-6.82	-9.05
Office machinery	-3.15	-2.84	-3.55	-2.62
Radio and TV	10.98	12.99	9.73	13.32
Medical instruments	14.21	17.01	11.57	17.98
Cars	-3.84	-3.14	-4.46	-2.94
Other transport means	0.18	0.4	0.11	0.55
Furniture	2.06	2.55	1.35	3.02
Electricity	0.66	1.95	0.41	6
Construction	-6.27	-6.81	-5.18	-7.65
Trade and repair	0.29	1.77	0.33	6.6
Hotels and rest.	-2.98	-3.78	-2.01	-5.55
Transport	-1.33	-1.06	-1.13	-0.98
Financial activities	-0.91	-0.36	-0.38	-0.36
Rental services	-0.20	-0.01	-0.08	0.96
Non-financial services	9.01	12.02	7.35	30.55

Source: Author's calculations.

inputs. How does the change of intermediary consumption structure affect the results of the benchmark model?

Intermediary demand for input i in the private sector ps is henceforth given by:

$$DI_{i,ps} = A_{i,ps} CI_{ps} (\frac{PIC_{ps}}{PC_i})^{\sigma_{ps}}$$

where $A_{i,ps}$ is a scale parameter. The price of intermediary consumption PIC_{ps} by private sector ps is a weighted average of input composite prices PC_i, the weights being the share of each input in total intermediary consumption of the corresponding sector $aij_{i,ps}$:

$$PIC_{ps} = \sum_i PC_i aij_{i,ps}$$

The elasticity of substitution $0 \leq \sigma_{ps} \leq \infty$ between inputs 1 and 2 measures the relative variation of input use following an infinitesimal variation of their relative price.

$$\sigma_{ps} = \frac{d(DI_{1,ps}/DI_{2,ps})}{DI_{1,ps}/DI_{2,ps}} / \frac{d(PC_2/PC_1)}{PC_2/PC_1}$$

In this exercise, σ_{ps} is chosen equal to 0.5 in order to reflect the relative rigidity of intermediate consumption in the short run.

In EXTER, intermediary consumption change induces an equal variation of all input demand, regardless of the input relative prices. By contrast, input demand is here affected by the price of composite products, according to an elasticity of substitution equal to 0.5. For instance, the agricultural sector reduces the demand of agricultural and textile inputs as well as electricity, water and education services to the benefit of food and oil refining inputs, chemicals, rubber and plastics, machines, construction, trade, transport and financial services, whose composite price sharply falls following trade liberalisation[8]. Intermediate demand by the fishing sector for agricultural and textile goods as well as transport means and non-financial services also decreases to the benefit of inputs whose composite price sharply falls, such as fishery and food products, mining and paper products, oil refining, chemicals, rubber and plastics, metallurgy, metal processing, machines and equipment, office machinery, radio and TV, furniture, electricity and water, trade services, hotels and

[8] For the sake of brevity, the results are not reported here. However, they are available to the interested reader at request.

restaurants, transport, construction and financial services. Intermediate demand for the above-mentioned less demanded inputs was rising in the benchmark simulation. Moreover, intermediate demand of wood, rubber and non-metallic minerals increases in the majority of sectors because their composite price sharply falls.

Sectoral intermediary consumption, by modifying the demand for inputs originated from different sectors, affects internal demand addressed to sectors and consequently sectoral production. This is the case for example of total intermediate demand of trade services that decreases now, by contrast to the benchmark simulation, inducing a reduction of total domestic demand for these goods. Producers then adjust downward their production (by 0.01% instead of a positive evolution of 0.29% previously).

The change of intermediary consumption structure affects the results of trade liberalisation: trade services add to losers. Indeed, the Leontief function is somewhat extreme, in the sense that intermediate demand for inputs is independent on changes in relative prices. But trade liberalisation primarily affects prices. Therefore, it is likely to modify the demand for inputs as well as total demand addressed to sectors and thus production level. In addition, sectoral classification changes following tariff removal. For example, radio and TV industry replaces the editing sector as the second winner (Table I.8).

The elasticity of substitution seems to play an important role because it determines the intensity of input demand variation following the change in input relative prices. For this reason, two additional simulations, SIM2B and SIM2C, are also run, one with an elasticity of 0.8 and the other with an elasticity of 1.1. When the elasticity is equal to 0.8, rubber industry adds to winners: rubber production increases by 1.12% after being decreasing by 3.20% in the EXTER simulation. When it is equal to 1.1, rubber industry adds again to winners, and other transport means to losers. The production of the latter falls by 0.08%

after being increasing by 0.18% in the benchmark simulation[9]. Indeed, the higher the elasticity of substitution between inputs is, the more input demand reacts to changes in relative prices following trade liberalisation, and the more total internal demand addressed to sectors varies. Given that other things ar equal, producers then adjust their production in order to meet domestic demand. Consequently, the sectoral classification of losers and winners changes with respect to the benchmark simulation. Finally, it is worth mentioning that the change of intermediary consumption structure leads to a slight welfare improvement. Welfare also increases with the elasticity of substitution (1.4%, 1.5% and 1.6% of household disposable income respectively instead of 1.3% in the EXTER simulation). In addition, the economic contraction slightly decreases (-4.10% for the 3 simulations instead of -4.11%).

2.1.2 CES vs. Cobb-Douglas

SIM3: Value Added Function

GTAP, IFPRI and MIRAGE suppose an imperfect substitutability between factors in the value added, by the means of a CES function. The latter allows richer behaviours than the Cobb-Douglas function of EXTER. The adoption of this functional form is justified in MIRAGE by the need to illustrate the relative complementarity between skilled labour and capital, highlighted in empirical studies. Value Added is thus a CES function of land, natural resources, unskilled labour and a composite factor of skilled labour and capital, the last term being itself a CES function of its components. The elasticity of substitution within the capital and skilled labour bundle is assumed to be 0.6 while the elasticity between this bundle and all other factors is fixed to 1.1.

When the value added VA is a CES function of labour LD and capital KD, it

[9] Recall that this sector is among the least protected ones. Therefore, the decrease of transport price following tariff removal is weak in comparison to other commodities.

Table I.8: **SIM2: The Effects on Production of a Leontief and a CES Intermediary Consumption Function**

Percentage Change with Respect to the Base Year

Private Sectors	**EXTER**	**SIM2A**	**SIM2B**	**SIM2C**
Agriculture	0.13	0.12	0.11	0.1
Fishing	1.44	1.37	1.29	1.2
Mining	1.88	2.3	2.46	2.58
Food	3.90	4.49	4.79	5.07
Tobacco	-1.17	-1.15	-1.15	-1.15
Textile	2.40	2.15	1.94	1.72
Clothing	3.84	4.12	4.24	4.34
Leather and shoes	5.94	6.43	6.58	6.69
Wood	-2.04	-1.55	-1.33	-1.14
Paper	4.70	5.14	5.28	5.37
Edition	12.98	12.64	12.43	12.22
Oil refining	-1.68	-1.34	-1.2	-1.08
Chemicals	1.84	2.44	2.69	2.9
Rubber and plastics	-3.20	-0.45	1.12	2.66
Non-metallic minerals	-6.17	-5.44	-5.06	-4.73
Metallurgy	-2.71	-1.66	-1.2	-0.83
Metal processing	-3.59	-3.25	-3.09	-2.95
Machines	-8.84	-8.62	-8.59	-8.58
Office machinery	-3.15	-2.93	-2.81	-2.7
Radio and TV	10.98	12.76	13.28	13.63
Medical instruments	14.21	15.46	15.8	16.01
Cars	-3.84	-3.1	-2.7	-2.32
Other transport means	0.18	0.15	0.05	-0.08
Furniture	2.06	2.28	2.34	2.37
Electricity	0.66	0.37	0.23	0.11
Construction	-6.27	-6.57	-6.72	-6.86
Trade and repair	0.29	-0.01	-0.11	-0.19
Hotels and rest.	-2.98	-3.02	-3.03	-3.04
Transport	-1.33	-1.39	-1.44	-1.49
Financial activities	-0.91	-0.83	-0.81	-0.79
Rental services	-0.20	-0.25	-0.27	-0.29
Non-financial services	9.01	8.49	8.21	7.97

Notes: (1) SIM2A: $\sigma_{ps} = 0.5$
(2) SIM2B: $\sigma_{ps} = 0.8$
(3) SIM2C: $\sigma_{ps} = 1.1$
Source: Author's calculations.

has the following form:

$$VA_{ps} = A_{ps}[\alpha_{ps} LD_{ps}^{(\sigma_{ps}-1)/\sigma_{ps}} + (1-\alpha_{ps}) KD_{ps}^{(\sigma_{ps}-1)/\sigma_{ps}}]^{\sigma_{ps}/(\sigma_{ps}-1)}$$

and labour demand is then given by:

$$LD_{ps}/KD_{ps} = (\frac{\alpha_{ps}}{1-\alpha_{ps}} \frac{r_{ps}}{w})^{\sigma_{ps}}$$

where $0 \leq \sigma_{ps} \leq \infty$ is the constant elasticity of substitution between labour and capital, A_{ps} a scale parameter in the CES function and α_{ps} a share parameter in this function. If $\sigma_{ps} \rightarrow 0$, substitutability is impossible and inputs are perfect complements. If $\sigma_{ps} \rightarrow \infty$, inputs are perfect substitutes. σ measures the relative variation of factor use following an infinitesimal variation of their relative price.

$$\sigma = \frac{d(KD/LD)}{KD/LD} / \frac{d(w/r)}{w/r}$$

The degree of substitution between production factors differs according to sectors. For example, in industry, a strong substitution between labour and capital is barely tolerated: some technologies can hardly be substituted by labour. For this reason, I choose an elasticity of substitution of 0.4 in industrial sectors, reflecting the relative complementarity between labour and capital. This relative complementarity is less true in agriculture where the elasticity is fixed to 0.7. In services, some activities such as "hotels and restaurants", tolerate a strong elasticity of substitution between labour and capital. Indeed, if the wage strongly increases, it is possible to replace workers that wash dishes by machines. In this case, the elasticity of substitution is fixed to 1.1. The perfect complementarity is kept between labour and capital in non-tradable services, as it was the case in EXTER adapted to the Moroccan SAM.

The unitary elasticity of substitution between labour and capital in the Cobb-Douglas function implies that the change in the relative price of labour and capital induces an equal change of the relative demand for these two inputs. When the elasticity of substitution falls below 1, like in industrial and agricultural sectors, relative factor demand reacts less to the variation of their relative price. For tradable services, an elasticity of substitution greater than 1 implies a stronger reaction of relative factor demand to the change of their relative price. In what follows, the analysis is made with respect to the benchmark simulation.

For the same variation of relative factor price and given that other things are equal, labour demand must decrease with respect to the benchmark simulation in agricultural and industrial sectors and increase in tradable services. Table I.9 shows that labour demand in agricultural and industrial sectors moves in the same direction as in the benchmark simulation, increasing or decreasing but always less than before. This is also explained by the drop of the production with respect to the EXTER simulation. Only labour demand increases in "other transport means", with respect to the benchmark simulation, because at the present case, this sector expands with respect to the EXTER simulation. In tradable services, labour demand grows more in the electricity sector and non-financial services, reflecting the strong elasticity of substitution (1.1). However, in the remaining tradable services, it decreases less, because production increases with respect to the benchmark simulation. In "trade and repair", labour demand decreases when compared to EXTER, following lower production growth. Lower labour demand in agricultural and industrial sectors reduces the wage rate with respect to the benchmark simulation (-5.13% against -3.78%).

The adoption of a CES value added function also has indirect effects on the remaining variables of the model. Here are some examples: first, the negative evolution (-2.5%) of the editing composite price at the benchmark simulation turns to be positive (+0.85%) now. Indeed, the lower reaction of labour demand to factor relative price variation induces a lower growth of labour demand (19.89% against 27.56%), and *ceteris paribus*, a weaker increase of value added and production[10] (8.85% against 12.98%). The lower rise of production results in weaker exports (+8% instead of 14%) and lower volume of production intended for the local market (9% against 13%). If the demand level is the same as in the EXTER simulation, producers raise their price by 2.4% (it decreased before by 1.72%). Consequently, the market price of domestic products also increases as well as the composite price. The same logic applies for medical instruments to describe the weaker drop of the composite price. Secondly, agricultural production intended for the local market decreases by 0.08% now, instead of a positive change of 0.02% before. The weaker

[10] Recall that production is a Leontief combination of value added and intermediary consumption. Therefore, value added, intermediary consumption and production vary in the same proportions.

reaction of labour demand to the wage relative variation induces, *ceteris paribus* a weaker increase of agricultural value added and production. Thirdly, exports of non-metallic minerals increase by 3.1% now whereas they fall by 0.77% in the benchmark simulation. Indeed, the lower decrease of labour demand limits the production fall, that in turn, makes possible export increase.

In sum, although the CES function allows richer behaviours than the Cobb-Douglas, the results of the trade liberalisation shock on the Moroccan economy are only marginally affected: the modifications are limited to the amplitude of variable change, in particular the variation in labour demand, value-added and production. The impact on welfare is weaker but still positive (about 1% instead of 1.3% of household disposable income), and economic contraction is slightly reduced (-4.10% rather than -4.11%). However, the classification of winners from trade liberalisation is modified: non-financial services is henceforth ranked first instead of medical instruments that is now classified after the editing sector.

SIM4: Investment Volume Function

In section 2, it was argued that trade liberalisation reduces government savings and, given that other things are equal, total investment value. In turn, the drop of total investment should lead, *ceteris paribus*, to a proportional fall in the demand of each investment good:

$$INV_i = \frac{\mu_i IT}{PC_i}$$

where INV_i represents the investment demand of product i, PC_i the composite price of good i, μ_i the proportion of good i in total investment volume $ITVOL$, IT total investment value given by: $IT = ITVOL \times PINV$, and $PINV$ the aggregate price of investment. This reproduces the facts that total investment volume in EXTER is a Cobb-Douglas function of investment products.

Table I.9: **SIM3: Comparing CES and Cobb-Douglas Value Added Functions, Some Selected Results**

Percentage Change with Respect to the Base Year

Private Sectors	**Production / Value Added EXTER**	**Labour Demand EXTER**	**Production / Value Added SIM3**	**Labour Demand SIM3**
Agriculture	0.13	4.86	0.1	3.86
Fishing	1.44	4.15	1.35	3.9
Mining	1.88	4.90	1.46	3.86
Food	3.90	10.08	3.04	8.09
Tobacco	-1.17	-9.31	-0.46	-3.68
Textile	2.40	5.81	1.38	3.37
Clothing	3.84	9.22	2.23	5.43
Leather and shoes	5.94	11.29	4.3	8.36
Wood	-2.04	-9.82	-0.92	-4.42
Paper	4.70	15.35	2.85	9.6
Edition	12.98	27.56	8.85	19.89
Oil refining	-1.68	-9.31	-1.12	-6.05
Chemicals	1.84	6.02	1.21	4
Rubber and plastics	-3.20	-4.54	-2.97	-4.18
Non-metallic minerals	-6.17	-18.25	-4.74	-13.32
Metallurgy	-2.71	-15.14	-1.17	-6.51
Metal processing	-3.59	-7.28	-2.57	-5.13
Machines	-8.84	-17.07	-7.25	-13.44
Office machinery	-3.15	-5.58	-1.71	-3.02
Radio and TV	10.98	19.19	7.76	14.02
Medical instruments	14.21	34.20	8.33	21.19
Cars	-3.84	-5.11	-2.97	-3.93
Other transport means	0.18	0.41	0.65	1.49
Furniture	2.06	5.98	1.54	4.53
Electricity	0.66	2.62	0.77	3.06
Construction	-6.27	-16.46	-5.39	-14.31
Trade and repair	0.29	1.62	0.21	1.2
Hotels and rest.	-2.98	-12.00	-2.96	-11.97
Transport	-1.33	-3.64	-0.99	-2.73
Financial activities	-0.91	-5.90	-0.85	-5.55
Rental services	-0.20	-2.38	-0.13	-1.59
Non-financial services	9.01	33.81	9.51	35.53

Source: Author's calculations.

By contrast, MIRAGE assumes that total investment volume is a CES function of investment demand by product. The constant elasticity of substitution is fixed to 0.6 so that to reflect the relative rigidity of the production structure in the short run: the change of investment product relative prices should not have a significant effect on the demand of investment goods. Investment demand of product i is now given by:

$$INV_i = B_i ITVOL(\frac{PINV}{PC_i})^{\sigma}$$

where B_i is a scale parameter and σ the elasticity of substitution between investment products. σ was equal to unity in EXTER. The drop of the elasticity to 0.6 implies lower reaction of investment demand to relative price changes. $PINV$ is the investment aggregate price given by the following equation:

$$PINV \times ITVOL = \sum_i PC_i INV_i$$

How do the results of the benchmark simulation change following the CES specification of the investment volume?

The drop of the investment aggregate price (-12%) should stimulate, *ceteris paribus*, total investment volume and induce a proportional increase in investment demand of all goods and services. Surprisingly, total investment volume decreases by 6.5%, despite the drop of the aggregate investment price, because total savings decrease by 18%, also reducing total investment value. Lower investment volume causes a decline in investment demand of goods and services. My concern is how investment demand by product changes with respect to the benchmark simulation. It happens that investment demand for some products (fishing, tobacco, textile, clothing, leather, oil refining, metal processing, machines, office machinery, radio and TV, transport means, trade services, hotels and retsaurants, transport, financial and rental services) increases with respect to the benchmark simulation, despite a higher composite price (Table I.10). Indeed, at present, the reaction of investment demand to the same change in prices is weaker than EXTER due to lower elasticity of substitution between investment goods (0.6 rather than 1). Higher investment demand with respect to the benchmark simulation stimulates, *ceteris paribus*, internal demand addressed to sectors so that, as shown in Table I.11, firms adjust their production upward in the above-mentioned sectors.

By contrast, investment demand of wood, rubber and plastics, non-metallic minerals and construction services decrease with respect to the benchmark simulation despite a lower composite price. This is also explained by the weaker reaction of investment demand to price changes. In addition, it happens that the share of investment demand in total domestic demand addressed to these sectors is high. Therefore, when total investment volume decreases, it induces a significant drop in the demand addressed to them. The depressive effect on domestic demand is greater in wood industry and non-metallic minerals, inducing a stronger contraction of their production activity.

The changes in results due the new functional form of investment volume are not strong enough to reverse the sign of production variation. However, the ranking of winners is somewhat modified: medical instrument manufacturing is always the first winner, but is now followed by radio and TV industry instead of the editing sector, which is henceforth ranked third. I also investigate the sensitivity of the results to different choices of the constant elasticity of substitution. Two additional simulations are run, one with an elasticity of 0.8 (SIM4B), the other with an elasticity of 1.1 (SIM4C). The classification of winners and losers is only marginally altered and no changes in signs with respect to SIM4A are detected. Finally, in the three simulations, household welfare improves (by 1.6% of household disposable income instead of 1.3%) and the economic contraction is slightly attenuated for SIM4A and SIM4B (-4.08% and -4.10% instead of -4.11%) and emphasised for SIM4B (-4.13% instead of -4.11%).

2.1.3 LES vs. Cobb-Douglas

SIM5: Household Consumption Function

In EXTER, household utility is a Cobb-Douglas function of saving propensity and commodity consumption. The Cobb-Douglas choice is not without consequences on

Table I.10: **SIM4: Comparing CES and Cobb-Douglas Investment Volume Functions, Some Selected Results**

Percentage Change with Respect to the Base Year

Activities	**PC EXTER**	**INV EXTER**	**PC SIM4A**	**INV SIM4A**
Agriculture	-2.9	-15.13	-3.47	-11.59
Fishing	-3.61	-14.5	-3.47	-11.59
Mining	-9.15	-9.29	-9.22	-8.27
Food	-7.8	-10.62	-8.07	-8.96
Tobacco	-9.24	-9.19	-8.99	-8.41
Textile	-2.62	-15.37	-2.56	-12.09
Clothing	-5.99	-12.33	-5.89	-10.24
Leather and shoes	-7.18	-11.21	-7.18	-9.49
Wood	-12.38	-5.94	-12.56	-6.19
Paper	-7.47	-10.93	-7.94	-9.04
Edition	-2.5	-15.47	-3.25	-11.71
Oil refining	-8.57	-9.87	-8.41	-8.76
Chemicals	-9.31	-9.13	-9.33	-8.21
Rubber and plastics	-13.06	-5.2	-13.09	-5.84
Non-metallic minerals	-12.59	-5.72	-12.72	-6.08
Metallurgy	-13.39	-4.84	-13.36	-5.67
Metal processing	-9.76	-8.68	-9.7	-7.98
Machines	-6.33	-12.01	-6.22	-10.04
Office machinery	-10.09	-8.33	-10.05	-7.76
Radio and TV	-5.92	-12.4	-5.77	-10.3
Medical instruments	-3.71	-14.41	-3.74	-11.44
Cars	-12.52	-5.8	-12.49	-6.23
Other transport means	-2.55	-15.43	-2.49	-12.12
Furniture	-5.27	-13	-5.3	-10.57
Electricity	-3.72	-14.4	-3.91	-11.35
Construction	-12.01	-6.34	-12.13	-6.46
Trade and repair	-3.79	-14.34	-3.55	-11.55
Hotels and rest.	-8.6	-9.84	-8.29	-8.83
Transport	-6.16	-12.17	-5.78	-10.29
Financial activities	-7.38	-11.02	-7.04	-9.57
Rental services	-5.57	-12.72	-5.28	-10.58
Public administration	-4.57	-13.64	-4.63	-10.95
Education	-3.17	-14.89	-3.27	-11.7
Non-financial services	12.26	-26.59	5.61	-16.23

Source: Author's calculations.

elasticities: price elasticity, income elasticity and elasticity of substitution are all equal to unity, and cross-price elasticity is zero. Such assumptions are quite strong and unrealistic.

MIRAGE and IFPRI make use for household consumption of a functional form somewhat more complicated than the Cobb-Douglas and CES functions: the linear

Table I.11: **SIM4: The effects on Production of a CES and a Cobb-Douglas Investment Volume Function**

Percentage Change with Respect to the Base Year

Activities	EXTER	SIM4A	SIM4B	SIM4C
Agriculture	0.13	0.11	0.12	0.14
Fishing	1.44	1.56	1.5	1.41
Mining	1.88	1.86	1.88	1.88
Food	3.9	3.89	3.89	3.91
Tobacco	-1.17	-1.08	-1.12	-1.2
Textile	2.4	2.83	2.63	2.27
Clothing	3.84	3.93	3.89	3.81
Leather and shoes	5.94	5.92	5.93	5.94
Wood	-2.04	-2.13	-2.07	-2.04
Paper	4.7	4.09	4.37	4.9
Edition	12.98	10.59	11.7	13.7
Oil refining	-1.68	-1.45	-1.55	-1.76
Chemicals	1.84	1.85	1.85	1.84
Rubber and plastics	-3.2	-3.2	-3.18	-3.22
Non-metallic minerals	-6.17	-6.26	-6.17	-6.2
Metallurgy	-2.71	-2.67	-2.67	-2.75
Metal processing	-3.59	-3.39	-3.46	-3.68
Machines	-8.84	-7.54	-8.16	-9.21
Office machinery	-3.15	-2.88	-2.98	-3.27
Radio and TV	10.98	11.98	11.5	10.7
Medical instruments	14.21	13.16	13.66	14.51
Cars	-3.84	-4.17	-3.97	-3.81
Other transport means	0.18	0.72	0.46	0.04
Furniture	2.06	1.91	1.98	2.12
Electricity	0.66	0.63	0.64	0.66
Construction	-6.27	-6.39	-6.28	-6.31
Trade and repair	0.29	0.38	0.34	0.26
Hotels and rest.	-2.98	-2.63	-2.79	-3.09
Transport	-1.33	-0.95	-1.14	-1.43
Financial activities	-0.91	-0.75	-0.82	-0.96
Rental services	-0.2	-0.15	-0.17	-0.21
Public administration	-1.28	-1.02	-1.15	-1.36
Education	0.26	0.19	0.22	0.28
Non-financial services	9.01	5.57	7.06	10.18

Notes: (1) SIM4A: $\sigma = 0.6$
(2) SIM4B: $\sigma = 0.8$
(3) SIM4C: $\sigma = 1.1$
Source: Author's calculations.

expenditure system (LES)[11]. This functional form allows a richer consumption behaviour due to the existence of a minimum consumption level by commodity, as well as non-unitary income elasticities. In other words, the budgetary shares of commodities vary with changes in the consumption budget. Supernumerary income,

[11] The LES demand function is obtained from a maximisation problem of the Stone-Geary utility function (Stone, 1954).

i.e. the consumption budget minus the minimum consumption value of all products, is divided among commodities according to a Cobb-Douglas function in IFPRI and a CES function in MIRAGE. The representative household's consumption of good i is then given by[12]:

$$C_i = Cmin_i + \frac{\gamma_i}{PC_i}(BC - \sum_i PC_i Cmin_i) \tag{I.1}$$

where BC represents household consumption budget, PC_i the composite price of good i, γ_i the budgetary share of good i in supernumerary income and C_{min_i} the minimum consumption volume of good i. Minimum consumption by commodity is exogenous and the consumption budget is given by the following equation:

$$BC = YDH - S_{\text{``}hh\text{''}}$$

where YDH represents household disposable income and $S_{\text{``}hh\text{''}}$ household savings.

With the LES, the calibration procedure is more complex and needs to be clarified. First, income elasticities are adjusted in order to respect Engel aggregation: the income elasticity-weighted sum of individual consumptions divided by total consumption must equal one.

$$\frac{\sum_i \varepsilon_i PC_i C_i}{BC} = 1$$

with ε_i the income elasticity of demand of good i. Secondly, budgetary shares γ_i are calibrated from adjusted income elasticities of demand:

$$\varepsilon_i = \frac{\gamma_i BC}{PC_i C_i}$$

Finally, the Frisch parameter, defined as the negative value of the ratio of household

[12] This equation implies that the supernumerary income is a Cobb-Douglas function of consumption goods, as it is the case in IFPRI.

consumption budget to supernumerary income:

$$Frisch = -\frac{BC}{BC - \sum_i PC_i Cmin_i}$$

is used to calibrate the minimum consumption volume by commodity $Cmin_i$ from equation (I.1).

Income elasticities were estimated by the Economic Research Service (ERS) of the US Department of Agriculture (Bernstein et al., 2003) for the following groups: beverages and tobacco, clothing and footwear, fuel and power, house operations, medical care, education, transport and communication, recreation and others. For food products, income elasticities were estimated for bread and cereals, meat, fish, dairy products, fats and oils, fruits and vegetables, other food products. Data come from the International Comparison Project Data (ICP) of the World Bank for the year 1996.

If any changes in results may occur, they mainly concern consumption levels. The increase of household consumption budget, as in the benchmark simulation, should not lead, *ceteris paribus*, to a proportional increase in the consumption of all commodities. Consumption volumes depend now on income elasticities, besides changes in relative prices. Let me point out that lower prices reduce the total value of minimum consumption and consequently, the supernumerary income increases. Table I.12 shows that household consumption of almost all products grows. Household demand mostly increases for commodities whose income elasticity is the highest (such as wood, rubber, non-metallic minerals, cars and construction services). For instance, consumption of transport services increases more than food (+4.02% against +3.53%), despite the sharper drop of the food composite price (-8.41% compared to -5.96% for transportation services). This is explained by Engel law: income elasticity of food demand is positive but lower than 1. Indeed, the estimated elasticity of food demand is equal to 0.69. The income elasticity of transport demand is 1.22. Now, it becomes clear why the consumption of transport services increases more.

It is easy to notice that consumption volumes change with respect to the benchmark simulation where the income elasticity of demand was equal to unity. For example, the consumption of mining products increases in comparison to the EXTER simulation (+7.61% against +6.93% before) despite a lower drop of the composite price. This is explained by the greater income elasticity of mining products that is now equal to 1.36. The same reasoning applies to the following sectors whose income elasticities are greater than 1: paper industry, edition, chemicals, rubber industry, non-metallic minerals, metal processing, radio and TV, medical equipment manufacturing, transport means, furniture industry, electricity services, hotels and restaurants, transport, rental and financial services, public administration, education and health. Furthermore, a reversal in consumption change is detected for the consumption of editing and transport means. By contrast, consumption of food decreases with respect to the benchmark simulation (positive evolution of 3.53% rather than 5.36% before) despite a stronger drop of the composite price. This is due to the fact that income elasticity of food demand is now lower than 1. The same logic helps explain any decrease in the consumption of tobacco and clothing.

A LES utility function affects the behaviour of household consumption, and consequently the demand addressed to sectors as well as production level. Thus, it is not surprising to see that the classification of winners and losers from trade liberalisation is modified. However, no sign reversal in sectoral production growth is detected. Household welfare improves by 1.4% of household disposable income (instead of 1.3%) and economic contraction is slightly attenuated (-4.09% instead of -4.11%). Finally, it is worth mentioning that the LES function is hardly used in the case of poor countries where total minimum consumption value might exceed household income.

Table I.12: **SIM5: Comparing LES and Cobb-Douglas Consumption Functions, Some Selected Results**

Percentage Change with Respect to the Base Year

Activities	Prod. EXTER	PC EXTER	C EXTER	Prod. SIM5	PC SIM5	C SIM5
Agriculture	0.13	-2.9	0.05	0.11	-3.35	0.66
Fishing	1.44	-3.61	0.78	1.04	-3.95	1.49
Mining	1.88	-9.15	6.93	1.8	-9.04	7.61
Food	3.9	-7.8	5.36	2.19	-8.41	3.53
Tobacco	-1.17	-9.24	7.04	-1.33	-9.84	6.06
Textile	2.4	-2.62	-0.25	2.27	-2.57	-0.85
Clothing	3.84	-5.99	3.34	3.6	-5.99	3.04
Leather and shoes	5.94	-7.18	4.66	5.4	-7.32	3.93
Wood	-2.04	-12.38	10.87	-2.14	-12.48	10.05
Paper	4.7	-7.47	4.99	4.93	-7.24	5.76
Edition	12.98	-2.5	-0.37	14.91	-1.89	0.65
Oil refining	-1.68	-8.57	6.25	-1.75	-8.58	6.32
Chemicals	1.84	-9.31	7.12	1.9	-9.18	7.76
Rubber and plastics	-3.2	-13.06	11.74	-3.6	-13	11.97
Non-metallic minerals	-6.17	-12.59	11.14	-6.24	-12.5	11.39
Metallurgy	-2.71	-13.39	0	-2.78	-13.41	0
Metal processing	-3.59	-9.76	7.65	-3.7	-9.76	8.38
Machines	-8.84	-6.33	3.71	-8.74	-6.38	4.33
Office machinery	-3.15	-10.09	8.05	-3.22	-10.07	7.69
Radio and TV	10.98	-5.92	3.25	11.09	-5.92	3.93
Medical instruments	14.21	-3.71	0.89	15.15	-3.67	2.3
Cars	-3.84	-12.52	11.04	-3.99	-12.53	10.24
Other transport means	0.18	-2.55	-0.31	0.53	-2.52	1.09
Furniture	2.06	-5.27	2.55	2.59	-5.1	3.22
Electricity	0.66	-3.72	0.9	0.86	-3.08	1.53
Construction	-6.27	-12.01	10.4	-6.33	-11.92	9.49
Trade and repair	0.29	-3.79	0.97	0.15	-4.06	2.66
Hotels and rest.	-2.98	-8.6	6.28	-2.71	-8.27	7.52
Transport	-1.33	-6.16	3.53	-1.35	-5.96	4.02
Financial activities	-0.91	-7.38	4.88	-0.87	-6.97	5.48
Rental services	-0.2	-5.57	2.88	-0.17	-5.1	3.22
Public administration	-1.28	-4.57	1.79	-1.27	-4.37	2.94
Education	0.26	-3.17	0.32	0.59	-3	1.31
Non-financial services	9.01	12.26	-13.47	12.07	18.63	-14.68

Source: Author's calculations.

2.2 Macroeconomic Constraints

SIM6: Investment-driven vs. Savings-driven

EXTER has a savings-driven determination of investment: public expenditures and tax rates are fixed. Government and firms' savings are determined by the model. Household savings are a fixed share of household disposable income. External savings are fixed. Hence, none of the four types of savings is free to equilibrate the aggregate savings-investment balance. Consequently, gross fixed capital formation varies endogenously to achieve savings-investment equilibrium. However, in a static model like EXTER, the most appropriate closure would be the one that considers the volume of investment fixed. In a short term horizon, the rigidity of production structure implies that investment demand is unlikely to change when shocks affect aggregate savings.

In the IFPRI model, the savings-investment closure considers investment demand by commodity fixed in volume. If it is so, and if savings are not flexible, there is no guarantee for the savings-investment equilibrium to be achieved. Something must be released in the savings side. In the IFPRI model, household savings are released: instead of being a fixed share of disposable income, they adjust freely by the means of a fully flexible adjustment term that is added to the saving propensity. IFPRI macroeconomic closure is therefore “investment-driven”. Since the volume of investment demand by product is now fixed, the equations that help determine this variable are removed from the benchmark model.

At present, when tariff removal reduces government’s income and savings, household savings must adjust upward in order to maintain the volume of investment by product fixed. Household savings increase by 35.76% whereas it was decreasing by 2.86% in the benchmark simulation (Table I.13). When household savings increase, the share of disposable income spent on consumption should decrease, *ceteris paribus*, as well as household consumption by product. However, this is not always the case. Consumption of goods and services depends on changes in relative prices.

Rubber products exhibit the largest reduction of their composite price (-13%). That is why households mostly increase their consumption of rubber goods (6.12%). In the benchmark simulation, the composite price of rubber products also decreased by 13.06% but household consumption increased by 11.74% (Table I.14). The lower consumption growth of rubber products with the new macroeconomic closure, for

Table I.13: **SIM6: The Effect on Income of Investment and Savings-driven Closures**

Percentage Change with Respect to the Base Year

Household	**Income**	**Disposable Income**	**Savings**	**Consumption Budget**
EXTER	-2.80	-2.86	-2.86	-2.86
SIM6	-3.15	-3.21	35.76	-7.67

Source: Author's calculations.

the same drop of the composite price as before, is explained by the sharp drop of household consumption budget (-7.67% instead of -2.86% before).

When the consumption budget decreases, households reduce their demand for commodities whose relative price declines the least. Such is the case for example of the following products: fishery, tobacco, clothing, leather, oil refining, machines, radio and TV, medical instruments, furniture, electricity, trade and construction services, hotels and restaurants, transport, rental and financial services, public administration, health and education. By contrast to the EXTER simulation, the consumption of those products decreases now. Only the consumption of non-financial services increases with respect to the benchmark simulation (negative change of 0.84% instead of 13.47% before) because the composite price declines now by 6.88%, after being increasing by 12.26% in EXTER.

If lower consumption depresses the demand addressed to sectors in comparison with the benchmark simulation, the stability of investment demand now compensates for this loss. Recall that before, investment demand by product was decreasing. Therefore, how internal demand changes with respect to the benchmark simulation depends on the weight of household consumption and investment demand in total demand. When consumption loss outweighs the positive effect of investment stability, total internal demand decreases, and producers adjust their production downward. This is the case of nearly half of the sectors (Table I.14). More interesting is the fact that some of the expanding sectors in the benchmark simulation contract now. Such is the case of agriculture, paper industry, edition, furniture industry, electricity and education services, and non-financial services. Conversely, domestic demand addressed to the other sectors increases and help explain production growth with respect to the EXTER simulation. More specifically, oil refining and office machinery sectors expand now, after being contracting in the benchmark simulation.

By contrast to the EXTER simulation, intermediate demand of mining products increases by 0.13% (it fell by 1.55% before) because mining inputs constitute 62% of total intermediary consumption of oil refining industry and 11% of total intermediary consumption of non-metallic mineral products. At present, the production of oil refining and non-metallic minerals increases with respect to the EXTER simulation and so does the demand of inputs used intensively in these sectors, such as mining products. The same logic helps explain the rising intermediate demand of oil refining and metal processed products, office machinery, other transport means, electricity services, hotels and restaurants, transport and construction services. Conversely, intermediate demand of paper products decreases with respect to the EXTER simulation (negative evolution of 0.01% rather than positive change of 3.38% before) despite a lower composite price (negative change of 10.6% instead of 7.47%). This is due to the fact that paper products constitute 54% of intermediary consumption of paper industry and 57% of intermediary consumption of the editing sectors. The contraction of paper and editing sectors explain the drop of paper input demand. The drop of intermediate demand of editing products is explained by the same logic.

The "investment driven" closure generates different results from the "savings driven" one, and the differences are important in terms of trade liberalisation effects. With the "investment driven" closure, more sectors benefit from trade liberalisation: oil refining and office machinery are added to winners. Their production grows at present in order to meet increasing domestic demand that does not bear anymore the depressive effect of investment demand. By contrast, agriculture, paper industry, editing, furniture industry, electricity, education and non-financial services join losers. The classification of winners is also altered: radio and TV sector is experiencing the strongest expansion (+16.32%), followed by medical instruments

(6.13%) that was ranked first before. Furthermore, real GDP decrease less than before (-3.76% instead of -4.11%) and household welfare improvement is lower (about 0.1% of household disposable income instead of 1.3%).

Table I.14: **SIM6: Investment-driven vs. Savings-driven Closures, Some Selected Results**

Percentage Change with Respect to the Base Year

Activities	**Prod. EXTER**	**PC EXTER**	**C EXTER**	**Prod. SIM6**	**PC SIM6**	**C SIM6**
Agriculture	0.13	-2.9	0.05	-0.14	-8.31	0.7
Fishing	1.44	-3.61	0.78	0.15	-4.06	-3.76
Mining	1.88	-9.15	6.93	0.91	-9.1	1.58
Food	3.9	-7.8	5.36	1.56	-10.69	3.38
Tobacco	-1.17	-9.24	7.04	-0.71	-7.41	-0.27
Textile	2.4	-2.62	-0.25	3	-2.5	-5.3
Clothing	3.84	-5.99	3.34	2.64	-6.29	-1.47
Leather and shoes	5.94	-7.18	4.66	3.19	-7.6	-0.07
Wood	-2.04	-12.38	10.87	-1.06	-10.55	3.23
Paper	4.7	-7.47	4.99	-0.51	-10.6	3.29
Edition	12.98	-2.5	-0.37	-1.38	-6.73	-1.01
Oil refining	-1.68	-8.57	6.25	0.04	-7.05	-0.66
Chemicals	1.84	-9.31	7.12	0.83	-9.59	2.13
Rubber and plastics	-3.2	-13.06	11.74	-2.77	-13	6.12
Non-metallic minerals	-6.17	-12.59	11.14	-1.21	-8.42	0.82
Metallurgy	-2.71	-13.39	0	-0.92	-11.4	0
Metal processing	-3.59	-9.76	7.65	-0.55	-8.26	0.64
Machines	-8.84	-6.33	3.71	-0.89	-5.63	-2.16
Office machinery	-3.15	-10.09	8.05	1.17	-8.95	1.41
Radio and TV	10.98	-5.92	3.25	16.32	-5.01	-2.8
Medical instruments	14.21	-3.71	0.89	6.13	-3.94	-3.88
Cars	-3.84	-12.52	11.04	-1.88	-12.09	5.04
Other transport means	0.18	-2.55	-0.31	0.97	-2.27	-5.52
Furniture	2.06	-5.27	2.55	-1.55	-6.16	-1.6
Electricity	0.66	-3.72	0.9	-0.67	-5.7	-2.09
Construction	-6.27	-12.01	10.4	0	-6.6	-1.14
Trade and repair	0.29	-3.79	0.97	0.26	-2.98	-4.83
Hotels and rest.	-2.98	-8.6	6.28	-0.46	-5.84	-1.94
Transport	-1.33	-6.16	3.53	-0.05	-3.94	-3.88
Financial activities	-0.91	-7.38	4.88	-0.43	-5.68	-2.11
Rental services	-0.2	-5.57	2.88	-0.29	-5.51	-2.28
Public administration	-1.28	-4.57	1.79	-0.1	-3.74	-4.08
Education	0.26	-3.17	0.32	-1.78	-2.46	-5.34
Non-financial services	9.01	12.26	-13.47	-1.88	-6.88	-0.84

Source: Author's calculations.

SIM7: The *Numéraire*

EXTER is a real model that ignores money. However, in an economy where commodities are traded, a common unit of account is required in order to justify the decision of economic agents concerning the exchange of goods and services. Flows are then expressed in terms of a *numéraire* whose price is kept fixed. It is for this reason that in real models, only relative prices, or real prices, matter. Changes in relative prices induce changes in consumption and production quantities. By contrast, if absolute prices, also called nominal and monetary prices, change in the same proportion, leaving relative prices unchanged, production and consumption will not be affected. For instance, double all prices, equilibrium production and demand do not change: the model is then homogeneous of degree zero in prices. Homogeneity states that economic agents are not subject to "money illusion", where currency is not neutral but is used both as a medium of exchange and a store of value. In other words, counting in euros, in cents or in millions of euros does not affect the actual behaviour of economic agents.

In "classic" CGE models, the actors are producers and households. On the production side, firms maximize profits subject to available technology and aggregate factor supplies. In EXTER, the value added is a Cobb-Douglas function of labour and capital volumes. The Cobb-Douglas function is homogeneous of degree zero in prices. In other words, if the relative price of labour and capital is constant, labour and capital demand do not change. As well, sectoral production function, that is a CET aggregate of domestic supply and exports, is homogeneous of degree zero in prices. Any change of export and domestic price by the same percentage keeps export and domestic supply volumes unchanged. On the consumption side, households maximize utility subject to income constraints determined by prices and their ownership of production factors. In EXTER, household utility is a Cobb-Douglas function of consumption and savings. Consequently, if commodity relative prices are constant, consumption volumes are unchanged. In addition, consumption is a CES combination of domestic and imported goods. The CES function is also homogeneous of degree zero in prices, implying that local supply and import volumes are unchanged for a given relative price. In sum, EXTER is homogeneous of degree zero in prices.

The homogeneity of the model is verified as follows: all exogenous values and prices, that are not multiplied by any flexible price, must be indexed to the *numéraire*. Then, double, for example, the *numéraire*, all prices and values double, but quantities do not change because relative prices are the same. In EXTER, the *numéraire* is the nominal exchange rate. In IFPRI, it is the consumer price index, and the exchange rate is flexible. The consumer price index CPI is defined by the following equation:

$$CPI = \sum_i \theta_i PC_i$$

where θ_i represents the weight of commodity i in the CPI and PC_i the composite price of commodity i.

As expected, the change of the *numéraire* does not affect the results of the EXTER model following trade liberalisation: all quantities are unchanged and only values are modified, when the CPI is the *numéraire*. In sum, the *numéraire* choice is simply a reporting issue: it has no implications for model results. A general equilibrium model only determines relative prices.

2.3 Commodity Market Structure

SIM8: Imperfect vs. Perfect Competition

EXTER belongs to the traditional CGE family, where commodity markets are characterised by a perfect competition structure. The key condition for a competitive market is price-taking: every firm and every consumer takes the market price of goods as given. No one can unilaterally affect the price by their choice of how much to buy or sell. This means the individual firm will face a horizontal demand curve. It will be horizontal at the market price, established by supply and demand on the market as a whole. An infinite number of firms operate within each sector, all producing homogeneous goods. The representative firm optimisation choice equates the price to the marginal cost, that in turn is equal to the average cost, in presence of zero profits and constant returns to scale. If the firm sells its production at a price greater than the marginal cost, perceived demand turns down to zero. In other words, the price elasticity of demand perceived by the firm is infinite. In a perfect competition model with perfect substitutability between local and imported products, tariff removal leads to the contraction of highly protected sectors and the expansion of the least protected ones.

With the emergence of the new trade theory, elements of imperfect competition were incorporated in CGE models, with the pioneering work of Harris (1984). MIRAGE belongs to this new generation of CGE models. It describes imperfection competition and horizontal differentiation, but also is the first to introduce vertical differentiation. The non-competitive sectors are modelled in a Cournot oligopoly framework, without strategic interactions, combining horizontal differentiation and increasing returns to scale. A finite number of symmetrical firms operate within every sector, each one producing its own and unique variety and taking into account its market power measured by the mark-up rate. The single firm's behaviour depends now on consumer demand, as illustrated in the mark-up equation below, where the mark-up rate is linked to the price elasticity of demand and the market share of the firm. The marginal production cost is constant at given factor prices, and production involves fixed costs. Trade liberalisation would not necessarily have the same consequences as in the perfect competition case: on the one hand, domestic products become more expensive with respect to imports so that agents consume relatively less domestic commodities. On the other hand, the firm's monopoly power on the domestic market decreases, illustrated by a higher perceived price elasticity of demand. In other words, the firm must reduce its price in order to sell more. It is the pro-competitive effect of trade liberalisation. In sum, the overall impact of tariff removal on production is ambiguous, it depends on the magnitude of the two previous effects.

In what follows, market power and scale economies are incorporated in EXTER, without product differentiation[13]. EXTER should be amended to incorporate[14]:
Firstly, the profit-maximising problem of the firm in the imperfect competition framework.
Since EXTER assumes imperfect substitutability between domestic supply and exports through a CET function, the marginal cost of producing an additional unit for the domestic market differs from the marginal cost of producing an additional export unit. This difference may be related to the quality of products by destination. Therefore, two Lerner equations corresponding to the firm's profit maximisation problem on domestic and international markets are added to the system:

$$\frac{PD_{imc} - MCD_{imc}}{PD_{imc}} = \frac{1}{N_{imc}{\epsilon^d}_{imc}}$$

$$\frac{PFOB_{imc} - MCE_{imc}}{PFOB_{imc}} = \frac{1}{N_{imc}{\epsilon^e}_{imc}}$$

where PD_{imc} and $PFOB_{imc}$ represent respectively the domestic market price and the export free on board (FOB) price in the non-competitive sector imc, MCD_{imc} and MCE_{imc} the marginal cost of producing to the domestic and foreign markets, N_{imc} the number of firms in the non-competitive sector, ${\epsilon^d}_{imc}$ and ${\epsilon^e}_{imc}$ the price elasticity of domestic and export demand. It is worth mentioning that the export price is no more equal to the exogenous world price: in order to sell more on foreign markets, producers must reduce the FOB price below the world price.
Secondly, the relation between marginal and average cost reflecting returns to scale. The average total cost is the sum of the average variable and fixed costs. The average variable cost is equal to the marginal cost. If fixed costs are zero, there are constant returns to scale, otherwise increasing returns.

[13] The introduction of the Dixit-Stiglitz horizontal differentiation (Dixit and Stiglitz, 1977) induces changes in consumer utility function. It will then be difficult to distinguish between the effects of imperfect competition on trade liberalisation results and the effects of the consumer new utility function.

[14] For a detailed description of the imperfect competition equations, see Cockburn et al. (1998).

Thirdly, an equation for the perceived price elasticity of domestic demand, that is endogenised so that to reflect the pro-competitive effect of trade liberalisation. Tariff removal attenuates the domestic market power of national firms. They have to reduce their prices in order to sell more. By contrast, the price elasticity of export demand is considered exogenous.

The calibration procedure is more difficult in comparison with the perfect competition case. Baseline values are needed for fixed costs, the number of firms, and the perceived price elasticity of demand. None of these are given in the original SAM. Furthermore, those variables are linked within sectors by the zero-profit constraint. It is also easy to show that the price elasticity of domestic demand depends on Armington elasticities (Cockburn et al., 1998). Consequently, two of them are taken from external sources and the third one is calibrated. Gasiorek, Smith and Venables (1992) calibrate substitution elasticities from data on scale elasticities and the number of firms. Mercenier (1992) calibrates fixed costs by using data on substitution elasticities and the number of firms. In the Moroccan case, no information is available on the number of firms by sector. Therefore, it is calibrated from Armington elasticities and the scale parameter. Following Bouzahzah et al. (2007), only industrial sectors are supposed to be non-competitive. They are all modelled with increasing returns except for car industry, radio and TV, medical instruments, machines and rubber industry[15]. The scale parameter is set to 1.05, which is equivalent to say that fixed costs account for 5% of total costs by firm. Indeed, this means that the firm's average cost is continuously decreasing. However, the cost curve is often described as a U-curve. Although unrealistic, the use of fixed costs to represent sacle economies is simplistic. The price elasticity of export demand is exogenous and fixed to 20 in competitive sectors, reflecting the weak market power of Moroccan producers on international markets. For non-competitive sectors, it is calibrated from Lerner equations. Moreover, for lack of statistical data

[15] A scale parameter equal to 1.05 increases the volume of fixed capital and induces a negative value of the variable capital volume in those sectors. That is why they are modelled with constant returns to scale.

on profits made by the corresponding firms, they are set to 10% of the baseline capital remuneration by sector. Two other simulations are run in order to examine the sensitivity of the results to different profit levels, 30% (SIM8B) and 40% (SIM8C) of the sectoral capital remuneration at the base year.

By contrast to the static EXTER framework, MIRAGE is a dynamic model that allows free entry and exit of firms until profits turn down to zero. That is why a short run shock (SIM8A) is first simulated, where the number of firms is kept constant and profits are allowed to vary. Later on, a long run simulation (SIM8A') is driven, where free entry and exit of firms keeps profits equal to their base year value.

Table I.15 shows that twelve of the non-competitive activities expand: mining industry, food, textile and clothing, leather industry, paper industry, editing, chemical industry, radio and TV, medical instruments, other transport means and furniture industry. The expansion reflects, for mining, food, paper, chemical and furniture industries, the pro-competitive effect of trade liberalisation: facing foreign competition that increases the perceived price elasticity of demand (Table I.16), producers reduce their price on the domestic market in order to boost their sales. By contrast, in the case of textile, clothing and leather industries, editing, radio and TV, medical instruments and transport means, the price elasticity of demand decreases. These are sectors whose protection was initially low so that their import price decreases the least. They win additional market shares because their domestic price falls with respect to the import price. Whereas most of the expanding sectors exhibit higher production growth with respect to the perfect competition model, food, radio and TV and medical instruments contract, in comparison to EXTER, due to lower demand. By contrast, in tobacco, wood and rubber industries, non-metallic minerals, metallurgy, metal processing and car industry, falling demand dominates the pro-competitive effect, hence the production drop. On the one hand, the contraction of the tobacco and wood industries, non-metallic minerals and metal processing is greater than the benchmark simulation because of the stronger fall in domestic demand. On the other hand, oil refining, machines and office machinery expand with respect to the EXTER simulation. Indeed, they are among sectors whose import price decreases the least. Consequently, they earn additional market shares, through a smaller contraction of their production in comparison to the perfect competition model, following the drop of the relative domestic price.

Expanding sectors also increase their exports. Indeed, in order to sell more on foreign markets, producers reduce their FOB price below the exogenous world price. Only exports of non-financial services decrease because the domestic market increases with respect to the FOB price. Even when production declines in sectors where the demand effect dominates the pro-competitive effect, exports increase, due to the drop of the relative domestic price (tobacco, wood, rubber ...). Increasing exports explain, *ceteris paribus*, the drop of domestic supply on the local market in agriculture, clothing and radio industries. The current account deficit being constant and given that other things are equal, more imports are necessary to compensate export expansion. Despite the stronger boost of total exports with respect to the simulation with perfect competition (7% against 5%), imports increase less because the pro-competitive effect in some non-competitive sectors limits the demand for imported products. Lower domestic demand for particular products also plays a role in import drop with respect to the benchmark simulation. For example, car imports decrease due to the simultaneous drop of the relative domestic price (relative to the import price) and domestic demand addressed to this sector. Only imports of metallurgical products decrease less than before due to rising relative market price.

According to SIM8A, only the classification of winners and losers is altered: in the benchmark simulation, medical instruments and edition were respectively the first and the second winners from trade liberalisation. With the imperfect competition model, edition moves to the first rank. Table I.17 shows that profits only increase in this sector (26.66%). Recall that editing profits are not due to the pro-competitive effect of trade liberalisation, since the price elasticity of demand decreases. On the contrary, it is an initially low-protected sector that suffers less than others from foreign competition. Medical instruments is now ranked second. The aggregate economic effects of imperfect competition are summarised by a drop of real GDP (-4.2% against -4.11%) and weaker welfare improvement (positive change of 0.3% instead of 1.3% of his disposable income). Given that households receive a share of total capital remuneration, lower welfare is partly explained by decreasing profits in non-competitive sectors.

Table I.15 also shows that when different values are assumed for the baseline profits, a sign reversal of production growth is detected. Oil refining industry that was losing under SIM8A and SIM8B, when the baseline profit value accounted for 10% and 30% of capital remuneration respectively, joins the winners from trade liberalisation in SIM8C, when profits account for 40% of capital remuneration. Indeed, when the initial level of profits is high, the calibration procedure ensures that the base year average cost is lower, and then firms can better face foreign competition. In addition, sector ranking is modified: medical instruments is now the second winner and "non-financial services" is ranked first. Moreover, the negative impact on economic growth increases and welfare improvement is reduced. This implies that benchmark values must be adequately chosen based on reliable econometric studies.

A long run simulation is now performed, where the number of firms is allowed to change while profits are fixed to the base year value. The difference between this simulation, SIM8A', and the previous one, SIM8A, is that firms are free to enter and exit the market until profits turn down to the base year value. Table I.17 shows that the number of firms decreases in all sectors except editing industry. This result is perfectly compatible with SIM8A where profits were falling in all sectors, except in the editing one. Indeed, in the long run, less efficient firms leave the market, making possible to the remaining ones to produce more and maintain positive profits in the corresponding industry (equal to the base year value). In addition, the scale parameter, given by the ratio of average to marginal cost[16] decreases, with respect to SIM8A, in non-competitive sectors with increasing returns to scale, after firm exit. The remaining firms exploit scale economies by increasing their production. By contrast, the scale parameter increases relatively to SIM8A in the editing sector because firm entry induces a weaker exploitation of scale economies by reducing the market share by firm. When firm exit is important, a sign reversal of production growth by firm occurs in some sectors, in comparison with SIM8A. For example, in SIM8A, production by firm decreased in tobacco industry, oil refining, rubber industry, non-metallic minerals, metallurgy, metal processing, machines, office machinery and car industry. At present, production by firm increases in these sectors due to the presence of fewer producers. Only production by firm in the editing sector decreases with respect to SIM8A because the number of firms in this sector increases. The radio and TV sector is mostly affected by firm exit (33.5% less firms) and consequently, displays the largest increase of total production by firm as well as domestic supply and exports by firm.

Entry and exit of firms affect the variable capital KV_{imc} given by the following equation:

$$KV_{imc} = KD_{imc} - NBR_{imc}FC_{imc}$$

In SIM8A, total capital volume by sector, the number of firms and fixed cost by firm were fixed, preventing variable capital in non-competitive industries with increasing returns from changing. Now, variable capital varies in order to reflect the decline in the total fixed cost in sectors losing firms, and the rise of total fixed cost in industries hosting more firms. It becomes clear now why the variable capital only declines in the editing sector (Table I.17). Variable capital change is not without consequences

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$$\frac{AC}{MC} = 1 + \frac{FC \times NBR}{XS \times MC}$$

where AC, MC and FC are respectively the average, marginal and fixed costs by firm, XS total production of the industry, and NBR the number of firms in the sector.

on the results. For instance, despite the higher production of transport means with respect to SIM8A, labour demand decreases by 0.3% in this sector whereas it was increasing by 0.49% in SIM8A. Indeed, following firm exit, the volume of variable capital increases by 1.39%. *Ceteris paribus* and given the substitutability between capital and labour in the value added[17], labour demand decreases in favour of a greater use of capital.

Finally, the results show that only the classification of winners is altered. However, as in SIM8A, simulations with different profit shares (30% and 40% of capital remuneration) modify the number of winners and losers. Oil refining industry is added to winners when profits account for 40% of capital remuneration (Table I.15). Indeed, when profits keep rising, more firms have to leave the market so that profits turn down to their base year value. The number of firms in oil refining industry decreases by 2.02% when profit share reaches 40% of capital remuneration, and by 1.85% and 1.48% when profit shares account for 30% and 10% of capital remuneration, respectively. Since firms exit more when profits are higher, variable capital increases the most (by 2.51%) when profits account for 40% of capital remuneration. Given that other things are equal, higher variable capital leads to higher variable value added and production level. Hence the sign reversal of production change in oil refining industry: its production increases by 0.03% with a profit share equal to 40% of capital remuneration. Furthermore, rental services are added to winners when profit shares are equal to 30% and 40% of capital remuneration. Finally, as it was the case in SIM8A, SIM8A' entails an increase in economic contraction and lower welfare improvement with respect to the benchmark simulation.

The obvious conclusion to draw is that it is dangerous to ignore imperfect competition in trade liberalisation analysis. Not only the impact of tariff removal would be underestimated, but also resource reallocation would be misunderstood.

[17] Variable value added in non-competitive sectors with increasing returns is a Cobb-Douglas function of labour and variable capital.

Table I.15: **SIM8: The Effects on Production of Imperfect and Perfect Commodity Market Structure**
Percentage Change with Respect to the Base Year

Activities	**EXTER**	**S.8A**	**S.8B**	**S.8C**	**S.8A'**	**S.8B'**	**S.8C'**
Agriculture	0.13	0.17	0.18	0.19	0.18	0.2	0.21
Fishing	1.44	1.76	1.95	2.02	1.91	2.21	2.33
Mining**	1.88	2.8	3.27	3.53	3.01	3.39	3.52
Food**	3.9	3.2	3.31	3.35	3.29	3.33	3.29
Tobacco**	-1.17	-1.34	-1.71	-1.98	-1.49	-2.34	-3.08
Textile**	2.4	3.24	3.55	3.68	3.54	3.96	4.11
Clothing**	3.84	4.77	4.85	4.88	5.06	5.24	5.29
Leather and shoes**	5.94	8.38	8.42	8.39	8.53	8.67	8.67
Wood**	-2.04	-2.29	-2.55	-2.69	-1.71	-2.36	-2.87
Paper**	4.7	5.53	6.12	6.4	5.56	6	6.14
Edition**	12.98	13.97	14.67	15.01	13.67	14.22	14.46
Oil refining**	-1.68	-0.31	-0.1	0.02	-0.24	-0.05	0.03
Chemicals**	1.84	2.38	2.73	2.92	2.62	2.87	2.94
Rubber and plastics*	-3.2	-1.99	-2.1	-2.08	-1.82	-1.93	-1.94
Non-metallic min.**	-6.17	-6.32	-6.48	-6.55	-5.96	-6.16	-6.28
Metallurgy**	-2.71	-2.66	-2.89	-3.01	-2.04	-2.58	-2.97
Metal proc.**	-3.59	-4.15	-4.27	-4.33	-3.81	-4.05	-4.21
Machines*	-8.84	-8.62	-8.79	-8.86	-8.35	-8.4	-8.39
Office machinery**	-3.15	-2.03	-2.1	-2.12	-1.81	-1.96	-2.07
Radio and TV*	10.98	2.18	1.06	0.93	2.02	1.07	1.02
Medical inst.*	14.21	10.37	7.33	6.93	10.54	7.58	7.22
Cars*	-3.84	-2.55	-3	-3.15	-2.69	-2.9	-2.95
Transport means**	0.18	0.27	0.28	0.29	0.46	0.44	0.41
Furniture**	2.06	2.31	2.46	2.51	2.33	2.39	2.37
Electricity	0.66	0.7	0.75	0.78	0.8	0.9	0.94
Construction	-6.27	-6.76	-6.85	-6.89	-6.38	-6.38	-6.39
Trade and repair	0.29	0.34	0.35	0.37	0.45	0.47	0.47
Hotels and rest.	-2.98	-2.96	-2.9	-2.87	-2.75	-2.56	-2.47
Transport	-1.33	-0.9	-0.74	-0.66	-0.69	-0.37	-0.24
Financial activities	-0.91	-0.81	-0.76	-0.73	-0.7	-0.57	-0.52
Rental services	-0.2	-0.11	-0.08	-0.06	-0.05	0.01	0.04
Public adm.	-1.28	-1.23	-1.2	-1.19	-1.16	-1.07	-1.03
Education	0.26	0.18	0.19	0.2	0.27	0.34	0.38
Non-financial serv.	9.01	8.91	8.88	8.86	8.79	8.67	8.61

Notes: (1) Sectors with increasing returns are referred to by two stars, and those with constant returns by one star.
(2) SIM8A, SIM8B, SIM8C: Short run simulations + profits shares by sector equal to 10%, 30% and 40% of capital remuneration respectively.
(3) SIM8A', SIM8B', SIM8C': Long run simulations + profits shares by sector equal to 10%, 30% and 40% of capital remuneration respectively.
Source: Author's calculations.

Furthermore, the different calibration procedures and time horizons lead to changes in the results: hence the need for a suitable choice of the base year modelling.

Even though this chapter aims at studying the changes in trade liberalisation results under different structures of the EXTER model, it is worth mentioning that

Table I.16: **SIM8: Perceived Price Elasticity of Domestic Demand**
Percentage Change with Respect to the Base Year

Activities	**SIM8A**	**SIM8B**	**SIM8C**	**SIM8A'**	**SIM8B'**	**SIM8C'**
Mining**	0.14	0.10	0.08	0.13	0.09	0.08
Food**	0.49	0.48	0.48	0.48	0.47	0.47
Tobacco**	0.08	0.08	0.08	0.08	0.09	0.10
Textile**	-0.21	-0.25	-0.26	-0.22	-0.26	-0.27
Clothing**	-0.13	-0.14	-0.15	-0.14	-0.15	-0.15
Leather and shoes**	-0.13	-0.15	-0.16	-0.13	-0.15	-0.16
Wood**	0.21	0.21	0.22	0.18	0.22	0.25
Paper**	0.43	0.37	0.35	0.42	0.36	0.34
Edition**	-0.02	-0.06	-0.08	-0.03	-0.08	-0.10
Oil refining**	-0.02	-0.02	-0.03	0.00	0.00	0.00
Chemicals**	0.21	0.17	0.16	0.20	0.17	0.16
Rubber and plastics*	0.62	0.60	0.59	0.63	0.60	0.60
Non-metallic minerals**	0.24	0.25	0.26	0.24	0.27	0.28
Metallurgy**	0.09	0.11	0.13	0.05	0.12	0.16
Metal processing**	0.07	0.06	0.06	0.06	0.07	0.08
Machines*	-0.11	-0.12	-0.13	-0.11	-0.12	-0.12
Office machinery**	-0.09	-0.10	-0.10	-0.07	-0.07	-0.06
Radio and TV*	-0.12	-0.13	-0.13	-0.11	-0.12	-0.12
Medical instruments*	-0.07	-0.08	-0.08	-0.07	-0.09	-0.09
Cars*	0.30	0.29	0.28	0.32	0.30	0.30
Other transport means**	-0.19	-0.20	-0.21	-0.20	-0.20	-0.20
Furniture**	0.05	0.03	0.02	0.05	0.02	0.01

Notes: (1) Sectors with increasing returns are referred to by two stars, and those with constant returns by one star.
(2) SIM8A, SIM8B, SIM8C: Short run simulations + profits shares by sector equal to 10%, 30% and 40% of capital remuneration respectively.
(3) SIM8A', SIM8B', SIM8C': Long run simulations + profits shares by sector equal to 10%, 30% and 40% of capital remuneration respectively.
Source: Author's calculations.

Morocco, like other developing countries, is subject to various barriers to foreign competition (high tariff rates, quantitative restrictions...) and barriers to firm entries (complex administrative mechanisms, absence of antitrust policies, small local market, underdeveloped capital markets...). Imperfect competition is then an appropriate market structure for such countries. In addition, in developing countries, the domestic market is small reflecting unexploited scale economies. This inefficiency is exacerbated by policies that encourage local producers to invest. Given the low utilisation of productive capacity, efficiency gains resulting from increasing the scale of local production are even more important.

2.4 Dynamic vs. Static

SIM9: Time Dimension

Table I.17: **SIM8: Imperfect Commodity Market Structure, Some Selected Results**

Percentage Change with Respect to the Base Year

Activities	**Prof. S.8A**	**Var. Cap. S.8A**	**Firms Numb. S.8A**	**Prof. S.8A'**	**Var. Cap. S.8A'**	**Firms Numb. S.8A'**
Mining**	-9.1	0	0	0	0.39	-2.25
Food**	-28.33	0	0	0	5.59	-2.99
Tobacco**	-23.55	0	0	0	0.13	-1.29
Textile**	-7.65	0	0	0	0.42	-0.99
Clothing**	-3.16	0	0	0	0.16	-0.38
Leather and shoes**	-22.29	0	0	0	1.54	-1.22
Wood**	-34.32	0	0	0	1.71	-9.04
Paper**	-7.21	0	0	0	0.47	-1.36
Edition**	26.66	0	0	0	-1.64	3.29
Oil refining**	-67.75	0	0	0	0.93	-1.48
Chemicals**	-20.41	0	0	0	1.07	-3.3
Rubber and plastics*	-32.21	0	0	0	0	-9.2
Non-metallic minerals**	-48.58	0	0	0	2.29	-9.39
Metallurgy**	-42.34	0	0	0	2.28	-9.14
Metal processing**	-62.8	0	0	0	4.61	-7.38
Machines*	-25.6	0	0	0	0	-11.39
Office machinery**	-87.97	0	0	0	6.8	-6.74
Radio and TV*	-62.36	0	0	0	0	-33.5
Medical instruments*	-0.67	0	0	0	0	-0.83
Cars*	-127.12	0	0	0	0	-5.89
Other transport means**	-25.14	0	0	0	1.39	-3.85
Furniture**	-18.21	0	0	0	0.78	-1.96

Notes: (1) Sectors with increasing returns are referred to by two stars, and those with constant returns by one star.
(2) SIM8A, SIM8B, SIM8C: Short run simulations + profits shares by sector equal to 10%, 30% and 40% of capital remuneration respectively.
(3) SIM8A', SIM8B', SIM8C': Long run simulations + profits shares by sector equal to 10%, 30% and 40% of capital remuneration respectively.
Source: Author's calculations.

Until the midst of the 90s, CGE models dealing with trade policies were operating in a static framework, excluding accumulation effects as well as the transition path of the economy where short run policy impacts are likely to be different from those of the medium and long run. Despite the theoretical and empirical evidence on the benefits of trade liberalisation, the majority of these models have found that welfare gains were less than 1% of GDP (Srinivasan and Whalley, 1986). This is mainly imputed to the fact that static models do not capture the dynamic gains from trade liberalisation. The simulation is run in a static comparative framework where the new situation is viewed as an approximation of the long run equilibrium. However, the convergence process is interesting because it is likely to entail welfare costs, that are difficult to be ignored from a social point of view. Indeed, when assessing the impact of trade liberalisation on Tunisia, Annabi and Rajhi (2001) show that the static version of the model underestimates the impact of trade liberalisation on production and welfare because it excludes the accumulation effects. Therefore, economists became aware of the need for dynamic CGE models to assess the impact of various trade policies.

Dynamic CGE models are twofold: sequential (recursive) and intertemporal. Intertemporal models are based on optimal growth theory where the behaviour of economic agents is characterised by perfect foresight. They know everything about the future and react to future changes in prices. Households maximise their intertemporal utility function under a wealth constraint to determine their consumption schedule over time. Investment decisions by firms are the results of cash flow maximisation over the whole time horizon. By contrast, a sequential dynamic CGE model is a series of static models linked between periods by adjustment procedures. MIRAGE belongs to the recursive dynamic family. The modification of the static structure of EXTER according to MIRAGE dynamic structure involves the addition of adjustment procedures for the first period exogenous variables:
Firstly, the capital stock of private sectors KD_{ps} adjusts between periods by the means of capital depreciation rate and investment demand by sector:

$$KD_{ps,t+1} = (1 - dep_{ps})KD_{ps,t} + INVD_{ps,t}$$

where dep_{ps} is the capital depreciation rate of private sector ps[18] and $INVD_{ps,t}$ investment by destination of this sector at period t. For investment demand by sector, I adopt the quadratic form proposed by Bourguignon et al. (1989):

$$\frac{INVD_{ps,t}}{KD_{ps,t}} = D_{1ps}(\frac{r_{ps,t}}{PINV_t(i_t + dep_{ps})})^2 + D_{2ps}(\frac{r_{ps,t}}{PINV_t(i_t + dep_{ps})})$$

[18] The annual depreciation rate of capital is fixed at 5.4% for Morocco (Zouhar, 2005).

where D_{1ps} and D_{2ps} are scale parameters, $r_{ps,t}$ the rental rate of capital in sector ps at period t, i_t the interest rate at period t (exogenous) and $PINV$ the aggregate price of investment given by:

$$PINV_t = \prod_i \left(\frac{PC_{i,t}}{\mu_i}\right)^{\mu_i}$$

$PINV$ is the dual price of a Cobb-Douglas investment function, with μ_i being the share of product i in total investment. With the introduction of investment by sectors and the equation of capital accumulation, the calibration of the capital stock must be adjusted. I assume that the sectoral growth rate of capital $INVD_{ps,0}/KD_{ps,0}$ is equal to the sum of the depreciation rate of capital and population growth rate[19]. Since capital demand is endogenous in public sectors, investment is then determined by the model:

$$INVD_{pub,t} = KD_{pub,t+1} - KD_{pub,t}$$

The sum of investment by destination of private and public sectors must be equal to the gross fixed capital formation $ITVOL$ given by the ratio of total investment value IT and the aggregate price of investment:

$$ITVOL_t = IT_t/PINV_t$$

However, by constraining the sum of investment by destination of all sectors to be equal to total investment volume, the model contains an extra equation. A free variable needs to be introduced to the model in order to be squared. In addition, the savings-driven determination of investment states that investment adjusts in order to achieve the investment-savings equilibrium. Therefore, the free adjustment

[19] This assumption implies the steady state condition for capital accumulation that is used in intertemporal models.

variable SI is introduced in the gross fixed capital formation equation:

$$ITVOL_t = SI_t(\sum_{ps} INVD_{ps,t} + \sum_{pub} INVD_{pub,t})$$

Now, with the adjustment of total investment volume, the investment-savings equilibrium can be accomplished.

Secondly, labour supply LS is adjusted between periods according to an exogenous annual growth rate assumed to be equal to the population natural growth rate g_{LS}[20]:

$$LS_{t+1} = LS_t(1 + g_{LS})$$

Thirdly, it is also possible to add updating mechanisms for other variables, such as public expenditures, transfers, technological change or debt accumulation.

Before proceeding to the analysis, it is important to note that in a dynamic model, the economy grows between periods even in the absence of any shock, due to the updating mechanisms of the first-period exogenous variables. This growth path of the economy without any shock is called "Business As Usual" (BAU). How does the economy react to the updating mechanisms over periods?

On the one hand, the growing population induces, *ceteris paribus*, a higher level of household consumption and thus affects upward the demand addressed to sectors. On the other hand, the capital accumulation process increases the volume of capital allocated to the different sectors. Given the relative substitutability between labour and capital in the value added, more capital generates a higher production level. However, the volume of production by sector exceeds the level of demand so that producers lower their prices in order to sell more. Given that other things are equal, lower prices for investment products motivate capital accumulation. As well, lower input prices encourage firms to produce more. In sum, real GDP average annual growth rate is about 1.6%. Growing production helps satisfy the increasing

[20] g_{LS} is set to 1.6% for Morocco (World Development Indicators Database 2001, the World Bank).

domestic demand, but also, since domestic prices fall, producers are motivated to export. Given that other things are equal, imports must increase in order to keep external savings constant.

Following production growth, labour demand increases. Consequently, the wage rate must adjust upward in order to balance the market. However, the wage rate being equal to the product of the physical marginal productivity of labour and the average value added price, the drop of the latter is sufficient to decrease the wage rate between periods. But the wage payroll increases because labour supply also grows between periods. Since labour remuneration constitutes the principal source of household income, the latter increases and household welfare improves over time. Welfare improvement reaches 28% of household disposable income in the last period of the model (20 periods). Concerning capital remuneration, massive investment increases the volume of capital relatively to labour, and reduces the marginal productivity of capital, as well as the rental rate of capital by sector. However, given the increasing volume of capital allocated to sectors, total capital remuneration increases. Mainly affected by capital remuneration, firms' income grows and so does government income. The latter also collects more sales tax due to higher consumption, as well as more direct taxes. Following income growth, savings also increase, and so does the gross fixed capital formation.

When the trade liberalisation shock is simulated, the economy will have another growth path, due to simultaneous effect of the shock and the updating mechanisms of the first-period exogenous variables. Consequently, the analysis should be done with respect to the BAU growth path. In other words, the value of a given variable at period t after the shock should be compared to its value at period t before the shock.

Among the seventeen contracting sectors in the static model, ten are added to winners in the medium and long run: tobacco and rubber sectors, oil refining, metal processing, office machinery, car industry, transport, financial and rental services, education (Table I.18). This is explained by different reasons: first of all, capital accumulation is motivated by lower prices of investment products after tariff removal. The capital accumulation process helps increase sectoral production. The continuous expansion of the originally expanding sectors raises intermediary input demand addressed to all sectors, including the contracting ones. Secondly, the growing population induces a rise of household consumption, that in turn, positively affects, *ceteris paribus*, the demand addressed to sectors. In order to meet the increasing demand with respect to the static model, the above-mentioned sectors expand in the medium and long run.

In the static model, trade liberalisation boosted imports, with some exceptions. Imports of oil refining products, metallurgy, metal processing, machines, office machinery, other transport means, hotels and restaurants, transport services, financial and rental services decreased due to lower domestic demand. Imports of fishery and clothing products, radio and television also decreased, because local production replaced imports. In the long run simulation, increasing demand motivated by household consumption and intermediary input demand boosts imports in some of the above-mentioned sectors, mainly: fishery, clothing, oil refining, metallurgy, metal processing, office machinery, radio and TV, other transport means, transport and financial services. By contrast, exports evolve in the same direction in the short and long run.

When sectors expand, they need more production factors. For a given period, increased labour demand creates a pressure on labour market that drives the wage up, in presence of fixed labour supply. That is why the wage rate increases in the medium and long run, after being decreasing in the static model. Since labour remuneration mainly affects household income, when the wage rate increases, household income also does, by contrast to the static model.

While trade liberalisation leads, during the first period, to a contraction of the overall activity by 3.96%, this negative impact vanishes, starting period 5. The overall activity grows by 0.34% at the twentieth period of the model. Furthermore, welfare improvement increases with time and accounts for 0.39% of household

Table I.18: **SIM9: The effects on Production of the Static and Dynamic Structures**
Percentage Change with Respect to the BAU Growth Path.

Activities	**EXTER**	**SIM9 t**	**SIM9 t+5**	**SIM9 t+10**	**SIM9 t+15**	**SIM9 t+20**
Agriculture	0.13	0.03	2.46	4.85	6.68	8.13
Fishing	1.44	1.39	3.56	5.35	6.63	7.62
Mining	1.88	1.23	2.58	3.55	4.13	4.52
Food	3.90	3.75	6.32	8.46	10.03	11.28
Tobacco	-1.17	-0.86	-1.10	-0.69	0.01	0.79
Textile	2.40	2.68	5.82	8.58	10.49	11.83
Clothing	3.84	3.70	7.24	10.28	12.32	13.70
Leather and shoes	5.94	5.57	8.77	11.08	12.55	13.58
Wood	-2.04	-1.47	-1.80	-1.64	-1.17	-0.59
Paper	4.70	1.54	4.07	6.14	7.57	8.62
Edition	12.98	3.57	6.80	9.46	11.22	12.44
Oil refining	-1.68	-0.92	0.06	1.14	2.02	2.80
Chemicals	1.84	1.83	4.42	6.39	7.71	8.70
Rubber and plastics	-3.20	-2.64	-1.01	0.37	1.44	2.32
Non-metallic minerals	-6.17	-4.49	-5.35	-5.52	-5.21	-4.72
Metallurgy	-2.71	-2.02	-3.00	-3.07	-2.69	-2.17
Metal processing	-3.59	-2.22	-1.58	-0.80	-0.03	0.70
Machines	-8.84	-6.67	-5.79	-4.93	-4.11	-3.34
Office machinery	-3.15	-1.41	-0.96	-0.44	0.12	0.69
Radio and TV	10.98	11.48	18.93	25.87	31.97	37.83
Medical instruments	14.21	9.49	16.66	21.87	25.17	27.50
Cars	-3.84	-1.88	-0.59	0.54	1.50	2.35
Other transport means	0.18	0.38	1.48	2.27	2.84	3.31
Furniture	2.06	1.54	3.84	5.72	7.11	8.23
Electricity	0.66	0.46	2.14	3.60	4.74	5.70
Construction	-6.27	-4.23	-4.99	-5.09	-4.74	-4.21
Trade and repair	0.29	0.46	2.54	4.42	5.89	7.13
Hotels and rest.	-2.98	-1.99	-2.16	-1.70	-1.01	-0.27
Transport	-1.33	-0.86	-0.31	0.30	0.88	1.43
Financial activities	-0.91	-0.59	0.17	1.21	2.15	3.00
Rental services	-0.20	-0.15	0.89	1.93	2.85	3.70
Public administration	-1.28	-0.96	-1.05	-1.16	-1.27	-1.37
Education	-0.01	-0.01	0.11	0.24	0.37	0.50
Non-financial services	9.01	0.51	2.98	5.81	8.17	9.98

Notes: For EXTER, percentage change with respect to the base year. EXTER and period t of SIM9 lead to slightly different results because the calibration of the base year capital volume is different in the static and dynamic models.
Source: Author's calculations.

disposable income after 20 years. To put it in a nutshell, this exercise supports the scientific belief that the time dimension is crucial for analysing the effects of trade liberalisation.

3 Conclusion

This chapter is an attempt to assess the sensitivity of trade liberalisation results to changes in a CGE model structure. Tariff removal is first simulated on a small open economy model, EXTER, applied to the Moroccan SAM. Then the results of trade liberalisation are analysed for every change in EXTER assumptions, based on IFPRI, GTAP and MIRAGE models. As expected, the change of the *numéraire* only modifies values, all volumes being equal to the benchmark model. The results are not considerably affected when the functional form of production (CES instead of Leontief), value added (CES instead of Cobb-Douglas), investment volume (CES instead of Cobb-Douglas) and utility function (Stone-Geary instead of Cobb-Douglas) are modified: only the classification of winners and losers is altered as well as the magnitude of variable changes. They are, however, more sensitive to changes in the intermediate consumption Leontief function as well as to the macroeconomic closure, the commodity market structure and the time horizon adopted. Many changes are detected in signs. Hence it is crucial to accurately identify the problem in order to determine the most appropriate analytical framework for the corresponding economy.

The experience gained in this chapter concerning CGE model behaviours under different structures helps conceptualise the appropriate CGE models for assessing the impact of migration on Morocco. To begin with, a static CGE model was built, based on the conclusions of this chapter, in order to deal with the first question asked in this thesis, about the simultaneous impact of inflows and outflows of workers on the labour market of the sending country. Chapter 2 investigates this issue with a particular attention to the effect of migratory flows on unemployment in Morocco.

I.A Appendix A: Data

The SAM constitutes the empirical database required to satisfy the accounting coherence of a CGE model. I use the Moroccan SAM built by Abdelkhalek and Zaoujal (2004) for the year 1998 from several Moroccan data sources: the input-output table of the Moroccan economy for 1998, built by the Direction of Statistics and published, in a preliminary version, in 2002, the National Survey on Household Living Standards (NSHLS) in 1998-1999 carried out by the Direction of Statistics, documents from the Ministry of Economy and Finance, from External Trade department, from the Ministry of Agriculture, from Foreign Exchange department, and from Bank Al-Maghrib. The SAM gathers two production factors (labour and capital), four types of agents (households, firms, government, the RoW), 34 sectors of activity that match exactly those of the input-output table of the Moroccan economy in 1998.

The SAM describes the Moroccan economy in 1998. At this period, GDP amounted to MAD 344 billion. On the output side, the primary and secondary sector are relatively small accounting for respectively 16.4% and 29.4% of real GDP. By contrast, the tertiary sector accounts for 54.2% of real GDP. On the demand side, households consumption accounts for 68% of GDP, while government current expenditures account for 18% of GDP. At the same time, total investment expenditures represent 22% of GDP, implying that Morocco is running a trade deficit equivalent to 8% of GDP. Indeed, exports and imports represent respectively 23% and 31% of GDP. Industrial imports constitute 80% of total imports whereas agricultural products and services only account for 8% and 12% of total imports, respectively. Industrial exports are also the most important, about 81% of total exports, followed by services that represent 11% of total exports whereas agricultural products only account for 8% of total exports.

Income elasticities are based on estimates by the Economic Research Service, US Department of Agriculture from the International Comparison Project Data of the World Bank in 1996 (Bernstein et al., 2003). Elasticities are estimated for the following product groups: food, beverages and tobacco (0.65), clothing and footwear (0.916), fuel and power (1.206), house operations (1.202), medical care (1.375), education (1.076), transport and communication (1.219), recreation (1.503), Other (1.361). For food, the elasticities are estimated for breads and cereals (0.452), meat (0.694), fish (0.793), dairy (0.757), fats and oils (0.472), fruits and vegetables (0.563), and other foods (0.691).

I.B Appendix B: Sectoral Aggregation

AGR	Agriculture
FIS	Fishing
MII	Mining industry
FOO	Food industry
TOB	Tobacco industry
TEX	Textile industry
CLO	Clothing industry
LEA	Leather and shoes industry
WOO	Fabrication of wood and wood-based products
PAP	Paper industry
EDI	Edition, printing and reproduction
OIL	Oil refining
CHE	Chemical industry
RUB	Rubber and plastic industry
MIN	Manufacture of other non-metallic mineral products
MET	Metallurgy
MEP	Metal processing
MAC	Machines and equipments
OFF	Office machinery
RAD	Radio and TV equipments
MED	Medical instrument manufacturing
CAR	Car industry
MTR	Manufacture of other transport means
FUR	Furniture manufacturing, other industries
ELE	Electricity and water - production and distribution
CON	Construction
TRR	Trade and repair
HOT	Hotels and restaurants
TRA	Transport and telecommunication
FIN	Financial activities and insurance
REN	Rental services
ADM	Public administration and social security
EDU	Education and health
SER	Other non-financial services

I.C Appendix C: Mathematical Statement of the Model

Set indices are given by lower-case Latin letters as subscripts to variables and parameters. Parameters are represented with lower-case Latin letters or lower-case Greek letters, endogenous variables with upper-case Latin letters without a bar, exogenous variables with upper-case Latin letters with a bar.

Sets

$j \in J$	Sectors
$i \in I$	Products (=J)
$tr \in TR \subset J$	Tradable sectors
$ntr \in NTR \subset J$	Non-tradable sectors
$ps \in PS \subset J$	Private sectors
$pub \in PUB \subset J$	Public sectors
$ag \in AG$	Agents ("hh"=households, "fm"=firms, "gv"=government, "row"=RoW)

Parameters

v_j	Share of value added in the Leontief production function of sector j
io_j	Share of intermediary consumption in the Leontief production function of sector j
aij_{ij}	Intermediary consumption of good i by unit of production of sector j
A_{ps}	Scale parameter of the Cobb-Douglas value added function of sector ps
α_{ps}	Elasticity of value added with respect to labour demand in sector ps
l_{pub}	Share of labour in the Leontief value added function of public sector pub
k_{pub}	Share of capital in the Leontief value added function of public sector pub
φ	Household's propensity to save
γ_i	Budgetary share of good i in household income
μ_i	Share of product i in total investment
tx_j	Indirect taxes on product j
tm_{tr}	Import tariff rate on product tr
te_{tr}	Export tariff rate on product tr
tyh	Direct tax rate on household income
tyf	Direct tax rate on firms' income

Am_{tr}	Scale parameter of the Armington CES function
θ_{tr}	Share parameter of the Armington CES function
σ_{tr}	Elasticity of substitution (Armington function)
ρ_{tr}	Substitution parameter
Be_{tr}	Scale parameter of the CET production function
β_{tr}	Share parameter of the CET production function
τ_{tr}	Transformation elasticity (CET production function)
κ_{tr}	Transformation parameter
η_{ag}	Share of labour remuneration received by agent ag
λ_{ag}	Share of capital remuneration received by agent ag
δ_j	Share of sector j's value added in GDP at factor cost

Endogenous variables

a) **Prices**

w	Average wage
r_j	Capital return in sector j
PV_j	Value added price of sector j
PC_j	Composite price of product j
P_j	Producer price of product j
Pl_j	Producer price of product j sold on the domestic market
PD_j	Market price of product j sold on the domestic market
PM_{tr}	Domestic price of the imported good tr
PE_j	Producer price of the exported good tr
Pwm_{tr}	International import price of product tr, in foreign currency
Pwe_{tr}	International export price of product tr, in foreign currency
e	Nominal exchange rate (the price of a unit of foreign currency in domestic currency), *numéraire*
$Pindex$	GDP deflator

b) **Production**

VA_j	Value added of sector j (volume)
XS_j	Production of sector j (volume)
CI_j	Total intermediary consumption of sector j (volume)
$DI_{i,j}$	Intermediary demand of product i by sector j (volume)
LD_j	Labour demand by sector j (volume)
KD_j	Capital demand by sector j (volume)
LS	Labour supply

c) **Income/Savings**

Y_{ag}	Agent ag's income

YDH	Household disposable income
S_{ag}	Agent ag's savings
$T_{ag,ag}$	Transfers between agents

d) **Tax revenues**

TI_j	Indirect taxes on product j
TIM_{tr}	Import tariffs on imported good tr
TIE_{tr}	Export tariffs on exported good tr

e) **External trade**

EX_{tr}	Export supply of product tr (volume)
M_{tr}	Import demand of product tr (volume)
DOM_j	Domestic production of sector j sold on the domestic market (volume)
Q_j	Supply of composite product j (volume)

f) **Final demand**

C_i	Household consumption of good i (volume)
G_i	Public consumption of product i (volume)
INV_i	Investment demand of product i (volume)
DIT_i	Total intermediary demand of input i (volume)
IT	Gross fixed capital formation (value)

Exogenous variables

Pwm_{tr}	International import price of product tr, in foreign currency
Pwe_{tr}	International export price of product tr, in foreign currency
r_{pub}	Rental rate of capital in public sector pub
KD_{ps}	Capital demand by sector ps (volume)
G_i	Public consumption of product i (volume)
LS	Labour supply
$T_{\text{``}hh\text{''},ag}$	Transfers from agent ag to households
$T_{\text{``}fm\text{''},ag}$	Transfers from agent ag to firms
$T_{\text{``}row\text{''},ag}$	Transfers from agent ag to the RoW
$T_{\text{``}gv\text{''},\text{``}gv\text{''}}$	Transfers from the government to itself
$T_{\text{``}gv\text{''},\text{``}row\text{''}}$	Transfers from the RoW to the government
$S_{\text{``}row\text{''}}$	External savings
e	Nominal exchange rate (the price of a unit of foreign currency in domestic currency), *numéraire*

Equations

Production

$$XS_j = \frac{VA_j}{v_j} \tag{A1}$$

$$VA_{ps} = A_{ps} LD_{ps}^{\alpha_{ps}} \overline{KD_{ps}}^{(1-\alpha_{ps})} \tag{A2}$$

$$KD_{pub} = k_{pub} VA_{pub} \tag{A3}$$

$$CI_j = io_j XS_j \tag{A4}$$

$$DI_{ij} = aij_{ij} CI_j \tag{A5}$$

$$LD_{ps} = \frac{\alpha_{ps} PV_{ps} VA_{ps}}{w} \tag{A6}$$

$$LD_{pub} = l_{pub} VA_{pub} \tag{A7}$$

$$KD_{pub} = \frac{PV_{pub} VA_{pub} - wLD_{pub}}{\overline{r_{pub}}} \tag{A8}$$

Households and Firms

$$Y_{``hh"} = (1 - \eta_{``fm"} - \eta_{``gv"} - \eta_{``row"}) w \sum_j LD_j + \lambda_{``hh"} \sum_j r_j \overline{KD}_j + \sum_{ag} \overline{T_{``hh",ag}} \tag{A9}$$

$$YDH = Y_{``hh"} - \sum_{ag} \overline{T}_{ag,``hh"} \tag{A10}$$

$$Y_{``fm"} = \eta_{``fm"} w \sum_j LD_j + (1 - \lambda_{``hh"} - \eta_{``gv"} - \eta_{``row"}) \sum_j r_j \overline{KD}_j + \sum_{ag} \overline{T_{``fm",ag}} \tag{A11}$$

$$S_{``hh"} = \varphi YDH \tag{A12}$$

$$S_{``fm"} = Y_{``fm"} - \sum_{ag} \overline{T}_{ag,``fm"} \tag{A13}$$

The Government

$$TI_{tr} = tx_{tr}(P_{tr}XS_{tr} - PE_{tr}EX_{tr}) + tx_{tr}(1 + tm_{tr})\overline{Pwm_{tr}e}M_{tr} \tag{A14}$$

$$TI_{ntr} = tx_{ntr}PL_{ntr}XS_{tr} \tag{A15}$$

$$TIM_{tr} = tm_{tr}\overline{Pwm_{tr}e}M_{tr} \tag{A16}$$

$$TIE_{tr} = te_{tr}PE_{tr}EX_{tr} \tag{A17}$$

$$T_{\text{“}gv\text{”},\text{“}hh\text{”}} = tyhY_{\text{“}hh\text{”}} \tag{A18}$$

$$T_{\text{“}gv\text{”},\text{“}fm\text{”}} = tyfY_{\text{“}fm\text{”}} \tag{A19}$$

$$\begin{aligned} YG &= \eta_{\text{“}gv\text{”}} w \sum_j LD_j + \lambda_{\text{“}gv\text{”}} \sum_j r_j \overline{KD}_j + \sum_{tr} TIM_{tr} + \\ & \sum_{tr} TIE_{tr} + \sum_j TI_j + \sum_{ag} \overline{T}_{\text{“}gv\text{”},ag} \end{aligned} \tag{A20}$$

$$S_{\text{“}gv\text{”}} = Y_{\text{“}gv\text{”}} - \sum_i PC_i\overline{G_i} - \sum_{ag} \overline{T_{ag,\text{“}gv\text{”}}} \tag{A21}$$

External Trade

$$XS_{tr} = Be_{tr}[\beta_{tr}EX_{tr}^{-\kappa_{tr}} + (1-\beta_{tr})DOM_{tr}^{-\kappa_{tr}}]^{-\frac{1}{\kappa_{tr}}} \tag{A22}$$

$$XS_{ntr} = DOM_{ntr} \tag{A23}$$

$$\frac{DOM_{tr}}{EX_{tr}} = [(\frac{1-\beta_{tr}}{\beta_{tr}})(\frac{PE_{tr}}{PL_{tr}})]^{\tau_{tr}} \tag{A24}$$

$$Q_{tr} = Am_{tr}[\theta_{tr}M_{tr}^{-\rho_{tr}} + (1-\theta_{tr})DOM_{tr}^{-\rho_{tr}}]^{-\frac{1}{\rho_{tr}}} \tag{A25}$$

$$Q_{ntr} = DOM_{ntr} \tag{A26}$$

$$\frac{M_{tr}}{DOM_{tr}} = [(\frac{\theta_{tr}}{1-\theta_{tr}})(\frac{PD_{tr}}{PM_{tr}})]^{\sigma_{tr}} \tag{A27}$$

$$
\begin{aligned}
S_{\text{``}row\text{''}} \;\; = \;\; & \overline{e}\sum_{tr}\overline{Pwm_{tr}}M_{tr} + \eta_{\text{``}row\text{''}}w\sum_{j}LD_j + \lambda_{\text{``}row\text{''}}\sum_{j}r_j\overline{KD}_j + \\
& \sum_{ag}\overline{T_{\text{``}row\text{''},ag}} - \overline{e}\sum_{tr}\overline{Pwe_{tr}}EX_{tr} - \sum_{ag}\overline{T_{ag,\text{``}row\text{''}}}
\end{aligned} \tag{A28}
$$

Final Demand

$$C_i = \gamma_i YDH/PC_i \tag{A29}$$

$$INV_i = \frac{\mu_i IT}{PC_i} \tag{A30}$$

$$DIT_i = \sum_{j} DI_{ij} \tag{A31}$$

Prices

$$PV_j = \frac{P_j XS_j - \sum_i PC_i DI_{ij}}{VA_j} \tag{A32}$$

$$r_{ps} = \frac{PV_{ps}VA_{ps} - wLD_{ps}}{\overline{KD_{ps}}} \tag{A33}$$

$$PM_{tr} = \overline{Pwm_{tr}e}(1 + tm_{tr})(1 + tx_{tr}) \tag{A34}$$

$$PE_{tr} = \frac{\overline{Pwe_{tr}e}}{(1 + te_{tr})} \tag{A35}$$

$$PD_j = Pl_j(1 + tx_j) \tag{A36}$$

$$PC_{tr} = \frac{PD_{tr}DOM_{tr} + PM_{tr}M_{tr}}{Q_{tr}} \tag{A37}$$

$$PC_{ntr} = PD_{ntr} \tag{A38}$$

$$P_{tr} = \frac{PL_{tr}DOM_{tr} + PE_{tr}EX_{tr}}{XS_{tr}} \tag{A39}$$

$$P_{ntr} = PL_{ntr} \tag{A40}$$

$$Pindex = \sum_j PV_j \delta_j \tag{A41}$$

Equilibrium Conditions and Closure

$$\overline{LS} = \sum_j LD_j \tag{A42}$$

$$Q_i = DIT_i + C_i + INV_i + \overline{G_i} \tag{A43}$$

$$IT = \sum_{ag} S_{ag} \tag{A44}$$

$$EV = \left(\frac{\prod_i PCO_i}{\prod_i PC_i}\right)^{\gamma_i} YDH - YDHO \tag{A45}$$

Chapter II

Is International Migration a Cure for Moroccan Unemployment?[1]

Unemployment, which represented less than 17% of the economic causes of Moroccan emigration before 1960, far behind the search for a more lucrative work (50%) or the improvement of the living standards (25%), became the principal economic cause of emigration in the 1990s. According to the data collected by Hamdouch (2000), 41% of answers indicate unemployment as the first cause of emigration, whereas the search for a more lucrative work and the improvement of the standard of living represent 38% and 14% respectively of the reasons for emigration. In this context, dealing with the impact of migration on Moroccan unemployment becomes an interesting question.

The relation between migration and economic development of the sending country has not been correctly addressed for a long time, primarily due to scarce reliable data on migratory flows and migrants characteristics at the macroeconomic level as well as the microeconomic one[2]. In the majority of the cases, studies have

[1] This chapter is a new version of a joint paper with B. Decaluwé (Karam and Decaluwé, 2008).
[2] Fortunately, databases become increasingly available, like the one of Docquier and Marfouk (2004) on brain drain.

mainly analysed the impact of migration on the country of destination[3], and in very rare occasions on the country of origin. Only a limited number of studies address the impact of migration (directly or indirectly through remittances) on inequality and wages, growth and welfare, its social effects (children health, education, women's role...), or the impact of returned migrants who acquired experience in the host country, as well as the relation between migration and trade[4]. The "brain drain" and "brain gain" were also the issue addressed by several works.

The very few studies that try to encircle in a systematic way the impact of migration on labour market are limited to the effect of international migration on unemployment in developing countries. However, labour mobility could be observed in several directions. For instance, a transitory South-South migration from a developing country towards another one, before migrating to a developed country, can coexist with internal migration from rural to urban areas, or emigration to more developed countries[5]. The combination of these forces is able to exert unexpected effects on the labour market, and in order to understand them and study their consequences, I choose the Moroccan case. Indeed, Morocco seems the typical example of a developing country undergoing the combination of different migratory flows: rural and urban emigration towards the EU, internal migration from rural to urban areas, and finally Sub-Saharan immigration to Morocco for transit to Europe or in order to definitely stay there.

A sketchy analysis suggests that on the one hand, urban emigration reduces urban unemployment and increases wages, whereas internal migration and Sub-Saharan immigration to the cities raise the pressure on urban labour market. However, the simultaneous impact of these different forces on labour market conditions cannot be predicted without ambiguity since it depends on the magnitude of each migratory flow and the initial conditions of labour market. If internal migration to

[3] For a review of the literature on the effects of migration on the destination country, see Drinkwater et al. (2003).

[4] For a review of the literature on the effects of migration on the sending country, see Katseli et al. (2006).

[5] Emigration is the act of leaving one's native country or region to settle in another. By contrast, immigration is the entry of foreigners into a country to stay and work there.

urban areas and Sub-Saharan immigration to Morocco dominate urban emigration, urban unemployment rate must increase. Conversely, if urban emigration overrides internal migration and Sub-Saharan immigration, unemployment rate will probably decrease.

In order to take simultaneously into account the existing forces, I build a static CGE model. This tool allows to endogenise the determinants of migratory flows and to capture their coexisting direct effects on urban labour market, particularly on unemployment, and their direct and indirect effects on the remainder of the economy. Contrary to other studies on this question[6], I do not think that an aggregate approach is sufficient to seize the complexity of the existing mechanisms, and this is why I undertake a fine disaggregation by professional category. Such a fine description of the labour market that takes into account unemployment rates by professional category is justified by the fact that emigration and immigration do not affect all categories in the same way. In other terms, it allows to seize the impact of migration on each segment of labour market.

The chapter is structured as follows. Section 1 highlights some characteristics of Moroccan labour market. The theoretical framework is presented in Section 2. In Section 3, I run three simulations, the first one consisting of a 10% fall in migration costs, the second of a 10% rise of Sub-Saharan immigrant stock, and finally, the simultaneous effects of the two previous shocks. Section 4 concludes and discusses the policy implications of this study.

1 Moroccan Labour Market

As pointed out earlier, the Moroccan labour market is simultaneously affected by inflows and outflows of workers. Data on international migration come from OECD (2006) while data on internal migration and Sub-Saharan immigration are taken from empirical studies.

[6] See for example Agénor and El Aynaoui (2003).

OECD data indicate that the traditional destinations of Moroccan migrants, such as Belgium, France, Spain, Italy, and the Netherlands, continue to receive important migratory flows. In 2004, 8,000 Moroccans entered to Belgium, 21,700 to France, 24,600 to Italy, 3,300 to the Netherlands and 58,800 to Spain. Accounting for 21.5% of the foreign population living in Spain in 2002, they are considered as the largest foreign community in this country. Moreover and according to an opinion of the International Organisation of Migration, Moroccan migration towards the EU is mostly originated from rural areas (Erf and Heering, 2002).

Internal migration is motivated by climatic risks associated to agricultural production that encourage farmers to look for a stable employment in urban areas in order to mitigate the great fluctuations of their agricultural income. The available estimations indicate that, approximately 200,000 migrants move annually into urban areas, which is equivalent to 40% of the total increase in urban population (Agénor and El Aynaoui, 2003).

Clandestine migration from Sub-Saharan Africa proliferated since the beginning of the 1990s due to the fragility of this continent. Poverty exacerbation, natural resource shortages (water in particular), conflicts and wars of any nature encourage African immigrants to transit by Morocco to Spain and Europe[7] or to settle definitely in Morocco in order to profit from its stability and prosperity. One of the more important consequences of illegal immigration on Morocco is that an increasingly significant number of Sub-Saharan immigrants, scalded by the difficulties they meet on the migratory way leading them to Europe, choose finally to stay in Morocco (mainly in urban areas). Data on Sub-Saharan immigration are scarce and their collection is difficult because the vast majority of African immigrants are clandestine. According to Lahlou (2003), there would be between 6,000 and 15,000 irregular migrants. I retain the upper bound.

[7] The transit by Morocco is explained by geographical reasons (Morocco being at 14 km of the Spanish coast), as well as historical, cultural, religious, and socio-economic reasons like the possibility to work on spot all along the migratory way.

I deal here with the characteristics of Moroccan labour market[8]. In this model, the Moroccan labour market is divided in two segments: rural and urban, each one composed of ten sub-segments by professional category. National employment is roughly equally distributed between rural and urban areas. In 2005, urban employment accounted for 50.5% of national employment. This percentage slightly changes over time.

Table II.1: **Employment by Activity, in 2005 (%)**

Sectors	**National**	**Rural**	**Urban**
Agriculture	45.5	80.2	5.2
Industry	12.4	3.9	22.3
Services	26	8.8	45.9
Construction	7.1	5.2	9.3
Public sector	9	1.9	17.3

Source: Royaume du Maroc (2005).

The structure of employment by activity (Table II.1) shows the relatively important weight of agriculture. In 2005, this sector, absorbing 45.5% of national employment, predominates in rural areas, with 80.2% of total rural employment, and is particularly based on family work. The service sector absorbs 26% of national employment and is the principal provider of urban employment (45.9%). The industrial sector only accounts for 12.4% of total employment, 3.9% in rural areas and 22.3% in urban areas. The construction sector employs 7.1% of total labour, 9.3% in urban areas and 5.2% in rural areas. Employment opportunities come principally from the private sector, absorbing 91% of total employment at the national level, 98% in rural areas and 83% in urban areas. The public sector mainly employs urban workers, with 17.3% of urban employment against only 1.9% in rural areas.

The distribution of Moroccan working population by professional category (Table II.2) shows that "farm labourers" is the most exerted profession at the

[8] Illustrative figures are taken from the Royaume du Maroc (2005a). Employment is distributed between professional categories according to the Analytical Nomenclature of Professions established by the Direction of Statistics (Royaume du Maroc, 2001).

Table II.2: **Employment by professional category, in 2005 (%)**

Professions	National	Rural	Urban
Directors	0.8	0.1	1.6
Senior executive	1.1	0	2.4
Junior staff	3.6	0.4	7.2
Employees	7.9	1.6	15.2
Commercial intermediaries	7.5	3.3	12.4
Farmers	12.4	21.6	1.7
Craftsmen	16.3	6.6	27.5
Farm labourers	32.6	58.1	3.2
Drivers	3	1.3	5
Warehousemen	14.8	7	23.8

Notes: For the complete headings of professions, see Appendix B.
Source: Royaume du Maroc (2005).

national level. Then come the categories "craftsmen" and "warehousemen". The category "workmen" is also the biggest in rural areas followed by the categories "farmers", "warehousemen" and "craftsmen". In urban areas, the category "farm labourers" only accounts for 3.2% of urban employment. The category "craftsmen" is henceforth ranked first followed by "warehousemen", "employees" and "commercial intermediaries".

Table II.3: **Unemployment rates by professional category, in 2005**

Professions	National
Directors	2.2
Senior executive	1.7
Junior staff	6.1
Employees	11.2
Commercial intermediaries	3.2
Farmers	0.3
Craftsmen	10.1
Farm labourers	2
Drivers	8.5
Warehousemen	12

Source: Direction of Statistics, Rabat.

Like many developing countries, unemployment in Morocco is primarily an urban phenomenon. Unemployment rate rose in 1999 to 22% then fell to 18.3% in 2005. By contrast, rural unemployment rate is low, about 3.6% in 2005. At the national level, unemployment rate reached 13.9% in 1999 then fell to 11% in 2005. In addition, unpublished data provided by the Direction of Statistics, Rabat (Table II.3) show that warehousemen, employees and craftsmen have the highest unemployment rates (12%, 11.2% and 10.1% respectively). On the other hand, farmers and senior executive exhibit the lowest rates (0.3% and 1.7% respectively).

2 Theoretical Framework

In order to correctly analyse the impact of migration on the different segments of labour market, it is important to identify the origin of migratory flows. If one thinks that Moroccan emigration from rural or urban areas relaxes the pressure on the corresponding domestic labour markets, the drop in labour supply induces a rise in rural or urban wages. Given that unemployment is an important characteristic of urban labour market, emigration of urban workers, when it mainly affects some professional categories, obviously reduces unemployment rates for these categories and not for the others, if there is some degree of specificity in qualifications. On the contrary, internal migration of rural workers and African immigration to urban areas increase labour supply and unemployment rates of the different professions. Since emigration and immigration do not touch the same categories, their impact will be different from a market to another. It is also clear that the eventual labour surplus on some segments of labour market will reduce wages (freely adjusting or negotiated by the means of a wage convention). When these migratory flows coexist, the ultimate effect on urban unemployment rates by professional category is ambiguous. A fine modelling of labour market, illustrative of all these migratory movements, is therefore necessary. The remainder of this section describes the behavioural assumptions I retain.

The benchmark CGE model is a static real model of a small open economy, inspired from Decaluwé et al. (2001) and developed by Cockburn et al. (2006). This basic structure is however deeply modified in order to adequately describe the behaviour of labour market as well as the internal and external determinants of migratory flows. Very briefly, my version of this model contains 34 mono-productive sectors distributed between two aggregate sectors: a rural one (agriculture and fishing) and an urban one (industry, tradable and non-tradable services); five agents (rural and urban households, firms, government, and the RoW). I further modify the specification of the rural sector in order to distinguish, within this sector, between subsistence and industrial agriculture. The production process employs two production factors: labour and capital. Because of the relative complementarity of capital and labour in the public value added, it is now represented by a Leontief function, on the contrary to the CES function of private value added. The capital is sector-specific. Rural labour is a bundle of rural professional categories and each rural labour category is perfectly mobile between rural sectors. Urban labour is also a bundle of urban categories with each one being mobile between urban sectors, but sub-segments of urban market are imperfect due to the existence of unemployment. In addition, I endogenise the labour supply on each sub-segment of rural and urban markets. I further assume that unemployed persons can not change their profession. In other words, the cross elasticity of labour supply is null. Finally, I introduce a new block of equations, relative to rural and urban emigration, internal migration from rural to urban areas and Sub-Saharan immigration, and I suppose the existence of migration costs. The model has an investment-driven closure: total investment volume is fixed. Households and firms' savings are determined by the model and foreign savings are fixed. Uniform adjustments of the value added tax rate across all sectors assure that government savings vary endogenously to achieve savings-investment equilibrium[9].

For the sake of brevity, I only describe here the migration block, the specification

[9] However, the CGE literature on Morocco (Agénor et al., 2003; Löfgren et al., 1999) made use of a savings-driven closure where government savings are a fixed proportion of GDP. In the present case, an investment-driven closure is preferable because the model is static and firms' investment decisions rarely change in the short run. Nonetheless, I also run the simulations with a savings-driven closure: while this new closure is expected to generate different outcomes, as pointed out in Chapter 1, the results show that the signs of unemployment and wage changes are the same as before. The results are available to the interested reader upon request.

of rural and public sectors as well as the endogeneisation of labour supply. All equations can be examined in Appendix C. The model is calibrated on a disaggregated SAM for 1998. Data on migration come from OECD (2006). Appendix A and B present a detailed explanation of all data sources. The model is implemented in GAMS (Brooke et al., 1988) and solved with NLP, a solver for non-linear programming.

2.1 Migratory Flows

2.1.1 Migration Costs

When an individual migrates from a region to another or when he decides to leave his country, this can not be done without costs. Any migratory movement induces financial costs (travel cost, search for an apartment, search for a job...) and psychological costs (change of the way of life, adaptation to a new culture and a new community...) for the migrant. Migration costs are modelled *à la* Chan et al. (2005): when workers migrate from a region to another due to wage differentials, their net wage in the region of destination is lower than the effective wage in this region, and the difference is due to migration costs. According to the authors, this is equivalent to a reduction in household's available working time in the region of destination and results in a reduction of his labour endowment. In other words, migration costs are a fraction of the migratory flow[10]. For lack of precise information on the width of this cost, I follow Chan et al. (2005) who postulate that migration costs are equal to 10% of the international migratory flow. Given that migrant labour supply in the region of destination is reduced by 10%, total labour remuneration of their work decreases too. For internal migration, the cost of labour mobility is obviously lower than international migration and I suppose that internal migration costs are equal to 5% of the internal migratory flow.

Adjustment costs associated with Sub-Saharan immigration are neglected here

[10] These costs obviously decrease over time and vanish after some periods.

because the latter is supposed to be exogenous and not motivated by economic factors. Indeed, according to Lahlou (2003), political and security factors (disorders and conflicts between and inside several African countries) play a crucial role in stimulating illegal African immigration to Morocco. Thus, migration to Morocco takes place whatever migration costs fall down or not.

2.1.2 Migration from Rural Areas

Two types of migratory flows take place from rural areas: internal migration towards the cities and international migration. In 1960, more than 70% of Moroccans lived in rural zones. Four decades later, they are not more than 46% due to internal migration from rural areas to the cities and to foreign countries. Migration phenomenon seems mainly originated from rural areas. The gap between annual growth rates of rural and urban populations, which was around 2.5% in 1960 (4.2% in urban areas against 1.7% in rural areas), rose to more than 3% in the 1990s. Moreover, in 1997, the growth rate of rural population was negative (Erf and Heering, 2002).

In order to characterise this migratory movement, I postulate that the rural worker of professional category c carries out a choice in two stages: first, he maximizes his expected income $REVR_c$, considering the choice of staying in Morocco (staying in rural zones or migrating to the cities) or leaving the country[11]:

$$Max\ REVR_c = \frac{wn_c}{CPI} NAT_c + wi_c e(1 - mc) EMR_c$$

s.t.

$$LSR_c = Br_c [\varpi_c NAT_c^{(\varepsilon_c - 1)/\varepsilon_c} + (1 - \varpi_c) EMR_c^{(\varepsilon_c - 1)/\varepsilon_c}]^{\varepsilon_c/(\varepsilon_c - 1)}$$

[11] Given that CGE models usually analyse the behaviour of a representative agent, NAT_c and EMR_c correspond to the number of hours that the representative worker of category c chooses to offer respectively in Morocco and abroad.

where

wn_c	is the national wage rate of professional category c,
CPI	the consumer price index at the national level,
NAT_c	rural workers of category c that decide to stay in Morocco,
wi_c	the international real wage rate of category c in foreign currency,
e	the nominal exchange rate,
mc	international migration costs expressed as a percentage of the migratory flow,
EMR_c	the flow of rural emigrants of category c,
LSR_c	the rural population of category c,
Br_c	the scale parameter of the CET function,
ϖ_c	the share parameter of the CET function,
ε_c	the elasticity of transformation (negative).

The solution of the optimisation problem gives the ratio of rural emigrants to those who decide to stay in Morocco:

$$\frac{EMR_c}{NAT_c} = [\frac{\varpi_c}{1-\varpi_c}\frac{wi_c e(1-mc)}{wn_c/CPI}]^{-\varepsilon_c} \tag{II.1}$$

Secondly, the rural worker of category c who has decided to stay in Morocco carries out the choice of staying in rural areas or migrating to the cities. The potential internal migrant compares a rural job to an urban one belonging to the same professional category. Thus, labour supply of each professional category does not depend on the wage of the other categories. However, when he takes the decision to migrate to urban areas, he is aware of the possibility not to find a job there. Therefore, the expected urban wage of category c, wa_c, is equal to the urban wage of this category times the probability to find a job in town. This probability is itself equal to the ratio of total urban labour demand and total labour supply of category

c:

$$wa_c = wug_c(1 - u_c)$$

where

wug_c	is the average urban wage rate of category c,
u_c	the unemployment rate of category c.

The maximisation problem of this potential internal migrant is written as follows:

$$Max\ REVI_c = \frac{wa_c(1 - imc)}{CPIU} MIG_c + \frac{wr_c}{CPIR} NATR_c$$

s.t.

$$NAT_c = Bu_c[\vartheta_c NATR_c^{(\varrho_c - 1)/\varrho_c} + (1 - \vartheta_c) MIG_c^{(\varrho_c - 1)/\varrho_c}]^{\varrho_c/(\varrho_c - 1)}$$

where

$REVI_c$	is his expected income when he divides his working hours between urban and rural areas,
imc	internal migration costs expressed as a percentage of the migratory flow,
$CPIU$	the consumer price index in urban areas,
MIG_c	internal migrants of category c,
wr_c	the rural wage rate of category c,
$CPIR$	the consumer price index in rural areas,
$NATR_c$	rural workers of category c who decide to stay in rural areas,
Bu_c	the scale parameter of the CET function,
ϑ_c	the share parameter of the CET function,
ϱ_c	the elasticity of transformation (negative).

The ratio of internal migrants to workers who decide to stay in rural areas is then written:

$$\frac{MIG_c}{NATR_c} = [\frac{\vartheta_c}{1-\vartheta_c}\frac{(1-imc)wa_c/CPIU}{wr_c/CPIR}]^{-\varrho_c} \tag{II.2}$$

The elasticity of transformation is lower, in absolute value, in equation II.1 in comparison with equation II.2, reflecting a much stronger preference of workers for their country of origin. This is also explained by higher costs associated to migration abroad.

2.1.3 Migration from Urban Areas

In turn, the urban worker maximizes his expected income $REVU_c$ by choosing to stay in Morocco or to migrate abroad. Given that urban markets are imperfect, the urban worker is unable to offer all his disposable working hours. He is considered unemployed for the hours he can not offer. Therefore, to make his choice, he compares the international wage to the expected urban real wage and solves the following maximisation problem:

$$Max\ REVU_c = \frac{wa_c}{CPIU}NATU_c + wi_c e(1-mc)EMU_c$$

s.t.

$$LSU_c = Bi_c[\xi_c NATU_c^{(o_c-1)/o_c} + (1-\xi_c)EMU_c^{(o_c-1)/o_c}]^{o_c/(o_c-1)}$$

where

$NATU_c$	represents urban workers of category c who decide to stay in Morocco,
EMU_c	urban workers of category c who decide to emigrate,
LSU_c	the urban population of category c
Bi_c	the scale parameter of the CET function,

ξ_c the share parameter of the CET function,

o_c the elasticity of transformation (negative).

The ratio of urban migrants to those who decide to stay in Morocco is given by:

$$\frac{EMU_c}{NATU_c} = [\frac{\xi_c}{1-\xi_c}\frac{wi_c e(1-mc)}{wa_c/CPIU}]^{-o_c} \tag{II.3}$$

Note that the elasticity of transformation o_c is greater, in absolute value, than the one of equation II.1, reflecting less financial constraint for urban workers to migrate abroad, in comparison to rural workers. It is however lower than the one of equation II.2 because the costs associated with internal migration are lower than those associated with international migration[12] ($|\varepsilon_c| \prec |o_c| \prec |\varrho_c|$).

2.1.4 African Immigration

I suppose that, the African immigrant, when he comes to stay in Moroccan cities, does not have the same behaviour of the Moroccan urban worker. He does not maximise his expected income by choosing to offer his work in Morocco or abroad. He comes to work in Morocco, fleeing war or poverty, in order to stay there definitely or to survive before migrating to Spain. The decision to migrate to Europe is taken before the arrival to Morocco, and does not depend on wage differentials between Morocco and the rest of the world. Moreover, given that African immigration does not only occur for economic and financial reasons, but also for personal and security reasons, living conditions in Morocco and, in particular, urban wage variation does not affect Sub-Saharan immigration to this country. For this reason, I choose to exogenise the stock of African immigrants. This variable will be subject to a

[12] The simulations below are run with the following elasticity values (ε_c=-1.5, ϱ_c=-2.5 and o_c=-2). However, Table II.13 in Appendix D presents a sensitivity analysis for some selected combinations of migration elasticities. The results show that unemployment changes are mostly sensitive to internal migration elasticity. The greater the elasticity of internal migration is, the more rural workers react to the drop of internal migration costs. More people then move to urban areas and given that other things are equal, unemployment increases. The opposite occurs when the elasticity is low.

shock later on, a 10% rise of the Sub-Saharan immigrant stock, in order to see how exogenous reasons such as the exacerbation of poverty or conflicts in Sub-Saharan Africa exert a strong pressure on the Moroccan economy.

In addition, the majority of these immigrants are clandestine. Even if they are skilled, they occupy low-skilled jobs in Morocco (shoemakers, mason assistant, guards of private residences...). Therefore, I assume that these African immigrants work in low-skilled jobs in Morocco and they belong to the urban category "warehousemen and workers of small trades" (category 10). Moreover, these immigrants are not perfect substitutes to local labour. The majority of them being clandestine, they can only work in the informal sector. In other words, a company that employs workers belonging to the above-mentioned category does not pay social security contributions on the wages assigned to African immigrants, contrary to nationals belonging to the same category. Urban labour demand of category "10" by urban private sector *up* is a CES function of national and foreign workers. Relative demand of foreign workers is deduced from the wage cost minimisation problem of sector *up*:

$$Min\ wup_{up} LU_{\text{“10”},up} = (1+cs) wu_{\text{“10”}} NATI_{up} + wu_{\text{“10”}} ETR_{up}$$

s.t.

$$LU_{\text{“10”},up} = Ai_{up} [\Omega_{up} NATI_{up}^{(\varsigma_{up}-1)/\varsigma_{up}} + (1-\Omega_{up}) ETR_{up}^{(\varsigma_{up}-1)/\varsigma_{up}}]^{\varsigma_{up}/(\varsigma_{up}-1)}$$

where

wup_{up} is the average wage of category "10" in sector *up*, given by the following equation:

$$wup_{up} = \frac{(1+cs) wu_{\text{“10”}} NATI_{up} + wu_{\text{“10”}} ETR_{up}}{LU_{\text{“10”},up}}$$

$LU_{``10", up}$ the urban labour demand of category "10" by private urban sector up,

cs social security contributions,

wu_c the private urban wage of category c,

$NATI_{up}$ the demand of domestic workers belonging to category "10" by sector up,

ETR_{up} the demand of foreign workers belonging to category "10" by sector up,

Ai_{up} the scale parameter of the CET function,

Ω_{up} the share parameter of the CET function,

ς_{up} the elasticity of substitution between nationals and immigrants in sector up (positive).

This elasticity of substitution can be interpreted as a "repression" parameter reflecting the firm's fear from being punished for hiring informal Sub-Saharan workers. The weaker the elasticity is, the stronger the repression is and the less the firm changes the proportion of domestic and foreign workers following their relative wage change. Conversely, the stronger the elasticity is, the more the repression is laxest and the more the firm is incited to engage Africans when their relative wage decreases. The parameters of distribution Ω_{up} and $(1 - \Omega_{up})$ are then interpreted as "tolerance" parameters, i.e. the proportions of nationals and Sub-Saharan immigrants socially accepted for a given level of the "repression" parameter.

Relative demand for Sub-Saharan labour is therefore written:

$$\frac{ETR_{up}}{NATI_{up}} = [(\frac{(1-\Omega_{up})}{\Omega_{up}})(\frac{wu_{``10"}(1+cs)}{wu_{``10"}})]^{\varsigma_{up}}$$

Social security contributions cs are fixed to 20% of the private urban wage of each professional category. The employer pays 18.6% of the gross salary to Social Security for contributions to retirement and other social security covers, and an obligatory tax of 1.6% imposed on the wage bill as a contribution to the financing of the public system of vocational training.

Therefore, social security contributions create a gap between the wage paid by firms and labour remuneration received by households and the rest of the world. They are modelled explicitly in the urban private sector and in industrial agriculture. On the other hand, I assume that they are null in subsistence agriculture where a significant part of labour comes from family work. In addition, they are neglected in the public sector because they are paid by public firms and received by the agent "government" that is constituted of the central government and public firms.

2.2 The Rural Sector

I distinguish, within the rural sector, between subsistence and industrial agriculture. This modelling perfectly agrees with the reality of Moroccan agriculture, of which a considerable share is for subsistence[13]. With production only supplied on the domestic market, the subsistence sector satisfies consumers's final demand and does not provide intermediary inputs to other industries. By contrast, industrial agriculture delivers intermediary inputs to industrial and food processing industries. It is intended to domestic and international markets and resorts to different production techniques than those of subsistence agriculture (transport, storage, conditioning, quality control...). The fishing sector is associated with industrial agriculture because Moroccan fishing is primarily industrial: domestic consumption remains very weak and is only around 6 kg/person. The canning facility corresponds to one third of pelagic catches, the remainder being intended to flour and fish oil production. I also assume that subsistence agriculture only employs labour in the production process, whereas industrial agriculture uses labour and capital.

The history of Moroccan agriculture is marked by frequent dryness periods and extreme pluviometric fluctuations. Repeated drynesses in 1981, 1983 and 1984 induced a negative growth rate of agricultural production (-1.9% on average). Such

[13] By definition, subsistence agriculture (also known as self sufficiency) is a method of farming where farmers plan to grow only enough food to feed the family farming, pay taxes, and perhaps provide a small marketable surplus. This definition is problematic because when production is intended to feed the family, it will not be offered on the domestic market and therefore will not enter national statistics. Here, I mean by subsistence agriculture the production of foodstuffs that uses traditional production techniques and is offered on the domestic market in order to satisfy the representative consumer demand and not only peasants' consumption.

periods are heavy on peasants who live from land and do not have other income sources[14]. They will be obliged then to move from rural areas and search for a job allowing to mitigate the fall of their agricultural income.

What are the effects of these variations in rural working population on agricultural production? Presumably, production should be done in the zone of decreasing marginal productivity of the mobile factor (to the right of the inflection point in figure II.1). However, it is not necessarily the case. Given that peasant departure to urban areas increases agricultural properties (for example after land sales by leaving peasants) or leads to the abandonment of less productive pieces, rural working population changes may drive us to the left of the inflection point, where marginal labour productivity is increasing. In the same way, the opposite movement of eventual comeback of urban workers to rural areas could lead to a fall in agricultural marginal productivity because of land bursting or the exploitation of more arid and less productive zones.

In order to model this phenomenon and allow a regime change (to pass from a situation of increasing productivity to a situation of decreasing one) after migratory movements between rural and urban areas, I adopt for subsistence agriculture a value added function of the Weibull type[15] represented by Figure 1:

$$VA_{``sa"} = a(1 - e^{-(LDR_{``sa"}/b)^f})$$

where

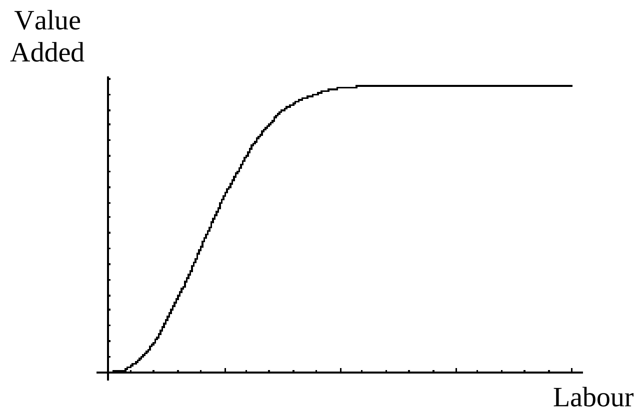
$LDR_{``sa"}$	is labour demand by subsistence agriculture sector,
a, b, f	parameters in the Weibull function.

Value added of subsistence agriculture being only created by labour, I write

[14] Certainly, transfers from internal and international migrants to their family in rural areas compensate for the loss of agricultural income. However, given that transfers are also used for investment needs besides consumption, this requires a dynamic CGE model dealing with capital accumulation, and not a static one as it is the case of this model.

[15] This is not possible with a CES function that models either an increasing or decreasing productivity, but not both at the same time.

Figure II.1:
Value Added Form of Subsistence Agriculture



labour demand by this sector in the following form:

$$LDR_{``sa"} = \frac{PV_{``sa"} VA_{"sa"}}{w_{``sa"}}$$

where

$PV_{``sa"}$	is the value added price of subsistence agriculture,
$w_{``sa"}$	the wage rate in subsistence agriculture.

In other words, in this sector and contrary to industrial agriculture, all profits are incorporated in labour remuneration.

The parameter f is fixed to 2.2814, so that the Weibull function is a symmetric one. In order to calibrate the parameters a and b, I have to make an assumption about the volume of labour corresponding to the inflection point. For that, I postulate that, before any migratory movement from rural areas, labour marginal productivity is decreasing. Once rural workers leave the countryside towards urban areas or abroad, I suppose that labour demand by subsistence agriculture corresponds to the inflection point of Figure II.1.

2.3 The Public Sector

Contrary to private firms that choose the volume of labour and capital in order to maximize their profits, the government as a producer of services does not have an optimisation behaviour. Therefore, I postulate that the value added of non tradable public services is a "Leontief" combination of labour and capital. In other words, for each job created in the public sector, the government must mobilise some quantity of capital (public buildings...) and add this cost to the remuneration of civil servants. The value added in the public sector is then written:

$$VA_{pub} = KD_{pub}/k_{pub}$$

and labour demand by this sector:

$$LDG_{pub} = l_{pub}VA_{pub}$$

where

VA_{pub}	is the value added of public sector *pub*,
KD_{pub}	the capital demand by public sector *pub*,
k_{pub}	a technical coefficient in the Leontief value added function,
LDG_{pub}	the labour demand by public sector *pub*,
l_{pub}	a technical coefficient in the Leontief value added function.

Moreover, I assume that the government needs a constant proportion of each professional category. Therefore, if the wage of engineers increases, it cannot replace them by office workers. By postulating that labour demand of category c by the public sector is insensitive to the variation of relative wages, I can express total labour demand by non-tradable public services as a Leontief function of labour demand by professional category:

$$LG_{c,pub} = LDG_{pub}lc_{c,pub}$$

where

$LG_{c,pub}$	is labour demand of category c by public sector pub,
$lc_{c,pub}$	the technical coefficient of the Leontief public labour demand function.

In tradable sectors, firms maximise their profits. Then, if available capital is sector-specific, profits or capital remuneration are residual and vary between sectors. This approach is obviously irrelevant for the public sector since the government, as a supplier of non-tradable services, does not have an optimisation behaviour. The cost and thus the price of public services is then the combination of wage and capital costs. Consequently, I normalise the rental rate of capital in the public sector and I calculate capital demand in the following way:

$$KD_{pub} = \frac{PV_{pub}VA_{pub} - w_{pub}LDG_{pub}}{r_{pub}}$$

where

PV_{pub}	is the value added price of public sector pub,
w_{pub}	the wage of public sector pub given by the following equation:

$$w_{pub} = \sum_{c} \frac{LG_{c,pub}wg_c}{LDG_{pub}}$$

wg_c	the public wage rate of professional category c,
r_{pub}	the rental rate of capital in public sector pub.

According to the World Bank (2002), monetary compensations in the Moroccan public sector are 8% higher than those in the private sector. If non-pecuniary compensations are added, such as job security and the existence of generous pension funds, the divergence between public and private sectors becomes larger. According to the National Survey on Household Living Standards in 1998-1999, this corresponds to a public wage of 1.5 to 2 times higher than the private sector wage.

The existence of this important wage differential between public and private sectors leads to an excessive labour supply in the public sector and, in particular for young and skilled people, waiting unemployment and a high reservation wage. I take into account this wage differential in the calibration procedure by postulating that:

$$wg_c \succ wu_c$$

The public wage by professional category wg_c is also considered exogenous. This wage rigidity allows internal migration flows in spite of urban unemployment rates.

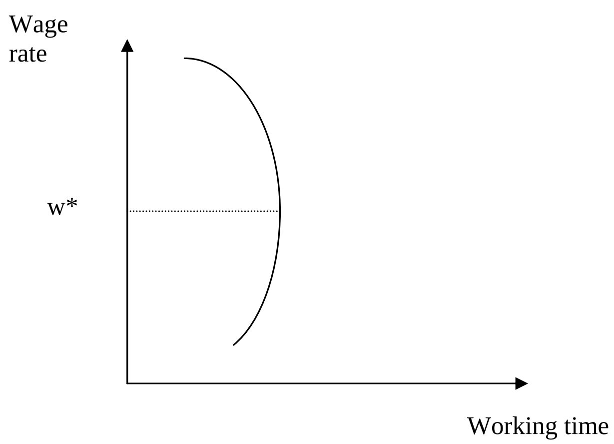
2.4 Endogenous Labour Supply

The assumption of a representative agent usually used in the literature on CGE models is not without posing conceptual difficulties in this model, where labour income of the representative household comes from the participation of a multitude of individuals to different labour markets. In the present case, wage rates are different between categories and the increase in the wage rate of a professional category does not necessarily induce a fall in labour supply of another category. In other words, the concepts of cross elasticities loose their significance when the representative household is composed of individuals having different qualifications.

In order to solve this problem, Decaluwé et al. (2005) describe the representative household as a group of individuals, each one belonging to a professional category and exerting only one profession. Each individual maximizes his utility independently from the others, taking into account his own leisure preference. Therefore, labour supply of each member (or each professional category) is independent from the wage rate of the other members and thus the opportunity cost of leisure differs between members. This approach is similar to a particular case of the collective household model (Chiappori, 1992) where the decision process is carried out in two stages: initially, income - here non-labour income - is divided between household members. Then, each member maximizes his utility independently from the others.

I follow this approach and postulate that each individual carries out an arbitration between the time allocated to work and the time allocated to leisure. Given that leisure is considered as a normal good, its opportunity cost is equal, in presence of unemployment, to the expected wage rate of the corresponding professional category, which is the product of the wage rate by the probability of being employed. In other words, I suppose that unemployment on urban labour market c affects proportionally all individuals who offer this work category. When the expected wage increases, an income effect and a substitution effect come into play. On the one hand, the rising wage increases the leisure opportunity cost, and consequently the individual increases his labour supply. This is the substitution effect. On the other hand, the rising wage increases consumption of all goods, including leisure (normal good), and consequently induces a fall in labour supply. This is the income effect. The final effect on labour supply depends on the extent of the two previous effects: if the substitution effect dominates, the labour supply curve is increasing. If the income effect is greater than the substitution effect, the labour supply curve is decreasing. It is called "Backward-bending" (Hanoch, 1965). It is represented by Figure II.2. For the following simulations, I assume that the substitution effect dominates and thus labour supply curve has a positive slope.

Figure II.2:
"Backward-bending" Labour Supply Curve



First, the consumer carries out the choice of consuming goods or leisure, by the means of an extended linear expenditure system (ELES) (Lluch, 1973)[16]. In order to define the optimisation problem of household's member c with a Stone-Geary utility function, it is necessary to separate between household members the minimum consumption level of each good and service i as well as the non-labour income. Let λ_c be the share of household's member c in total labour remuneration, with

$$\lambda_c = \frac{w_c \sum_j LD_{c,j}}{\sum_c (w_c \sum_j LD_{c,j})} \text{ and } \sum_c \lambda_c = 1.$$

where

w_c	is the wage of professional category c,
$LD_{c,j}$	the labour demand of professional category c by sector j

The optimisation problem of household's member c is written:

$$Max\, U_c \;=\; \sum_i m_{i,c} ln(C_{i,c} - \lambda_c Cmin_i) + \beta_c ln(TNL_c - TNLmin_c)$$

s.t.

$$\begin{aligned}\sum_i PC_i C_{i,c} &= (1-\psi)(1-ty)w_c \sum_j LD_{c,j} + \\ &\quad \lambda_c(1-\psi)(1-ty)[Y - \sum_c (w_c \sum_j LD_{c,j})] \\ &= prl_c(T_c - TNL_c) + \lambda_c(1-\psi)(1-ty)[Y - \sum_c (w_c \sum_j LD_{c,j})]\end{aligned}$$

where

U_c	is the utility of household's member c,
$m_{i,c}$	the budgetary share of good i in the supernumerary income of member c,
$C_{i,c}$	member c's consumption of good i,

[16] The ELES demand function is obtained from a static maximisation problem of the Stone-Geary function (Stone, 1954), where savings are considered as a good with zero minimum consumption. In the present endogenous labour supply problem, savings are replaced by leisure and I consider that the household must also consume a minimum level of leisure (De Melo and Tarr, 1992; Deaton and Muellbauer, 1980).

$Cmin_i$ household's minimum consumption of good i,

β_c the leisure share in member c's income,

TNL_c the leisure time of member c,

$TNLmin_c$ the minimum leisure time of member c,

PC_i the composite price of good i,

ψ the marginal (and average) propensity to save applied uniformly to all household members,

ty the direct tax rate on household income applied uniformly to all household members,

Y the total income of the representative household,

prl_c the leisure opportunity cost of member c given by:

$$prl_c = (1-\psi)(1-ty)(1-u_c)w_c$$

u_c the unemployment rate of professional category c,

T_c the total available time for member c

The equations of commodity demand and leisure demand become:

$$C_{i,c} = \lambda_c Cmin_i + \frac{m_{i,c}}{(1-\beta_c)PC_i}(\sum_i PC_i C_{i,c} - \sum_i PC_i \lambda_c Cmin_i)$$

and

$$TNL_c = TNLmin_c + \frac{\beta_c}{(1-\beta_c)prl_c}(\sum_i PC_i C_{i,c} - \sum_i PC_i \lambda_c Cmin_i) \qquad \text{(II.4)}$$

From the equality $TNL_c - TNLmin_c = lsmax_c - LS$, where $lsmax_c$ is household's member c maximum time available to work, and from equation II.4, I deduce the labour supply function of professional category c:

$$LS_c = lsmax_c - \frac{\beta_c}{(1-\beta_c)prl_c}(\sum_i PC_i C_{i,c} - \sum_i PC_i \lambda_c Cmin_i)$$

In the three previous equations, I replace $\sum_i PC_i C_{i,c}$ by its value given in the optimisation problem.

Since I am taking into account two segments of the labour market, rural and urban, each one divided in ten sub-segments according to the different professional categories, I distinguish two equations of labour supply, one for the rural market applied to all rural professions and one for the urban market applied to all urban ones[17]:

$$NATR_c = lsmax_c - \frac{\beta_c}{(1-\beta_c)prl_c}(\sum_i PC_i C_{i,c} - \lambda_c \sum_i PC_i Cmin_{i,\text{“}hr\text{”}})$$

where

$$\begin{aligned}\sum_i PC_i C_{i,c} &= (1-\psi_{\text{“}hr\text{”}})(1-ty_{\text{“}hr\text{”}})wr_c \sum_{ru} LR_{c,ru} + \\ &\quad \lambda_c(1-\psi_{\text{“}hr\text{”}})(1-ty_{\text{“}hr\text{”}})[Y_{\text{“}hr\text{”}} - \sum_c (wr_c \sum_{ru} LR_{c,ru})]\end{aligned}$$

in rural areas. For urban areas, this equation is more complex because the representative urban household is composed of Moroccans having decided to stay in urban areas, as well as internal migrants and Sub-Saharan immigrants. Labour income of these migrants is added to the income of the representative household and is used for consumption and savings ends. For lack of information on the consumption behaviour of these migrants and on the proportion employed, I must make an assumption about the fraction of the consumption budget and labour income that come from the participation of these individuals to the urban household.

[17] The parameter β_c is calibrated from the income elasticity of labour supply. The latter is fixed to -0.2 in the simulations, for rural and urban households. Table II.12 gives the effect on unemployment by professional category of selected combinations of rural and urban income elasticities of labour supply. The results show that unemployment change is hardly affected by the choice of these elasticities.

For that, I postulate that this fraction is equal to the proportion of internal migrants and African immigrants in the labour supply of each category.

$$NATU_c = lsmax'_c - \frac{\beta'_c}{(1-\beta'_c)plu_c}(1-\zeta_{1c}-\zeta_{2c})(\sum_i PC_iC'_{i,c} - \lambda'_c \sum_i PC_iCmin_{i,\text{``}hu\text{''}})$$

where

$$\zeta_{1c} = \frac{(1-imc)MIG_c}{NATU_c + (1-imc)MIG_c + IMMIG_c}$$

$$\zeta_{2c} = \frac{IMMIG_c}{NATU_c + (1-imc)MIG_c + IMMIG_c}$$

$$\begin{aligned}\sum_i PC_iC'_{i,c} &= (1-\psi_{\text{``}hu\text{''}})(1-ty_{\text{``}hu\text{''}})(wu_c \sum_{up} LU_{c,up} + wg_c \sum_{pub} LG_{c,pub}) + \\ &\lambda'_c(1-\psi_{\text{``}hu\text{''}})(1-ty_{\text{``}hu\text{''}})[Y_{\text{``}hu\text{''}} - \sum_c (wu_c \sum_{up} LU_{c,up} + wg_c \sum_{pub} LG_{c,pub})]\end{aligned}$$

Now, rural household demand of good i is written:

$$CT_{i,\text{``}hr\text{''}} = \sum_c \lambda_c Cmin_{i,\text{``}hr\text{''}} + \sum_c \frac{m_{i,c}}{(1-\beta_c)PC_i}(\sum_i PC_iC_{i,c} - \lambda_c \sum_i PC_iCmin_{i,\text{``}hr\text{''}})$$

and urban household demand (excluding the consumption of internal and African immigrants):

$$\begin{aligned}CT_{i,\text{``}hu\text{''}} = \sum_c (1-\zeta_{1c}-\zeta_{2c})[\lambda'_c Cmin_{i,\text{``}hu\text{''}} + \frac{m'_{i,c}}{(1-\beta'_c)PC_i} \\ (\sum_i PC_iC'_{i,c} - \lambda'_c \sum_i PC_iCmin_{i,\text{``}hu\text{''}})]\end{aligned}$$

For lack of data on consumption and income elasticity of household members that are necessary to calibrate the budgetary share of each one of them, I suppose, like in Decaluwé et al. (2005), that all household members distribute their supernumerary consumption budget in the same proportions, whatever their leisure budgetary share is. In other words, the fractions

$$\frac{m_{i,c}}{(1-\beta_c)} \text{ and } \frac{m'_{i,c}}{(1-\beta'_c)}$$

are the same between all members of rural and urban households, they are independent of the professional category to which the individual belongs. Thus, rural household demand of good i is written:

$$CT_{i,\text{``}hr\text{''}} = Cmin_{i,\text{``}hr\text{''}} + \frac{\gamma_{i,\text{``}hr\text{''}}}{PC_i}(BC_{\text{``}hr\text{''}} - \sum_i PC_i Cmin_{i,\text{``}hr\text{''}})$$

and urban household demand (excluding the consumption of internal and African immigrants):

$$CT_{i,\text{``}hu\text{''}} = \sum_c (1-\zeta_{1c}-\zeta_{2c})[\lambda'_c Cmin_{i,\text{``}hu\text{''}} + \frac{\gamma_{i,\text{``}hu\text{''}}}{PC_i}(\sum_i PC_i C'_{i,c} - \lambda'_c \sum_i PC_i Cmin_{i,\text{``}hu\text{''}})]$$

where $BC_{\text{``}hr\text{''}}$ et $BC_{\text{``}hu\text{''}}$ are respectively the consumption budgets of rural and urban households.

When internal migrants and African immigrants join the urban household, they participate to his consumption. Urban household consumption (including internal and African immigrants) is then written:

$$CT_{i,\text{``}hu\text{''}} = Cmin_{i,\text{``}hu\text{''}} + \frac{\gamma_{i,\text{``}hu\text{''}}}{PC_i}(BC_{\text{``}hu\text{''}} - \sum_i PC_i Cmin_{i,\text{``}hu\text{''}})$$

2.5 Labour Market Equilibrium

In Morocco, like in the majority of developing countries, unemployment is a characteristic of urban labour market. Therefore, a realistic representation of this market must take unemployment into account in equilibrium, in contrast with the bulk of the CGE literature.

I rely here on a Blanchflower and Oswald (1995) type approach. With international microeconomic data on more than twelve developed nations, Blanchflower and Oswald identified a negative relation between wage and unemployment rates, implying that an increase of unemployment rate in a particular region during a year, induces *ceteris paribus* a fall of the wage rate of the corresponding workers. Blanchflower and Oswald (1995) showed that the relation between wage and unemployment rates is stable among countries and through time with an elasticity around -0.1. I follow this approach (Figure II.3) in order to model urban unemployment by professional category and make the assumption that this elasticity does not depend on the development level of the country[18]:

$$\ln \frac{wu_c}{CPIU} = D_c - 0.1 \ln u_c$$

where

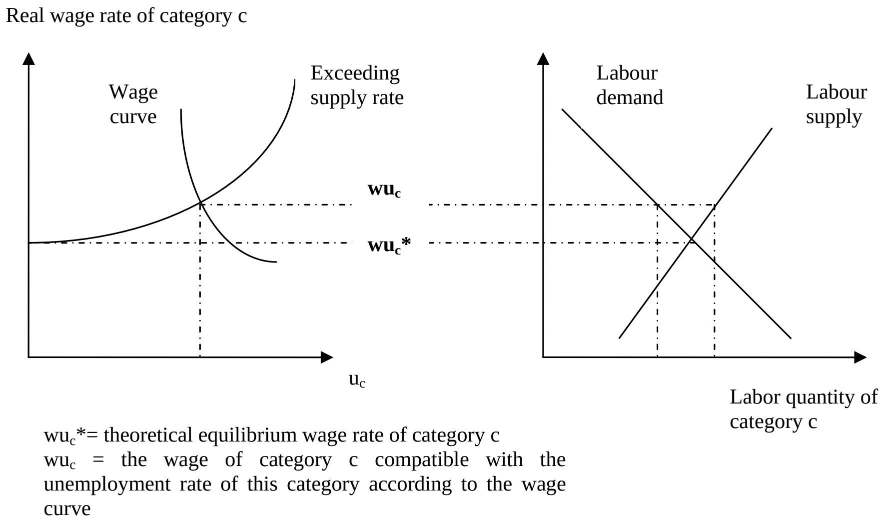
u_c	is the unemployment rate of category c compatible with the corresponding wage rate wu_c,
$CPIU$	the consumer price index in urban areas,
D_c	fixed effects related to regions and industries, as well as the whole characteristics of workers (age, sex, education...).

On the other hand, rural labour markets are competitive. Equilibrium occurs when:

$$NATR_c = \sum_{ru} LR_{c,ru} \tag{II.5}$$

[18] Table II.11 in Appendix D presents some selected results of the sensitivity analysis on alternative values of the wage elasticity. Unemployment rates by professional category change in the same direction as before. For those categories whose unemployment rate increases, the results show that the latter grows at a slower pace with a higher wage elasticity. Indeed, the higher the elasticity is, the more urban real wage decreases due to unemployment coming from the pressure of internal migration flows, and the more international migration increases, reducing unemployment in urban areas.

Figure II.3:
The Wage Curve



with $NATR_c$ being the rural labour supply by professional category c and $LR_{c,ru}$ the labour demand of category c by rural sector ru.

3 Simulation Experiments

I first ask how increasing migration affects the various segments of Moroccan labour market. To address this issue, I simulate the impact of a 10% drop in migration costs mc and imc. Such a shock can be interpreted as a translation of a larger facility for the migrant to become operational, for example because of a fall in migration costs, or a larger simplification and transparency of administrative procedures, or the existence of migrants networks that facilitate integration in the host country. Secondly, I investigate the impact of South-South migration on Moroccan labour market. The difficulty for African countries to ameliorate the welfare of their populations and the multiplication of conflicts let think that migratory flows originated from Sub-Saharan Africa will not be over soon. For that, I simulate a 10% rise in the stock of Sub-Saharan clandestine immigrants. This surge of clandestine migrants deteriorates the situation of Moroccan urban labour market, and can exert a pressure on the other migratory movements, those from rural areas to the cities or to foreign countries, as well as urban emigration. One can thus expect an increase in urban emigration due to the rise of unemployment and the decrease of urban wage. Simultaneously this exit of urban workers reduces, in turn, the pressure exerted by immigration on urban labour market, and increases wages. Finally, I consider an experiment combining the two previous simulations in order to reflect the actual shocks to Moroccan labour market. Simulation experiments are summarised in Table II.4.

Table II.4: **Alternative Simulations**

Item	**Scenario Definitions**
SIM1	Lower Migration Costs: 10% drop in *mc* and *imc*, international and internal migration costs
SIM2	Increasing Sub-Saharan Immigration: 10% rise in Sub-Saharan immigrant stock
SIM3	The Mutual Impact of All Migration Flows: Combined effect of SIM1 and SIM2

3.1 SIM1: Lower Migration Costs

The reduction in migration costs affects rural and urban emigration, as well as internal migration. I am interested in the level of labour remuneration and in the evolution of unemployment rates by professional category.

First of all, lower migration costs are expected to accelerate emigration and reduce, *ceteris paribus*, labour supply of urban workers as well as their unemployment rate. On the other hand, internal migration towards cities, also facilitated by the drop of migration costs, should increase labour supply and, given that other things are equal, unemployment rates. If these two migratory flows coexist, the final effect on unemployment and urban wage rates by professional category is ambiguous.

The results of Table II.5 (percentage change) and Table II.6 (absolute change) indicate that in the Moroccan case, the falling labour supply due to urban emigration is more than compensated by greater internal migratory flows. Thus, unemployment rates of all categories, except "senior executive" and "commercial intermediaries", increase. Given that unemployment is negatively related to real wage by the means of the wage curve, higher unemployment rates induce a drop in real wage rates[19]. If the urban consumer price index is kept constant, the "nominal" wage follows the evolution of the real one. Unemployment rates of "farmers" and "farm labourers" increase the most (8.62% and 8.81% respectively), inducing the strongest fall in their wages. Unemployment rates of "senior executive" and "commercial intermediaries" diminish by 0.02% and 0.14% respectively and their wage rates increase, despite greater labour supply. Indeed, since labour supply is endogenous in this model, the wage increase of the two previous professions following urban emigration rises the leisure opportunity cost and induces lower leisure consumption in order to increase labour supply. In spite of greater labour supply, unemployment rate of these categories decreases due to higher labour demand. Actually, sectors using intensively these categories of workers expand (such as mining industry, chemical industry, rubber industry, electricity and water, construction, trade and repair, financial and non-financial services).

In sum, only "senior executive" and "commercial intermediaries" staying in urban areas profit from the emigration of their counterparts, which agrees with the literature (Lucas, 1987; Lucas, 2005a)[20]. Migrants, whatever they were employed or not before their departure, yield their place to workers initially not employed, inducing a fall in unemployment and an increase in wages. On the other hand, and contrary to what is predicted in the literature, the other urban labour categories

[19] I recall that this is a real model. The wage is expressed in terms of the GDP deflator that stands for the *numéraire*. However, it is the wage in terms of the consumer price index that determines *ceteris paribus* migration incentives. For simplicity, the wage rate not corrected with the consumer price index is referred to by "*nominal* wage", and when corrected, by "*real* wage". In this context, only "nominal" wages appear in the tables.

[20] Lucas (2005a) shows that, in Bangladesh, India, Indonesia and Sri Lanka, workers migration has not induced production loss or wage increase. He gives different explanations to this stylised fact such as the possibility that those who have migrated did not have a job before leaving. Therefore, their departure generated a fall in unemployment. By contrast, Pakistani workers emigration to Gulf countries has exerted an upper pressure on wages in Pakistan. A wage increase has also been noticed in the Philippines. Lucas (1987) arrives to the same conclusion in Mozambique and Malawi after worker emigration to South African mines.

loose[21].

In rural areas, wages increase because rural emigration and migration to urban areas (stimulated by the lower migration costs) reduce labour supply on each rural market. When labour supply diminishes, the wage rate increases *ceteris paribus*, in order to rebalance the market. International migratory movements and internal movements create a scarcity of labour on rural markets and push labour remuneration upward. On the contrary, two opposite movements take place in urban areas: departure of workers to foreign countries and internal migration from rural to urban areas. Consequently, the wage evolution is ambiguous.

Rural household welfare, measured by the equivalent variation[22], increases by MAD 27 million, or about 0.03% of his consumption budget. Rural welfare improvement is explained the rural wage increase after migration to urban areas and foreign countries. By contrast, urban household welfare decreases by MAD 20 million, or 0.01% of his consumption budget, because urban wages of most professions fall after the different migratory movements affecting urban labour markets.

It is worth mentioning that rural and urban consumer price indexes increase by 0.003% and 0.002% respectively. Indeed, rural household consumption growth is made possible by higher rural wages. Given that other things are equal, prices increase in order to rebalance commodity markets. With higher prices, firms are incited to raise their production, hence the expansion of most sectors. Real rural wages of all categories except "senior executive" and "commercants" increase despite the rising rural consumer price index. In urban areas, real urban wages decrease except for "commercants". However, all migration flow are maintained due to lower migration costs.

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[21] Since "farm labourers" are a negligible share of urban employment, it is perfectly true to think that these workers, who migrate massively to the cities, change their professional category in urban areas and belong for example to the category "warehousemen". However, given that the pressure on the market of "warehousemen" increases with the fall of migration costs, the reception of workers belonging to the category "farm labourers" will do nothing but exacerbate the pressure on this market. Thus, the contradictory results with the literature on the impact of migration on unemployment are still verified.

[22] See equation A96 in Appendix C

Table II.5: **SIM1: Lower Migration Costs**

Percentage Change with Respect to the Base Year

Professions	**Urban Emig.**	**Internal Mig.**	**Urban Lab. Sup.**	**Unemp. Rates**	**Urban Wages**	**Rural Emig.**	**Rural Wages**
Directors	2.266	2.628	0.004	0.191	-0.003	1.758	0.060
Senior executive	2.250	0.000	0.001	-0.017	0.000	0.000	0.000
Junior staff	2.272	2.621	0.004	0.110	-0.003	1.756	0.060
Employees	2.267	2.629	0.007	0.048	-0.001	1.755	0.060
Comm. inter.	2.209	0.000	0.001	-0.141	0.016	0.000	0.000
Farmers	3.999	0.489	0.157	8.624	-0.822	1.685	0.059
Craftsmen	2.310	2.576	0.010	0.163	-0.010	1.745	0.060
Farm labourers	4.355	0.060	0.034	8.808	-0.838	1.627	0.059
Drivers	2.294	2.594	0.011	0.146	-0.007	1.744	0.060
Warehousemen	2.368	2.506	0.034	0.299	-0.015	1.871	0.059

Source: Authors' calculations.

Table II.6: **SIM1: Lower Migration Costs**

Absolute Change with Respect to the Base Year

In Millions of Working Hours for Migration and Unemployment and in MAD for Wages

Professions	**Urb. Emig.**	**Int. Mig.**	**Urb. L.S.**	**Unemp. Rates**	**Urb. Wages**	**Rur. Emig.**	**Rur. Wages**
Directors	5.3E-05	1.6E-04	6.1E-05	4.2E-05	-3.2E-05	1.8E-05	4.8E-04
Senior executive	2.5E-04	0.0E+00	2.1E-05	-2.8E-06	1.9E-06	0.0E+00	0.0E+00
Junior staff	2.4E-04	7.3E-04	3.0E-04	6.7E-05	-2.8E-05	5.3E-05	4.2E-04
Employees	9.2E-04	1.6E-03	1.1E-03	5.4E-05	-1.1E-05	1.9E-04	4.5E-04
Comm. interm.	8.2E-04	0.0E+00	1.5E-04	-4.5E-05	1.2E-04	0.0E+00	0.0E+00
Farmers	1.6E-04	2.5E-03	2.2E-03	2.6E-04	-6.1E-03	2.6E-03	3.5E-04
Craftsmen	3.2E-03	3.8E-03	4.5E-03	1.6E-04	-7.8E-05	7.7E-04	3.5E-04
Farm labourers	2.2E-04	6.0E-04	5.1E-04	1.8E-03	-6.2E-03	6.5E-03	3.4E-04
Drivers	5.0E-04	7.5E-04	7.4E-04	1.2E-04	-6.2E-05	1.4E-04	3.8E-04
Warehousemen	2.7E-03	1.2E-02	1.2E-02	3.6E-04	-1.3E-04	8.6E-04	3.7E-04

Source: Authors' calculations.

3.2 SIM2: Increasing Sub-Saharan Immigration

Table II.7 (percentage change) and Table II.8 (absolute change) show that higher Sub-Saharan immigration creates a pressure on the urban labour market of "warehousemen and workers of small trades". This category absorbs all Sub-Saharan immigrants, skilled and unskilled. Given that other things are equal, the unemployment rate of warehousemen increases and induces a fall in their urban real wage, according to the wage curve. Moroccan urban workers belonging to the same category are thus incited to leave their country and rural workers prefer to stay in rural areas. However, lower internal migration and higher urban emigration do not compensate increasing African immigration. Indeed, the unemployment rate of warehousemen increases by 0.53% and their real wage decreases. If urban consumer price index remains constant, the "nominal" wage of warehousemen also decreases.

The wage variation of warehousemen induces indirect effects on the labour market of the remaining professions. Indeed, urban sectors increase their demand of warehousemen (nationals and foreign in the same proportion) whose wage falls. Consequently, sectors intensive in this category of workers expand (especially mining, textile, clothing and chemical industries, construction services, hotels and restaurants, transport and telecommunication). Given that capital is sector-specific, the increase in production should induce, in turn, a rise in labour demand of the other categories, reduce their unemployment rate and increase their real wage, by the means of the wage curve. The evolution of nominal wages displayed in the tables depends on the evolution of the urban consumer price index. This will be discussed later.

Increasing urban real wages improve urban household welfare by 0.002% of his initial consumption budget. The growth of urban household consumption increases total demand addressed to sectors. However, it happens that rising demand is lower than sectoral expansion due to cheaper warehousmen, so that firms reduce their prices in order to sell the extra production. Consequently, urban and rural consumer price indexes decrease by 0.001% and 0.0003% respectively.

Given that other things are equal, higher urban real wages dampen migration intention to foreign countries. While increasing internal migration is expected, Table 7 and 8 show lower rural migration to the cities and to foreign countries. This is explained *ceteris paribus* by the lower rural price index that improves rural household purchasing power. Indeed, rural household welfare improves by 0.006% of his initial consumption budget. Increasing consumption of rural household also raises the demand addressed to sectors. In particular, agricultural products are heavily consumed. Therefore, peasants raise rural labour demand in order to produce more. The increasing labour demand offsets the higher rural labour supply so that rural wages increase.

What about "nominal" labour remuneration? In urban areas, real wages are linked to unemployment rates by the wage curve. When unemployment rates by professional category decrease (except for warehousemen), urban real wages increase. As pointed out earlier, the urban consumer price index decreases. The evolution of the "nominal" urban wage depends on the magnitude of real wage change and consumer price index change. In sum, the "nominal" urban wage of "senior executive", "commercial intermediaries", "farmers" and "farm labourers" only increase.

I have just explained how the entry of workers on a specific urban labour market stimulates the emigration of their counterparts. However, the exit of workers is not great enough to reduce the pressure exerted by African immigration on this market. Moreover, African immigration induces indirect effects on the labour market of the remaining urban professions by wage and migration changes.

Table II.7: **SIM2: Increasing Sub-Saharan Immigration**

Percentage Change with Respect to the Base Year

Professions	**Urban Emig.**	**Internal Mig.**	**Urban Lab. Dem.**	**Unemp. Rates**	**Urban Wages**	**Rural Emig.**	**Rural Wages**
Directors	-0.005	-0.012	0.000	-0.021	0.000	-0.003	0.006
Senior executive	-0.008	0.000	0.001	-0.070	0.001	0.000	0.000
Junior staff	-0.005	-0.012	0.001	-0.013	0.000	-0.003	0.006
Employees	-0.006	-0.010	0.001	-0.012	0.000	-0.003	0.006
Comm. inter.	-0.021	0.000	0.003	-0.078	0.006	0.000	0.000
Farmers	-0.006	-0.016	0.000	-0.026	0.001	-0.015	0.009
Craftsmen	-0.005	-0.011	0.001	-0.010	0.000	-0.003	0.006
Farm labourers	-0.010	-0.011	0.000	-0.037	0.002	-0.015	0.008
Drivers	-0.004	-0.014	0.000	-0.007	-0.001	-0.004	0.007
Warehousemen	0.207	-0.280	0.032	0.532	-0.033	0.016	0.008

Source: Authors' calculations.

3.3 SIM3: The Mutual Impact of All Migration Flows

Since the two previous shocks induce a greater pressure on the labour market of "warehousemen and workers of small trades", their simultaneous effect consists, as expected, in a stronger rise of unemployment (0.83% rather than 0.30% and 0.53%

Table II.8: **SIM2: Increasing Sub-Saharan Immigration**
Absolute Change with Respect to the Base Year
In Millions of Working Hours for Migration and Unemployment and in MAD for Wages

Professions	Urb. Emig.	Int. Mig.	Urb. L.S.	Unemp. Rates	Urb. Wages	Rur. Emig.	Rur. Wages
Directors	-3.3E-07	-2.4E-07	5.7E-06	-4.7E-06	-3.9E-07	-3.0E-08	5.1E-05
Senior executive	-8.3E-07	0.0E+00	2.7E-05	-1.2E-05	7.3E-06	0.0E+00	0.0E+00
Junior staff	-1.6E-06	-1.1E-06	5.7E-05	-8.2E-06	-2.5E-06	-8.0E-08	4.4E-05
Employees	-4.6E-06	-3.6E-06	1.6E-04	-1.4E-05	-4.5E-06	-3.1E-07	4.8E-05
Comm. inter.	-7.9E-06	0.0E+00	3.1E-04	-2.5E-05	4.6E-05	0.0E+00	0.0E+00
Farmers	-2.5E-07	-8.2E-05	1.4E-05	-7.9E-07	8.5E-06	-2.3E-05	5.1E-05
Craftsmen	-7.6E-06	-1.6E-05	4.0E-04	-1.0E-05	-2.7E-06	-1.5E-06	3.7E-05
Farm labourers	-4.9E-07	-1.1E-04	1.6E-05	-7.4E-06	1.6E-05	-6.0E-05	4.8E-05
Drivers	-8.6E-07	-4.0E-06	2.7E-05	-5.9E-06	-5.1E-06	-2.8E-07	4.3E-05
Warehousemen	2.4E-04	-1.3E-03	9.8E-03	6.4E-04	-2.9E-04	7.2E-06	4.9E-05

Source: Authors' calculations.

respectively in the first and second shocks[23]). Since the unemployment rate of this category rises more, the corresponding real urban wage falls more. If urban consumer price index remains constant, the "nominal" wage of warehousemen also decreases and urban sectors ask for more workers. Given that other things are equal, sectors intensive in warehousemen expand more (especially mining, textile, clothing, and chemical industries, construction services, hotels and restaurants, transports and telecommunication). These sectors also require additional workers belonging to the other categories, and this could reduce the pressure exerted by internal migration on some segments of labour market. The results in Table II.9 (percentage change) and Table II.10 (absolute change) show that higher labour demand and urban emigration flows reduce the pressure exerted by internal migration but do not succeed to reduce unemployment rates. They evolve positively but their variation is lower with respect to SIM1. By contrast, the increase of labour demand and urban emigration of "senior executive" and "commercial intermediaries" causes a stronger fall of their unemployment rates, in absence of internal migration flows. All urban real wages vary inversely with unemployment rates.

[23] Because variable changes in the last simulation are generally the sum of variable changes in the two previous shocks, one may think of a shock linearity. However, this is mainly due to the weak intensity of the selected shocks: a stronger fall of migration costs is sufficient to eliminate the apparent linearity.

Rural wages increase more under the simultaneous effect of the drop in migration costs and the increase in Sub-Saharan immigration: indeed, the fall in migration costs stimulates rural emigration (direct effect) and Sub-Saharan immigration induces indirectly an expansion of agricultural sectors that raises rural labour demand (indirect effect).

The positive evolution of rural household equivalent variation is accentuated with respect to the previous shocks due to the higher rise of rural wages acting on rural household income. Welfare is improved by MAD 32 million or 0.04% of rural household's initial consumption budget. Rural welfare improvement is higher than SIM1 and SIM2. For urban household, the overall welfare deterioration is lower than SIM1 due to welfare improvement in SIM2. It ends up decreasing by MAD 16 million, or 0.009% of his initial consumption budget.

Rural household consumption growth is strong enough to raise the demand addressed to the different sectors. Since the demand for goods is higher than production expansion, firms adjust upward their prices. Rural and urban price indexes increase by 0.003% and 0.0007% respectively. But the rural "nominal" wage growth is so strong that real rural wage also increases, in spite of lower purchasing power in rural areas. In urban areas, only the real wage of "senior executive" and "commercial intermediaries" increases. However, when real wages increase, migration flows are maintained due to lower migration costs. Finally, let me point out that urban "nominal" real wage by professional category follows the evolution of the real wage because of the small change of the urban consumer price index.

4 Conclusion

This chapter is interested in a particular shutter of the relation between migration and economic development of the sending country. It investigates the relation between migration and unemployment by professional category, that is little exploited in the literature. Moreover, all the proposed analysis does not take

Table II.9: **SIM3: The Mutual Impact of All Migration Flows**

Percentage Change with Respect to the Base Year

Professions	**Urban Emig.**	**Internal Mig.**	**Urban Lab. Sup.**	**Unemp. Rates**	**Urban Wages**	**Rural Emig.**	**Rural Wages**
Directors	2.262	2.615	0.004	0.170	-0.003	1.754	0.066
Senior executive	2.242	0.000	0.001	-0.086	0.001	0.000	0.000
Junior staff	2.267	2.609	0.003	0.097	-0.003	1.753	0.066
Employees	2.260	2.618	0.006	0.036	-0.001	1.752	0.066
Comm. inter.	2.187	0.000	0.001	-0.218	0.023	0.000	0.000
Farmers	3.992	0.473	0.152	8.595	-0.820	1.670	0.067
Craftsmen	2.304	2.564	0.010	0.153	-0.010	1.741	0.066
Farm labourers	4.345	0.049	0.027	8.769	-0.836	1.611	0.067
Drivers	2.290	2.580	0.011	0.140	-0.008	1.741	0.066
Warehousemen	2.579	2.220	0.139	0.830	-0.047	1.886	0.067

Source: Authors' calculations.

Table II.10: **SIM3: The Mutual Impact of All Migration Flows**

Absolute Change with Respect to the Base Year

In Millions of Working Hours for Migration and Unemployment and in MAD for Wages

Professions	**Urb. Emig.**	**Int. Mig.**	**Urb. L.S.**	**Unemp. Rates**	**Urb. Wages**	**Rur. Emig.**	**Rur. Wages**
Directors	5.2E-05	1.6E-04	5.8E-05	3.7E-05	-3.2E-05	1.8E-05	5.3E-04
Senior executive	2.5E-04	0.0E+00	1.8E-05	-1.5E-05	9.2E-06	0.0E+00	0.0E+00
Junior staff	2.3E-04	7.3E-04	2.9E-04	5.9E-05	-3.0E-05	5.3E-05	4.6E-04
Employees	9.2E-04	1.6E-03	1.0E-03	4.0E-05	-1.5E-05	1.9E-04	5.0E-04
Comm. inter.	8.1E-04	0.0E+00	1.6E-04	-7.0E-05	1.7E-04	0.0E+00	0.0E+00
Farmers	1.6E-04	2.4E-03	2.1E-03	2.6E-04	-6.1E-03	2.6E-03	4.0E-04
Craftsmen	3.2E-03	3.7E-03	4.4E-03	1.5E-04	-8.0E-05	7.7E-04	3.9E-04
Farm labourers	2.2E-04	4.9E-04	4.1E-04	1.8E-03	-6.2E-03	6.4E-03	3.9E-04
Drivers	5.0E-04	7.5E-04	7.2E-04	1.2E-04	-6.8E-05	1.4E-04	4.2E-04
Warehousemen	3.0E-03	1.1E-02	4.8E-02	1.0E-03	-4.2E-04	8.7E-04	4.2E-04

Source: Authors' calculations.

into account, to my knowledge, more than one type of migration flows, mainly international migration. The present work takes simultaneously into consideration three types of migratory flows characterising a country having a long history with migration: Morocco. Rural and urban emigration, internal migration to urban areas and Sub-Saharan immigration (towards Moroccan cities) are taken into account. Each one of these migratory flows has different effects on urban labour market and does not affect equally all professional categories. Urban emigration reduces unemployment rates and increases wages. On the other hand, Sub-Saharan immigration and internal migration increase unemployment rates and reduce wages. If these flows coexist, the final effect on unemployment and wage rates is ambiguous:

this is the interest of the present analysis.

The results of this chapter obtained from a CGE model of the Moroccan economy, calibrated on the SAM for the year 1998, attest to the expected ambiguity of the impact of these migratory flows on wage and unemployment rates. In the first simulation where migration costs decrease, the increase in internal migration offsets the expected effects associated with urban emigration, such as the fall in unemployment and the rise in wage rate. In the second simulation, Sub-Saharan immigration affects indirectly the urban labour market of the other professions, by modifying their unemployment rates, wages and emigration flows. But the increase of warehousemen emigration induced by a lower real wage does not compensate the effects of African immigration on this segment of the labour market. In the third simulation, the two previous shocks are run simultaneously because they reflect the actual migration flows affecting the Moroccan economy. The effects on unemployment and wage rates of urban emigration do not correspond, once again, to what is awaited, due to the existence of inflows affecting the urban labour market.

Currently, the debates on migration evoke that a good management of migratory policies can generate important profits to sending and receiving countries. The results of migration impact on Morocco show that it is more cautious to set up migratory policies once having a global vision of all migratory flows and the way they affect labour market and the remainder of the economy. In particular, it has been shown that the expected effect of urban emigration can be offset by the impact of another flow entering the urban labour market. By comparing the three previous scenarios, one can notice that Sub-Saharan immigration is not such harmful to welfare. Urban household welfare is largely improved and becomes positive. On the other hand, the improvement of rural household welfare is reduced. Finally, the last scenario is the best in terms of rural household welfare.

II.A Appendix A: Data

The model is calibrated on the Moroccan SAM described in Appendix A of Chapter 1. The SAM is further disaggregated in order to be adapted to the model. In order to distinguish between rural and urban areas, two types of households and two types of production factors need to be be taken into consideration: rural labour offered by rural household and urban labour offered by urban household. All household accounts must be adjusted in order to distinguish, from now on, between two representative households:

1- The sub-matrix of transfers is distributed between the two households according to weights calculated essentially from the Moroccan SAM built for the IMMPA[24] project of the World Bank (Abdelkhalek, 2003).

2- Labour remuneration going to rural household comes only from rural labour and the one going to urban household comes only from urban labour.

3- The NSHLS of 2001 provides percentages on the distribution of total consumption between rural and urban households. These percentages are respectively around 0.3% and 0.7% of total consumption. In addition, the NSHLS publishes percentages on the distribution of rural and urban households' consumption between the different aggregated sectors of activity. From these percentages, different calculations are made in order to quantify the distribution of rural and urban households' consumption according to the 34 sectors of the input-output table.

4- According to the NSHLS of 2001, the distribution of consumption expenditures would be a good approximation of the distribution of total income between rural and urban households. Thus, rural and urban household incomes are supposed to constitute respectively 0.3% and 0.7% of households' total income.

The distinction between rural and urban areas should also be done in terms of production. Agricultural and fishing form the rural sector, and all remaining activities, including public ones, constitute the urban sector. Indeed, as it was

[24] Integrated Macroeconomic Model for Poverty Analysis.

shown in Section 1, agriculture absorbs 80.2% of rural employment while industry and services absorb 77.5% of urban employment. The public sector mainly employs townsmen, and accounts for 17.3% of total employment in urban areas and only 1.9% in rural areas.

Rural employment, given in the matrix by the sum of labour demand by the agricultural and fishing sectors is around 3,166 workers. On the other hand, urban sectors employ 103,996 workers. This implies that rural employment is not more than 3% of total employment whereas it actually accounts for the half of national employment. According to Harrison et al. (2003), capital remuneration is overestimated in the agricultural sector because it is calculated residually from production value after deducing labour remuneration and intermediary consumption. However, the agricultural sector uses generally family work and informal labour that are not computed in input-output tables. Therefore, because agricultural labour is underestimated, capital remuneration is overestimated. This is why agricultural and fishing seem to be capital intensive whereas they should be labour intensive. The basic SAM should then be adjusted in order to make rural sectors labour intensive.

The SAM is further disaggregated in order to take into account professional categories. Ten big categories are listed in the *Nomenclature Analytique des Professions* of the Direction of Statistics in 2001. These categories are the same in rural and urban areas. Therefore, the labour market is composed of twenty sub-segments. I use the national survey of the Direction of Statistics on activity, employment and unemployment in 1999 in order to distribute rural and urban employment between professional categories. The only difference is that I assume that there is no "commercial intermediaries" in rural areas because they work primarily in trade services that belong to the urban sector and are consumed as intermediary inputs by rural activities.

Finally, migration data are taken from several sources:

1- To quantify Moroccan emigration, I resort to the data published by the OECD in 2006 on immigrant inflows by nationality in some OECD countries. I approximate

Moroccan emigration by the flows of Moroccan migrants to their traditional destinations in 1999, such as Belgium, France, Italy, the Netherlands and Spain. The sum of these flows is reported to the Moroccan working population of 1999 in order to calculate the annual percentage of emigrants (0.6%).

2- According to a report of the International Organisation of Migration (Erf and Heering, 2002), Moroccan emigration to European countries is more originated from rural areas. Therefore, I suppose that 60% of the national emigration flow take place from rural areas.

3- Agénor and El Aynaoui (2003) point out that each year, around 200,000 workers migrate from rural to urban areas. This corresponds approximately to 4% of the rural working population of 1999.

4- Data collection on African immigrants to Morocco is the most difficult because the vast majority of these immigrants are clandestine. According to Lahlou (2003), there would be between 6,000 and 15,000 clandestine immigrants, but these estimates are uncertain. In this model, I retain the upper bound. This number is reported to the urban working population of 1999 in order to calculate the stock of immigrants corresponding to the SAM.

5- Finally, for lack of data on migration by professional category, I assume that the flow of rural/urban migrants belonging to a professional category is proportional to the share of this category in rural/urban total employment. I have also simulated the previous shocks with an equal distribution of migrant flows between professional categories but I have not detected substantial changes in the main results.

II.B Appendix B: Professional Categories

Professional Categories

1	Directors
2	Senior executive and members of liberal professions
3	Junior staff
4	Employees
5	Commercial and financial intermediaries
6	Farmers, fishermen, foresters, hunters and workers assimilate
7	Craftsmen and artisanal trade qualified workers (farm labourers excluded)
8	Workmen and farm labourers (including skilled workers)
9	Drivers and assembly workers
10	Warehousemen and workers of small trades

II.C Appendix C: Mathematical Statement of the Model

Set indices are given by lower-case Latin letters as subscripts to variables and parameters. Parameters are represented with lower-case Latin letters or lower-case Greek letters, endogenous variables with upper-case Latin letters without a bar, exogenous variables with upper-case Latin letters with a bar.

Sets

$j \in J$	Sectors
$i \in I$	Products (=J)
$tr \in TR \subset J$	Tradable sectors
$ntr \in NTR \subset J$	Non-tradable sectors
$ps \in PS \subset J$	Private sectors
$pub \in PUB \subset J$	Public sectors
$ru \in RU \subset PS$	Rural private sectors
$up \in UP \subset PS$	Urban private sectors
$ag \in AG$	Agents
$da \in DA \subset AG$	Domestic agents
$h \in H \subset AG$	Households
$c \in C$	Professional categories

Parameters

A_{ps}	Scale parameter of the value added CES function of sector ps
α_{ps}	Share parameter of this function
σ_{ps}	Elasticity of substitution between labour and capital
a	Parameter in the value added function of subsistence agriculture
b	Parameter in the value added function of subsistence agriculture
f	Parameter in the value added function of subsistence agriculture
B_{ps}	Scale parameter of the Cobb-Douglas labour function in sector ps
$\omega_{c,ps}$	Share of category c in total labour demand by sector ps
Ai_{up}	Scale parameter of the CES function of imperfect substitutability between domestic workers and immigrants in sector up
Ω_{up}	Share parameter of this function
ς_{up}	Elasticity of substitution between Moroccans and immigrants (positive)
l_{pub}	Labour share in value added of sector pub (Leontief)

k_{pub}	Capital share in value added of sector *pub* (Leontief)
$lc_{c,pub}$	Share of category c in total labour demand (Leontief) by public sector *pub*
io_j	Share of intermediary consumption in the production (Leontief) of sector j
v_j	Share of value added in the production of sector j (Leontief)
$aij_{i,j}$	Intermediary consumption of good i by unit of production of sector j
tx_j	Indirect tax rate on product j
tm_{tr}	Import tariff rate on product *tr*
te_{tr}	Export tariff rate on product *tr*
ty_h	Direct tax rate on household h's income
tye	Direct tax rate on firms' income
Br_c	Scale parameter of the CET function of the rural population of category c
ϖ_c	Share parameter of this function
ε_c	Elasticity of transformation between international rural migrants and national workers (negative)
Bu_c	Scale parameter of the CET function of the rural population of category c that decides to stay in Morocco
ϑ_c	Share parameter of this function
ϱ_c	Elasticity of transformation between internal migrants and rural workers (negative)
Bi_c	Scale parameter of the CET function of the urban population of category c
ξ_c	Share parameter of this function
o_c	Elasticity of transformation between international urban migrants and urban workers (negative)
Be_{tr}	Scale parameter of the CET production function of sector *tr*
δ_{tr}	Share parameter of this function
κ_{tr}	Transformation elasticity of the CET production function (negative)
φ_{tr}	Price elasticity of export demand of product *tr* (positive)
Am_{tr}	Scale parameter of the Armington CES function of product *tr*
θ_{tr}	Share parameter of this function
χ_{tr}	Substitution elasticity in the Armington function (positive)
$\gamma_{i,h}$	Budgetary share of good i in the supernumerary income of household h
β_c	Leisure share in the income of rural household's member c
β'_c	Leisure share in the income of urban household's member c
$lsmax_c$	Maximal number of working hours offered by rural worker c
$lsmax'_c$	Maximal number of working hours offered by urban worker c
λ_c	Share of member c in rural household's non-labour income
ζ_{1c}	Share of internal migrants in labour supply of category c
ζ_{2c}	Share of African immigrants in labour supply of category c
λ'_c	Share of member c in urban household's non-labour income
μ_i	Share of product i in total investment
θ_j	Share of the value added of sector j in GDP at factor cost
ψ_h	Household h's propensity to save

η_{ag}	Share of capital remuneration received by agent ag
ϕ_{ag}	Share of labour remuneration received by agent ag
D_c	Scale parameter of the wage curve
ζ	The absolute value of the wage elasticity with respect to unemployment
mc	International migration costs
imc	Internal migration costs
cs	Social security contributions
θ_{1i}	Weight of commodity i in the consumer price index
$\theta_{2i,\text{``}hr\text{''}}$	Weight of commodity i in rural consumer price index
$\theta_{2i,\text{``}hu\text{''}}$	Weight of commodity i in urban consumer price index

Endogenous variables

a) **Prices**

w_j	Average wage rate of sector j
wr_c	Rural wage rate of professional category c
wu_c	Wage rate of category c in the urban private sector
wg_c	Wage rate of category c in the urban public sector
wi_c	International wage rate of category c, in foreign currency
wn_c	National wage rate of category c
wug_c	Average urban wage rate of category c
wup_{up}	Average wage of "warehousemen" in private urban sector up
wa_c	Expected urban wage of category c
r_j	Capital return in sector j
PV_j	Value added price of sector j
PL_j	Producer price of local product j
PD_j	Market price of local product j sold on the domestic market
P_j	Production price of sector j
PC_j	Market price of the composite good belonging to sector j
Pwm_{tr}	International import price of product tr, in foreign currency
Pwe_{tr}	International export price of product tr, in foreign currency
PM_{tr}	Domestic price of the imported good tr
PE_{tr}	Producer price of the exported good tr
$Pfob_{tr}$	FOB price of the exported good tr
$PINV$	Aggregate price of investment
Plr_c	Leisure price of rural household's member c
Plu_c	Leisure price of urban household's member c
e	Nominal exchange rate (the price of a unit of foreign currency in domestic currency)
CPI	Consumer price index
$CPIR$	Consumer price index in rural areas
$CPIU$	Consumer price index in urban areas
$Pindex$	GDP deflator, *numéraire*

b) **Production**

XS_j	Production of sector j (volume)
VA_j	Value added of sector j (volume)
$DI_{i,j}$	Intermediary demand of product i by sector j (volume)
CI_j	Total intermediary consumption of sector j (volume)

c) **Factors of production**

KD_j	Capital demand by sector j (volume)
LDR_{ru}	Labour demand by rural sector ru (volume)
$LR_{c,ru}$	Labour demand of category c by rural sector ru (volume)
LDU_{up}	Labour demand by urban private sector up (volume)
$LU_{c,up}$	Labour demand of category c by urban private sector up (volume)
LDG_{pub}	Labour demand by public sector pub (volume)
$LG_{c,pub}$	Labour demand of category c by urban public sector pub (volume)
LSR_c	Rural population belonging to category c
LSU_c	Urban population belonging to category c
u_c	Urban unemployment rate of category c

d) **Migration**

NAT_c	Rural workers of category c who decide to stay in Morocco
EMR_c	Rural emigrant flow of category c
$NATR_c$	Rural workers of category c who decide to stay in rural areas
MIG_c	Rural migrant flow of category c to urban areas
$NATU_c$	Urban workers of category c who decide to stay in urban areas
EMU_c	Urban emigrant flow of category c
$IMMIG_c$	The stock of Sub-Saharan immigrants belonging to category c
$NATI_{up}$	The demand of national "warehousemen" by urban private sector up
ETR_{up}	The demand of Sub-Saharan "warehousemen" by urban private sector up

e) **Income/Savings**

Y_{ag}	Agent ag's income
YD_h	Disposable income of household h
S_{ag}	Agent ag's savings
$T_{ag,ag}$	Transfers between agents

f) **Tax revenues**

TI_j	Indirect taxes on product j
TIM_{tr}	Import tariffs on product tr
TIE_{tr}	Export tariffs on product tr
adj	Compensatory tax

g) **External trade**

EXS_{tr}	Export supply of product tr (volume)
DOM_j	Domestic production of sector j sold on the domestic market (volume)
Q_j	Supply of the composite product belonging to sector j (volume)
EXD_{tr}	Export demand of product tr (volume)
M_{tr}	Import demand of product tr (volume)

h) **Final demand**

$CT_{i,h}$	Consumption of good i by household h (volume)
$Cmin_{i,h}$	Minimum consumption of good i by household h (volume)
BC_h	Consumption budget of household h
$IBC_{c,h}$	Consumption budget of member c belonging to household h
G_i	Public consumption of product i (volume)
DIT_i	Total intermediary consumption of product i (volume)
INV_i	Investment demand of product i (volume)
STK_i	Stock variation of product i (volume)
$ITVOL$	Gross fixed capital formation (volume)
IT	Gross fixed capital formation (value)

Exogenous variables

wg_c	Wage rate of category c in the urban public sector
wi_c	International wage rate of category c, in foreign currency
r_{pub}	Capital return of public sector pub
KD_{ps}	Capital demand by sector ps
Pwm_{tr}	International import price of product tr, in foreign currency
Pwe_{tr}	International export price of product tr, in foreign currency
$IMMIG_c$	The stock of Sub-Saharan immigrants belonging to category c
$Cmin_{i,h}$	Minimum consumption of product i by household h
G_i	Public consumption of product i
STK_i	Stock variation of product i
$ITVOL$	Gross fixed capital formation (volume)
$S_{\text{``}row\text{''}}$	External savings
$T_{h,da}$	Transfers by agent da to household h
$T_{\text{``}fm\text{''},da}$	Transfers by agent da to firms
$T_{\text{``}row\text{''},da}$	Transfers by agent da to the RoW, in foreign currency
$T_{\text{``}gv\text{''},\text{``}gv\text{''}}$	Transfers made by the government to itself
$T_{ag,\text{``}row\text{''}}$	Transfers by the RoW to agent ag, in foreign currency
$Pindex$	GDP deflator, numéraire

Equations

Rural Sectors

$$XS_{ru} = VA_{ru}/v_{ru} \tag{A1}$$

$$CI_{ru} = io_{ru} XS_{ru} \tag{A2}$$

$$DI_{i,ru} = aij_{i,ru} CI_{ru} \tag{A3}$$

$$VA_{``sa"} = a(1 - e^{-(LDR_{``sa"}/b)^f}) \tag{A4}$$

$$VA_{``ia"} = A_{``ia"} [\alpha_{``ia"} LDR_{``ia"}^{(\sigma_{``ia"}-1)/\sigma_{``ia"}} + (1 - \alpha_{``ia"}) \overline{KD_{``ia"}}^{(\sigma_{``ia"}-1)/\sigma_{``ia"}}]^{\sigma_{``ia"}/(\sigma_{``ia"}-1)} \tag{A5}$$

$$LDR_{``sa"} = \frac{PV_{``sa"} VA_{``sa"}}{w_{``sa"}} \tag{A6}$$

$$LDR_{``ia"} / \overline{KD_{``ia"}} = (\frac{\alpha_{``ia"}}{1 - \alpha_{``ia"}} \frac{r_{``ia"}}{w_{``ia"}})^{\sigma_{``ia"}} \tag{A7}$$

$$LDR_{ru} = B_{ru} \prod_c LR_{c,ru}{}^{\omega_{c,ru}} \tag{A8}$$

$$LR_{c,``sa"} = \frac{\omega_{c,``sa"} LDR_{``sa"} w_{``sa"}}{wr_c} \tag{A9}$$

$$LR_{c,``ia"} = \frac{\omega_{c,``ia"} LDR_{``ia"} w_{``ia"}}{wr_c (1 + cs)} \tag{A10}$$

$$NATR_c = lsmax_c - \frac{\beta_c}{(1 - \beta_c) prl_c} (IBC_{c,``hr"} - \lambda_c \sum_i PC_i \overline{Cmin_{i,``hr"}}) \tag{A11}$$

Urban Private Sectors

$$XS_{up} = VA_{up}/v_{up} \tag{A12}$$

$$CI_{up} = io_{up} XS_{up} \tag{A13}$$

$$DI_{i,up} = aij_{i,up}CI_{up} \tag{A14}$$

$$VA_{up} = A_{up}[\alpha_{up}LDU_{up}^{(\sigma_{up}-1)/\sigma_{up}} + (1-\alpha_{up})\overline{KD_{up}}^{(\sigma_{up}-1)/\sigma_{up}}]^{\sigma_{up}/(\sigma_{up}-1)} \tag{A15}$$

$$LDU_{up}/\overline{KD_{up}} = (\frac{\alpha_{up}}{1-\alpha_{up}}\frac{r_{up}}{w_{up}})^{\sigma_{up}} \tag{A16}$$

$$LDU_{up} = B_{up}\prod_{c} LU_{c,up}{}^{\omega_{c,up}} \tag{A17}$$

$$LU_{cm1,up} = \frac{\omega_{cm1,up}LDU_{up}w_{up}}{(1+cs)wu_c} \tag{A18}$$

$$LU_{``10",up} = \frac{\omega_{``10",up}LDU_{up}w_{up}}{wup_{up}} \tag{A19}$$

$$LU_{``10",up} = Ai_{up}[\Omega_{up}NATI_{up}^{(\varsigma_{up}-1)/\varsigma_{up}} + (1-\Omega_{up})ETR_{up}^{(\varsigma_{up}-1)/\varsigma_{up}}]^{\varsigma_{up}/(\varsigma_{up}-1)} \tag{A20}$$

$$\frac{ETR_{up}}{NATI_{up}} = (\frac{1-\Omega_{up}}{\Omega_{up}}\frac{wu_{``10"}(1+cs)}{wu_{``10"}})^{\varsigma_{up}} \tag{A21}$$

$$NATU_c = lsmax'_c - \frac{\beta'_c}{(1-\beta'_c)plu_c}(1-\zeta_{1c}-\zeta_{2c})(IBC_{c,``hu"} - \lambda'_c\sum_i PC_iCmin_{i,``hu"}) \tag{A22}$$

Public sector

$$XS_{pub} = VA_{pub}/v_{pub} \tag{A23}$$

$$CI_{pub} = io_{pub}XS_{pub} \tag{A24}$$

$$DI_{i,pub} = aij_{i,pub}CI_{pub} \tag{A25}$$

$$VA_{pub} = KD_{pub}/k_{pub} \tag{A26}$$

$$LDG_{pub} = l_{pub}VA_{pub} \tag{A27}$$

$$LG_{c,pub} = LDG_{pub}lc_{c,pub} \tag{A28}$$

$$KD_{pub} = \frac{PV_{pub}VA_{pub} - w_{pub}LDG_{pub}}{\overline{r_{pub}}} \tag{A29}$$

Migratory Flows

$$LSR_c = Br_c[\varpi_c NAT_c^{(\varepsilon_c - 1)/\varepsilon_c} + (1 - \varpi_c)EMR_c^{(\varepsilon_c - 1)/\varepsilon_c}]^{\varepsilon_c/(\varepsilon_c - 1)} \tag{A30}$$

$$\frac{EMR_c}{NAT_c} = [\frac{\varpi_c}{1 - \varpi_c}\frac{wi_c e(1 - mc)}{wn_c/CPI}]^{-\varepsilon_c} \tag{A31}$$

$$NAT_c = Bu_c[\vartheta_c NATR_c^{(\varrho_c - 1)/\varrho_c} + (1 - \vartheta_c)MIG_c^{(\varrho_c - 1)/\varrho_c}]^{\varrho_c/(\varrho_c - 1)} \tag{A32}$$

$$\frac{MIG_c}{NATR_c} = [\frac{\vartheta_c}{1 - \vartheta_c}\frac{(1 - imc)wa_c/CPIU}{wr_c/CPIR}]^{-\varrho_c} \tag{A33}$$

$$LSU_c = Bi_c[\xi_c NATU_c^{(o_c - 1)/o_c} + (1 - \xi_c)EMU_c^{(o_c - 1)/o_c}]^{o_c/(o_c - 1)} \tag{A34}$$

$$\frac{EMU_c}{NATU_c} = [\frac{\xi_c}{1 - \xi_c}\frac{wi_c e(1 - mc)}{wa_c/CPIU}]^{-o_c} \tag{A35}$$

Households and Firms

$$Y_{\text{``}hr\text{''}} = \sum_{ru}(\sum_{c} wr_c LR_{c,ru}) + \eta_{\text{``}hr\text{''}}\sum_{j} r_j\overline{KD}_j + \sum_{da}\overline{T_{\text{``}hr\text{''},da}} + e\overline{T_{\text{``}hr\text{''},\text{``}row\text{''}}} \tag{A36}$$

$$\begin{aligned} Y_{\text{``}hu\text{''}} &= (1 - \phi_{row})[\sum_{up}(\sum_{c} wu_c LU_{c,up}) + \sum_{pub}(\sum_{c}\overline{wg_c}LG_{c,pub})] + \\ &\quad \eta_{\text{``}hu\text{''}}\sum_{j} r_j\overline{KD}_j + \sum_{da}\overline{T_{\text{``}hu\text{''},da}} + e\overline{T_{\text{``}hu\text{''},\text{``}row\text{''}}} \end{aligned} \tag{A37}$$

$$Y_{\text{``}fm\text{''}} = (1 - \eta_{\text{``}hr\text{''}} - \eta_{\text{``}hu\text{''}} - \eta_{\text{``}gv\text{''}} - \eta_{\text{``}row\text{''}})\sum_{j} r_j\overline{KD}_j + \sum_{da}\overline{T_{\text{``}fm\text{''},da}} + e\overline{T_{\text{``}fm\text{''},\text{``}row\text{''}}} \tag{A38}$$

$$\begin{aligned} YD_{\text{``}hr\text{''}} &= Y_{\text{``}hr\text{''}}(1 - ty_{\text{``}hr\text{''}}) - \\ &\quad (\overline{T_{\text{``}hr\text{''},\text{``}hr\text{''}}} + \overline{T_{\text{``}hu\text{''},\text{``}hr\text{''}}} + \overline{T_{\text{``}fm\text{''},\text{``}hr\text{''}}} + e\overline{T_{\text{``}row\text{''},\text{``}hr\text{''}}}) \end{aligned} \tag{A39}$$

$$\begin{aligned} YD_{\text{``}hu\text{''}} &= Y_{\text{``}hu\text{''}}(1 - ty_{\text{``}hu\text{''}}) - \\ &\quad (\overline{T_{\text{``}hr\text{''},\text{``}hu\text{''}}} + \overline{T_{\text{``}hu\text{''},\text{``}hu\text{''}}} + \overline{T_{\text{``}fm\text{''},\text{``}hu\text{''}}} + e\overline{T_{\text{``}row\text{''},\text{``}hu\text{''}}}) \end{aligned} \tag{A40}$$

$$S_h = \psi_h YD_h \tag{A41}$$

$$BC_h = YD_h - S_h \tag{A42}$$

$$S_{\text{``}fm\text{''}} = Y_{\text{``}fm\text{''}} - \sum_{da} \overline{T_{da,\text{``}fm\text{''}}} - e\overline{T_{\text{``}row\text{''},\text{``}fm\text{''}}} \tag{A43}$$

The Government

$$TI_{tr} = tx_{tr}adj(P_{tr}XS_{tr} - PE_{tr}EXS_{tr}) + tx_{tr}adj(1 + tm_{tr})ePmw_{tr}M_{tr} \tag{A44}$$

$$TI_{ntr} = tx_{ntr}adjPL_{ntr}XS_{ntr} \tag{A45}$$

$$TIM_{tr} = tm_{tr}ePwm_{tr}M_{tr} \tag{A46}$$

$$TIE_{tr} = te_{tr}PE_{tr}EXS_{tr} \tag{A47}$$

$$T_{\text{``}gv\text{''},h} = ty_h Y_h \tag{A48}$$

$$T_{\text{``}gv\text{''},\text{``}fm\text{''}} = tyeY_{\text{``}fm\text{''}} \tag{A49}$$

$$\begin{aligned} Y_{\text{``}gv\text{''}} \quad = \quad & \eta_{\text{``}gv\text{''}} \sum_j r_j \overline{KD}_j + \sum_{tr} TIM_{tr} + \sum_{tr} TIE_{tr} + \sum_j TI_j + \sum_{da} \overline{T}_{\text{``}gv\text{''},da} + \\ & e\overline{T_{\text{``}gv\text{''},\text{``}rw\text{''}}} + (\sum_{up} w_{up}LDU_{up} - \sum_{up}(\sum_c wu_c LU_{c,up})) + \\ & (w_{\text{``}ar\text{''}}LDR_{\text{``}ar\text{''}} - \sum_c wr_c LR_{c,\text{``}ar\text{''}})) \end{aligned} \tag{A50}$$

$$S_{\text{``}gv\text{''}} = Y_{\text{``}gv\text{''}} - \sum_i PC_i\overline{G_i} - \sum_{da} \overline{T_{da,\text{``}gv\text{''}}} - e\overline{T_{\text{``}row\text{''},\text{``}gv\text{''}}} \tag{A51}$$

External Trade

$$XS_{tr} = Be_{tr}[\delta_{tr}EXS_{tr}^{(\kappa_{tr}-1)/\kappa_{tr}} + (1-\delta_{tr})DOM_{tr}^{(\kappa_{tr}-1)/\kappa_{tr}}]^{\kappa_{tr}/(\kappa_{tr}-1)} \tag{A52}$$

$$XS_{ntr} = DOM_{ntr} \tag{A53}$$

$$\frac{EXS_{tr}}{DOM_{tr}} = (\frac{\delta_{tr}}{1-\delta_{tr}}\frac{PL_{tr}}{PE_{tr}})^{\kappa_{tr}} \tag{A54}$$

$$EXD_{tr} = EXDO_{tr}(\frac{Pwe_{tr}}{Pfob_{tr}})^{\varphi_{tr}} \tag{A55}$$

$$Q_{tr} = Am_{tr}[\theta_{tr}M_{tr}^{(\chi_{tr}-1)/\chi_{tr}} + (1-\theta_{tr})DOM_{tr}^{(\chi_{tr}-1)/\chi_{tr}}]^{\chi_{tr}/(\chi_{tr}-1)} \tag{A56}$$

$$Q_{ntr} = DOM_{ntr} \tag{A57}$$

$$\frac{M_{tr}}{DOM_{tr}} = (\frac{\theta_{tr}}{1-\theta_{tr}}\frac{PD_{tr}}{PM_{tr}})^{\chi_{tr}} \tag{A58}$$

$$\begin{aligned}\overline{S_{\text{“}row\text{”}}} \quad = \quad & \sum_{tr}\overline{Pwm_{tr}}M_{tr} + \eta_{\text{“}row\text{”}}\frac{\sum_j r_j\overline{KD}_j}{e} + \sum_{ag}\overline{T_{\text{“}row\text{”},ag}} + \\ & \phi_{row}\frac{\sum_{up}(\sum_c wu_c LU_{c,up}) + \sum_{pub}(\sum_c \overline{wg_c}LG_{c,pub})}{e} - \\ & \sum_{tr}Pfob_{tr}EXS_{tr} - \sum_{ag}\overline{T_{ag,row}}\end{aligned} \tag{A59}$$

Final Demand

$$CT_{i,\text{“}hr\text{”}} = \overline{Cmin_{i,\text{“}hr\text{”}}} + \frac{\gamma_{i,\text{“}hr\text{”}}}{PC_i}(BC_{\text{“}hr\text{”}} - \sum_i PC_i\overline{Cmin_{i,\text{“}hr\text{”}}}) \tag{A60}$$

$$CT_{i,\text{“}hu\text{”}} = \overline{Cmin_{i,\text{“}hu\text{”}}} + \frac{\gamma_{i,\text{“}hu\text{”}}}{PC_i}(BC_{\text{“}hu\text{”}} - \sum_i PC_i\overline{Cmin_{i,\text{“}hu\text{”}}}) \tag{A61}$$

$$\begin{aligned}IBC_{c,\text{“}hr\text{”}} \quad = \quad & (1-\psi_{\text{“}hr\text{”}})(1-ty_{\text{“}hr\text{”}})wr_c\sum_{ru}LR_{c,ru} + \\ & \lambda_c(1-\psi_{\text{“}hr\text{”}})(1-ty_{\text{“}hr\text{”}})[Y_{\text{“}hr\text{”}} - \sum_c(wr_c\sum_{ru}LR_{c,ru})]\end{aligned} \tag{A62}$$

$$\begin{aligned}&IBC_{c,\text{“}hu\text{”}} = (1-\psi_{\text{“}hu\text{”}})(1-ty_{\text{“}hu\text{”}})(wu_c\sum_{up}LU_{c,up} + \overline{wg_c}\sum_{pub}LG_{c,pub}) \\ &+\lambda'_c(1-\psi_{\text{“}hu\text{”}})(1-ty_{\text{“}hu\text{”}})[Y_{\text{“}hu\text{”}} - \sum_c(wu_c\sum_{up}LU_{c,up} + \overline{wg_c}\sum_{pub}LG_{c,pub})]\end{aligned} \tag{A63}$$

$$INV_i = \mu_i IT/PC_i \tag{A64}$$

$$DIT_i = \sum_i aij_{i,j} CI_j \tag{A65}$$

Prices

$$\ln \frac{wu_c}{CPIU} = D_c - \zeta \ln u_c \tag{A66}$$

$$\overline{wg_c} \succ wu_c \tag{A67}$$

$$wn_c = \frac{wr_c \sum_{ru} LR_{c,ru} + wu_c \sum_{up} LU_{c,up} + \overline{wg_c} \sum_{pub} LG_{c,pub}}{\sum_{ru} LR_{c,ru} + \sum_{up} LU_{c,up} + \sum_{pub} LG_{c,pub}} \tag{A68}$$

$$wug_c = \frac{wu_c \sum_{up} LU_{c,up} + \overline{wg_c} \sum_{pub} LG_{c,pub}}{\sum_{up} LU_{c,up} + \sum_{pub} LG_{c,pub}} \tag{A69}$$

$$w_{pub} = \sum_c \frac{\overline{wg_c} LG_{c,pub}}{LDG_{pub}} \tag{A70}$$

$$wa_c = wug_c \frac{\sum_{up} LU_{c,up} + \sum_{pub} LG_{c,pub}}{NATU_c + (1 - imc) MIG_c + \overline{IMMIG_c}} \tag{A71}$$

$$wup_{up} = \frac{(1 + cs) wu_{``10"} NATI_{up} + wu_{``10"} ETR_{up}}{LU_{``10",up}} \tag{A72}$$

$$r_{``ia"} = \frac{PV_{``ia"} VA_{``ia"} - w_{``ia"} LDR_{``ia"}}{\overline{KD_{``ia"}}} \tag{A73}$$

$$r_{up} = \frac{PV_{up} VA_{up} - w_{up} LDU_{up}}{\overline{KD_{up}}} \tag{A74}$$

$$PV_j = \frac{P_j XS_j - \sum_i PC_i DI_{i,j}}{VA_j} \tag{A75}$$

$$PM_{tr} = e\overline{Pwm_{tr}}(1 + tm_{tr})(1 + tx_{tr} adj) \tag{A76}$$

$$PE_{tr} = \frac{ePfob_{tr}}{(1 + te_{tr})} \tag{A77}$$

$$PC_{tr} = \frac{DOM_{tr}PD_{tr} + M_{tr}PM_{tr}}{Q_{tr}} \tag{A78}$$

$$PC_{ntr} = PD_{ntr} \tag{A79}$$

$$PD_j = PL_j(1 + tx_j adj) \tag{A80}$$

$$P_{tr} = \frac{PL_{tr}DOM_{tr} + PE_{tr}EXS_{tr}}{XS_{tr}} \tag{A81}$$

$$P_{ntr} = PL_{ntr} \tag{A82}$$

$$PINV = \prod_i (\frac{PC_i}{\mu_i})^{\mu_i} \tag{A83}$$

$$Plr_c = (1 - \psi_{``hr"})(1 - ty_{``hr"})wr_c \tag{A84}$$

$$Plu_c = (1 - \psi_{``hu"})(1 - ty_{``hu"})(1 - u_c)wug_c \tag{A85}$$

$$CPI = \sum_i \theta_{1i}PC_i \tag{A86}$$

$$CPIR = \sum_i \theta_{2i,``hr"}PC_i \tag{A87}$$

$$CPIU = \sum_i \theta_{2i,``hu"}PC_i \tag{A88}$$

$$\overline{Pindex} = \sum_j \theta_j PV_j \tag{A89}$$

Equilibrium Conditions and Closure

$$NATR_c = \sum_{ru} LR_{c,ru} \tag{A90}$$

$$(NATU_c + (1 - imc)MIG_c + \overline{IMMIG_c})(1 - u_c) = \sum_{up} LU_{c,up} + \sum_{pub} LG_{c,pub} \tag{A91}$$

$$Q_i = \overline{G_i} + DIT_i + \sum_h CT_{i,h} + INV_i + \overline{STK_i} \tag{A92}$$

$$EXS_{tr} = EXD_{tr} \tag{A93}$$

$$\overline{ITVOL} = IT/PINV \tag{A94}$$

$$IT + \sum_i \overline{STK_i} PC_i = \sum_{da} S_{da} + e\overline{S_{"row"}} \tag{A95}$$

$$\begin{aligned} EV_h &= (BC_h - \sum_i PC_i CMIN_{i,h}) \left(\frac{\prod_i PCO_i}{\prod_i PC_i}\right)^{\gamma_{i,h}} - \\ & \quad (BCO_h - \sum_i PCO_i CMINO_{i,h}) \end{aligned} \tag{A96}$$

II.D Appendix D: Sensitivity Analysis

Table II.11: **Unemployment For Selected Values of Wage Elasticity ζ**

Percentage Change with Respect to the Base Year with Shock SIM3

Categories	$\zeta = 0.05$	$\zeta = 0.2$	$\zeta = 0.3$	$\zeta = 0.4$	$\zeta = 0.5$
Directors	0.23	0.11	0.08	0.06	0.05
Senior executive	-0.05	-0.10	-0.09	-0.08	-0.07
Junior staff	0.12	0.07	0.05	0.04	0.03
Employees	0.05	0.02	0.01	0.01	0.01
Commercants	-0.23	-0.18	-0.14	-0.12	-0.10
Farmers	16.98	4.32	2.88	2.16	1.73
Craftsmen	0.18	0.11	0.08	0.07	0.06
Farm labourers	15.11	4.74	3.24	2.46	1.98
Drivers	0.17	0.10	0.08	0.06	0.05
Warehousemen	0.98	0.64	0.51	0.43	0.37

Notes: ζ: The absolute value of the wage elasticity with respect to unemployment.
Source: Author's calculations.

Table II.12: **Unemployment For Selected Combinations of Rural and Urban Income Elasticities of Labour Supply**

Percentage Change with Respect to the Base Year with Shock SIM3

Rural Elasticity	**Urban Elasticity**	**Directors**	**Senior Executive**	**Junior Staff**	**Employees**	**Commercants**
-0.1	-0.1	0.17	-0.09	0.10	0.04	-0.22
-0.1	-0.2	0.17	-0.09	0.10	0.04	-0.22
-0.1	-0.4	0.17	-0.09	0.10	0.04	-0.22
-0.2	-0.1	0.17	-0.09	0.10	0.04	-0.22
-0.2	-0.2	0.17	-0.09	0.10	0.04	-0.22
-0.2	-0.4	0.17	-0.09	0.10	0.04	-0.22
-0.4	-0.1	0.17	-0.09	0.10	0.04	-0.22
-0.4	-0.2	0.17	-0.09	0.10	0.04	-0.22
-0.4	-0.4	0.17	-0.09	0.10	0.04	-0.22

Source: Author's calculations.

Rural Elasticity	**Urban Elasticity**	**Farmers**	**Craftsmen**	**Farm Labourers**	**Drivers**	**Warehousemen**
-0.1	-0.1	8.60	0.15	8.77	0.14	0.83
-0.1	-0.2	8.60	0.15	8.77	0.14	0.83
-0.1	-0.4	8.60	0.15	8.77	0.14	0.83
-0.2	-0.1	8.60	0.15	8.77	0.14	0.83
-0.2	-0.2	8.60	0.15	8.77	0.14	0.83
-0.2	-0.4	8.60	0.15	8.77	0.14	0.83
-0.4	-0.1	8.60	0.15	8.77	0.14	0.83
-0.4	-0.2	8.60	0.15	8.77	0.14	0.83
-0.4	-0.4	8.60	0.15	8.77	0.14	0.83

Table II.13: **Unemployment For Selected Combinations of Migration Elasticities**

Percentage Change with Respect to the Base Year with Shock SIM3

ε	ϱ	o	**Directors**	**Senior Executive**	**Junior Staff**	**Employees**	**Commercants**
-0.75	-1.25	-1	0.13	-0.09	0.08	0.02	-0.22
-0.75	-1.25	-2	0.13	-0.09	0.08	0.02	-0.22
-0.75	-1.25	-4	0.13	-0.09	0.08	0.02	-0.22
-0.75	-2.5	-1	0.17	-0.09	0.10	0.04	-0.22
-0.75	-2.5	-2	0.17	-0.09	0.10	0.04	-0.22
-0.75	-2.5	-4	0.17	-0.09	0.10	0.04	-0.22
-0.75	-5	-1	0.23	-0.11	0.12	0.07	-0.26
-0.75	-5	-2	0.23	-0.11	0.12	0.07	-0.26
-0.75	-5	-4	0.23	-0.11	0.12	0.07	-0.26
-1.5	-1.25	-1	0.13	-0.09	0.08	0.02	-0.22
-1.5	-1.25	-2	0.13	-0.09	0.08	0.02	-0.22
-1.5	-1.25	-4	0.13	-0.09	0.08	0.02	-0.22
-1.5	-2.5	-1	0.17	-0.09	0.10	0.04	-0.22
-1.5	-2.5	-2	0.17	-0.09	0.10	0.04	-0.22
-1.5	-2.5	-4	0.17	-0.09	0.10	0.04	-0.22
-1.5	-5	-1	0.23	-0.11	0.12	0.07	-0.26
-1.5	-5	-2	0.23	-0.11	0.12	0.07	-0.26
-1.5	-5	-4	0.23	-0.11	0.12	0.07	-0.26
-3	-1.25	-1	0.13	-0.09	0.08	0.02	-0.22
-3	-1.25	-2	0.13	-0.09	0.08	0.02	-0.22
-3	-1.25	-4	0.13	-0.09	0.08	0.02	-0.22
-3	-2.5	-1	0.17	-0.09	0.10	0.04	-0.22
-3	-2.5	-2	0.17	-0.09	0.10	0.04	-0.22
-3	-2.5	-4	0.17	-0.09	0.10	0.04	-0.22
-3	-5	-1	0.23	-0.11	0.12	0.07	-0.26
-3	-5	-2	0.23	-0.11	0.12	0.07	-0.26
-3	-5	-4	0.23	-0.11	0.12	0.07	-0.26

Notes: (1)ε_c: Elasticity of transformation between international rural migrants and national workers.
(2)ϱ_c: Elasticity of transformation between internal migrants and rural workers.
(3)o_c: Elasticity of transformation between international urban migrants and urban workers.
Source: Author's calculations.

ε	ϱ	o	**Farmers**	**Craftsmen**	**Farm Labourers**	**Drivers**	**Warehousemen**
-0.75	-1.25	-1	7.88	0.13	8.62	0.10	0.76
-0.75	-1.25	-2	7.88	0.13	8.62	0.10	0.76
-0.75	-1.25	-4	7.88	0.13	8.62	0.10	0.76
-0.75	-2.5	-1	8.60	0.15	8.77	0.14	0.83
-0.75	-2.5	-2	8.60	0.15	8.77	0.14	0.83
-0.75	-2.5	-4	8.60	0.15	8.77	0.14	0.83
-0.75	-5	-1	9.24	0.19	8.83	0.21	0.97
-0.75	-5	-2	9.24	0.19	8.83	0.21	0.97
-0.75	-5	-4	9.24	0.19	8.83	0.21	0.97
-1.5	-1.25	-1	7.88	0.13	8.62	0.10	0.76
-1.5	-1.25	-2	7.88	0.13	8.62	0.10	0.76
-1.5	-1.25	-4	7.88	0.13	8.62	0.10	0.76
-1.5	-2.5	-1	8.60	0.15	8.77	0.14	0.83
-1.5	-2.5	-2	8.60	0.15	8.77	0.14	0.83
-1.5	-2.5	-4	8.60	0.15	8.77	0.14	0.83
-1.5	-5	-1	9.24	0.19	8.83	0.21	0.97
-1.5	-5	-2	9.24	0.19	8.83	0.21	0.97
-1.5	-5	-4	9.24	0.19	8.83	0.21	0.97
-3	-1.25	-1	7.88	0.13	8.62	0.10	0.76
-3	-1.25	-2	7.88	0.13	8.62	0.10	0.76
-3	-1.25	-4	7.88	0.13	8.62	0.10	0.76
-3	-2.5	-1	8.60	0.15	8.77	0.14	0.83
-3	-2.5	-2	8.60	0.15	8.77	0.14	0.83
-3	-2.5	-4	8.60	0.15	8.77	0.14	0.83
-3	-5	-1	9.24	0.19	8.83	0.21	0.97
-3	-5	-2	9.24	0.19	8.83	0.21	0.97
-3	-5	-4	9.24	0.19	8.83	0.21	0.97

Chapter III

When Migrant Remittances Are Not Everlasting, How Can Morocco Make Up?

The static CGE model built in Chapter 2 helped determine the direct impact of migration on Moroccan labour market. Nevertheless, migration has as well indirect effects on the sending economy through remittances. This indirect effect was not taken into account in Chapter 2 so that the results would be comparable with those of the literature on the subject. It is however investigated in the present chapter.

According to data from the IMF's Balance of Payments Yearbook, Morocco is the fourth-largest recipient of official remittances among developing countries, totalling USD 3.3 billion (MAD 37 billion) in 2001. After their surge in 2001, their level remained high compared to other developing countries, about 9% of GDP and 25% of exports. For instance, they amounted to only 3% of GDP and 16% of exports in Egypt, 1% of GDP and 3% of exports in Turkey, 5% of GDP and 13% of exports in Tunisia (Bouhga-Hagbe, 2004). Since the early 70s, they have become increasingly

[0] This chapter is based on Karam (2008).

important for the Moroccan BoP. In 2001, they were six times higher than ODA and five times higher than FDI (de Haas, 2007). They represent the country's major source of foreign currency receipts and exceed receipts from phosphate and tourism (Nyberg-Sorensen, 2004).

Unlike the best part of the literature that focuses on households, ignoring linkages that transmit the influence of migration and remittances to other households and economic sectors, I use a CGE approach to investigate the impact of remittances on Morocco. To take into account the use of remittances for investment needs, I adopt a dynamic framework that allows the allocation of investment to the different sectors. I further assume a segmentation of the savings market in order to show clearly that remittances, unlike other sources of savings, mainly finance investment in real estate.

The scale and growth of remittances by destination of developing countries have attracted increased attention regarding their development impact. Many studies were concerned by their effect on poverty and inequality, on the balance of payments, and others by their use for consumption and investment needs. Putting aside the poverty reducing effect of remittances on which the different studies agree (Adams, 2006; Yang and Martinez, 2006), the results are mixed. To begin with, empirical works on the income distribution effects of remittances are not conclusive[1]. Secondly, remittances are supposed to affect unemployment, productivity and growth, depending on the breakdown between consumption and investment. If they are invested, they will promote output and employment and thereby finance future consumption in a sustainable way. Alternatively, if they are spent only on current consumption goods, then future consumption has to be

[1] For example, Ahlburg (1996) and Taylor and Wyatt (1996) find that remittances have an equalising effect on income distribution in Tonga and Mexico. By contrast, evidence from Egypt (Adams, 1991), Pakistan (Adams, 1998) and the Philippines (Rodriguez, 1998) show that remittances induced income inequality to rise. Adams (2006) shows that internal and international remittances have little impact on income inequality in Guatemala. The evidence from the Mexican case found support to the inverse U-shape relationship between migration and inequality (McKenzie and Rapoport, 2005).

financed by future remittances. However, Glytsos (1993) argues that remittances, even when not invested, can have an important multiplier effect. His study applied to Greece shows that this multiplier effect arises when consumption stimulates the demand of goods and services, which promotes, in turn, output and employment. Third, remittances affect the BoP and they have a more positive impact than other monetary flows such as financial aid, FDI and loans because they are a more stable source of foreign currency, bear no interest and do not have to be repaid. But one should be cautious here because remittance flows can also have negative inflationary effects if they stimulate demand more than supply and this demand falls on non-tradable goods. Finally, they can induce a moral hazard problem where people choose to work less due to the positive income effect of remittances (Chami, Fullenkamp and Jahjah, 2005).

The results of the previous works show that the effects of remittances are heterogeneous across space and depend on the amount of remittances received and other macroeconomic variables that are country-specific. In this context, it is worth mentioning that the literature is unevenly distributed with regard to country analyses. A lot of works have been done on Latin migrants living in the US while the interest for migrants from MENA countries in the EU has just begun, in spite of the large flows of remittances received by these countries. According to the IMF's Balance of Payments Yearbook, MENA countries received in 2001, as well as South Asia, the largest flow of remittances in percentage of GDP (2.3%) and the second largest flow, after Latin America and the Caribbean, in billions of US dollars (USD 14 billion v/s USD 23 billion). In particular, Morocco is ranked first between MENA countries and stood internationally after India, Mexico and the Philippines in 2001. Despite its place among the largest developing countries receiving remittances, works concerned by the impact of remittances on Morocco are limited to unpublished reports, theses or working papers on particular regions[2]. On the national level, only general surveys like those of Hamdouch (2000) and Nyberg-Sorensen (2004)

[2] See for example Berriane (1996), Lazaar (1987, 1989), McMurray (1992) cited in Nyberg-Sorensen (2004) on the Rif Mountains, and Bijaad (1987), de Haas (2003, 2006) on Southern Morocco.

are available. Regardless of empirical gaps and methodological flaws, available evidence suggests that migration and remittances have considerably improved living conditions, education, and triggered economic activity, from which non-migrants have indirectly profited. However, this impact is fundamentally heterogeneous across space and time, as well as across socio-ethnic and gender groups. In many cases, the development of migrant-sending regions is a prerequisite for return and/or investment rather than a consequence of migration. Consequently, additional works are needed to assess the effects of migration on marginal propensities to invest and multiplier effects of remittance expenditure (de Haas, 2007).

Yet, the literature based on households or on CGE models[3] has given less attention to the sectoral distribution of remittances invested, especially when the largest part of remittances in developing countries is invested in real estate. The problem with this sector is that construction services are offered domestically, unlike other sectors that export to international markets and compete with international products. On the one hand, increasing openness generates strong competitive pressures that drive costs down and ameliorate the product quality. On the other hand, it accelerates institutional change that reduces transaction costs for all business activities. This is the export-growth relationship in the heart of export-led growth strategy. In order to model the particular investment of remittances in real estate in a dynamic CGE framework, I resort to a segmentation of the savings market: unlike FDI and domestic savings that finance productive sectors, remittances finance mainly the real estate sector. Indeed, remittances by Moroccans residing abroad (MRA) are driven by altruistic motives: they tend to satisfy the family basic needs, among other things having more comfortable and decent houses. If remittances are treated analogously to foreign and domestic savings that finance productive sectors, this will overestimate the volume of capital invested in these sectors and create an illusion of a sustainable growth. This is the main contribution of this chapter. Then, I look to the long-term tendency of migratory flows and

[3] I could identify only few CGE models studying the impact of remittances in a dynamic framework. See for example the paper of Taylor and Dyer (2006) on Mexico.

remittances. With family reunification and strict immigration policies in receiving countries, remittances are expected to be cut away. In partial equilibrium, one may conclude that the economy would not be affected by the downward evolution of remittances if they are invested in a non-productive sector like real estate. However, in a general equilibrium framework, the drop of remittances will be harmful to the economy, even when invested in real estate, due to the existing linkages between sectors.

It turns out that the fear from the cut down in remittances is justified. Therefore, the economy should take a maximum profit from current flows. This could be achieved for example by reducing the international cost of transfers in order to channel a larger amount of money to the receiving country. Another option consists of transmitting remittances to the exporting sectors rather than to real estate. Finally, the government should undertake policies that are likely to improve the investment climate and thus reduce the country risk premium in favour of investors. The results show that investment of remittances in productive sectors rather than in real estate is unexpectedly harmful. The improvement of the country risk premium and the reduction of transfer costs give the best results.

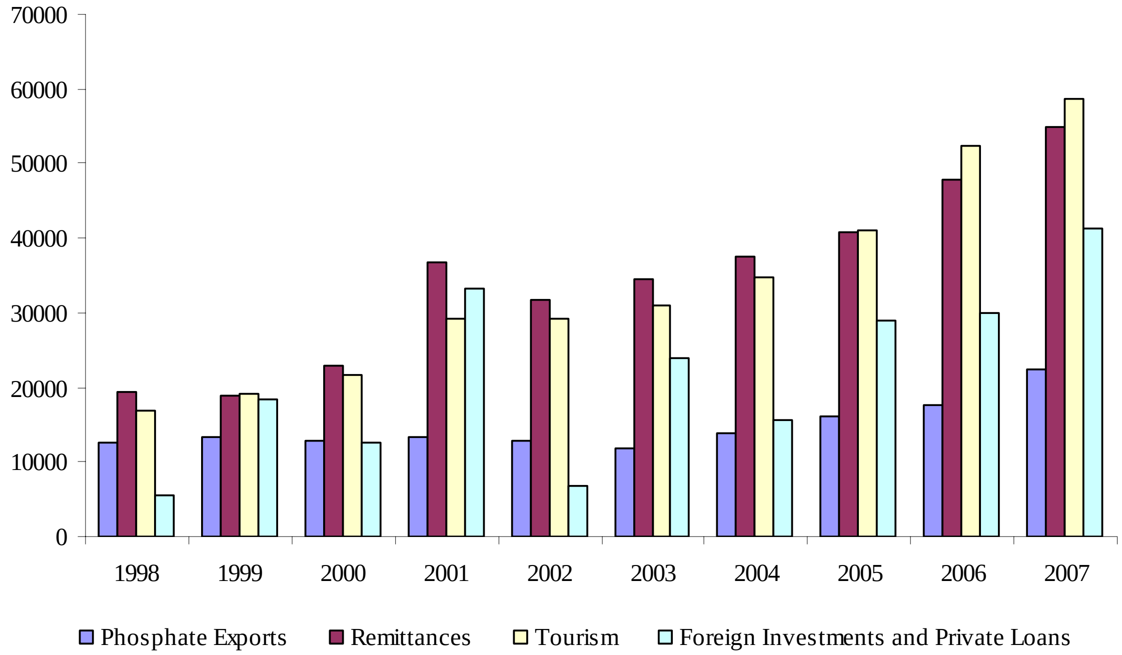
This chapter is structured as follows. Section 1 illustrates Morocco's dependency upon remittances. Section 2 is devoted to the theoretical framework. The results of the simulations are presented in Section 3. Section 4 concludes and discusses the policy implications of my results.

1 A Brief Overview of Remittances to Morocco

Morocco's dependency on migration and remittances is as old as migration into Europe. This dependency is such that the Kingdom's budgetary plans (1968-72) proposed emigration as a means of solving the unemployment problem, providing additional foreign currency through remittances and creating a group of nationals with professional skills favourable to economic development. Moreover, migrant remittances would help finance internal investments. The five-year plan of 1973-77 further proposed to set up a network of social bureaus abroad.

Morocco is the fourth-largest developing country receiving official remittances, totalling MAD 37 billion (USD 3.3 billion) in 2001. Remittance flows moved from MAD 2 billion in 1975 to MAD 10 billion in 1985 and MAD 19 billion in 1998. They reached a record level of nearly MAD 37 billion in 2001 before moving down to MAD 32 billion in 2002. In 2003, they rose again to MAD 35 billion. They have particularly increased during the past five years, encouraged by some events such as the renewed interest of the new king for the Moroccan community living abroad, the adoption of the Euro that dismantled the savings made in the old European currencies, the devaluation of the Dirham in 2001, the strong increase in the number of Moroccan immigrants to Italy and Spain and the remarkable attachment of Moroccans to their country of origin. Remittances role in the BoP is often higher than phosphate, tourism, foreign investments and private loans (Figure III.1).

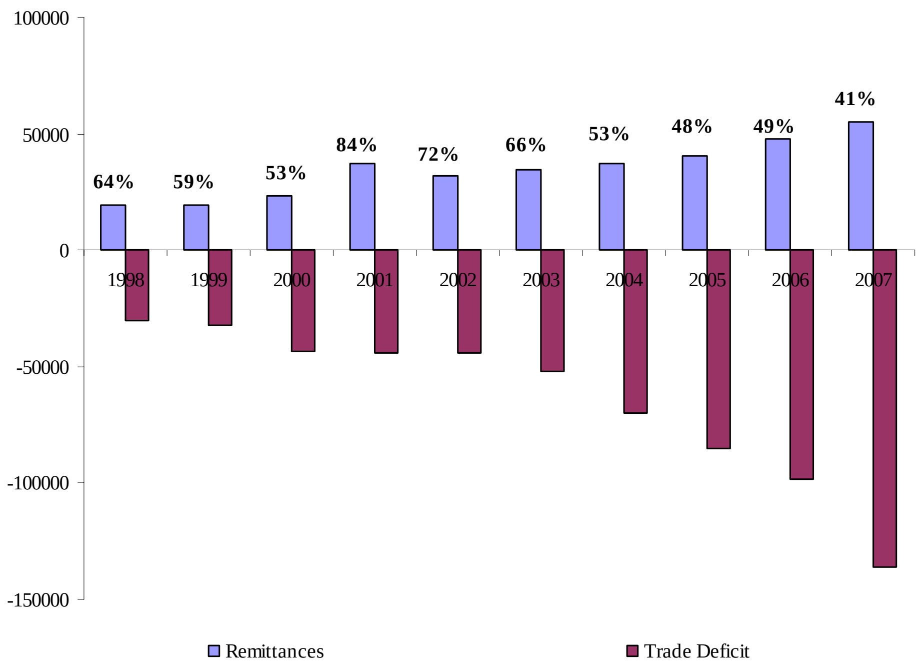
Figure III.1:
Remittances and other flows of the BoP, 1998-2007 (MAD million)



Notes: The word remittances refers here to workers' remittances that are registered as current transfers.
Source: Ministry of Foreign Trade, Rabat.

As it is shown in Figure III.2, remittances almost cover the trade deficit and have contributed to the recent surpluses of the external current account, as well as the overall BoP surplus. In spite of their magnitude in the balance of payments, they do not seem to constitute a significant risk in terms of stability because they are mainly driven by altruism and attachment to the home country. Portfolio diversification motives are not significant among the long run explanatory factors of remittances to Morocco (Bouhga-Hagbe, 2004). According to van Dalen et al. (2005), it is the parent-child relation that determines the motive for remitting money.

Figure III.2:
Remittances as % of trade deficit, 1998-2007 (Values in MAD million)



Notes: The word remittances refers here to workers' remittances that are registered as current transfers.
Source: Ministry of Foreign Trade, Rabat.

However, the long term tendency goes against the increase of remittances. With the restriction of Western immigration policies, the rise in the number of educated migrants that tend to settle abroad, family reunification, naturalisation, and the succession of generations living abroad, remittances are expected to decrease, negatively affecting the Moroccan economy largely dependent on this source of foreign currency. That is why it is important to know the treatment reserved for them: are they consumed or invested? And if invested, are they in productive sectors? In this context, the allocation of remittances between sectors plays an essential role, mainly because the best part is invested in real estate. First, construction services are offered domestically and do not profit from technical progress due to competitiveness with international products. Secondly, real estate only accounts for 4% of GDP at factor costs, compared to 17% for agriculture, 14% for trade and repair and 11% for rental services. Besides, it only constitutes 3% of the wage payroll compared to 34% in agriculture. At first sight, one concludes that remittances should be channelled to productive sectors in order to promote the economic activity and guarantee the conditions of a sustainable growth.

The main purpose of sending money to Morocco is to support the family and other close relatives and/or build a house. Real estate monopolizes the lion's share with nearly 83.7% of investments by MRA in their country of origin. There is only limited evidence of investments in productive sectors (Table III.1). Migrants find it difficult and unattractive to make investments in Morocco because of the lack of information about investment opportunities, a slow bureaucratic system, widespread corruption and the insecurity resulting from the economic and political situation. To this is added, especially in rural villages, the lack of infrastructure such as electricity, water and roads that deeply inhibits the productive use of remittances.

However, things are changing: first, fewer migrants consider investing in the future. Secondly, future projects are more concentrated into productive sectors (Table III.1). Real estate, while remaining the principal sector of investment, consists of no more than 35.6% of the projects. This reflects the change in migrants' behaviour, especially the second generation of migrants, and also the fact that MRA have already invested heavily in real estate.

Transfers are increasingly taking place through official channels after the tighter control imposed by the authorities on financial flows to and from Arab countries in the wave of the "war on terror" declared by the United Nations (FEMISE, 2004). Official remittance flows have also been stimulated by the expansion of the national

Table III.1: **Sectoral distribution of MRA's investments (%)**

Sectors	**MRA's investments**	**MRA's investment projects**
Real estate	83.7	35.6
Agriculture	7.5	10.6
Trade	4.9	27.4
Tourism	1.4	12.1
Manufacturing	1.3	7.5
Other services	1.1	5.3
Other sectors	0.1	1.5

Source: Hamdouch (2000).

banking system and the extension of banking services to the principal immigration countries. More than 62% of migrants transfer their funds through Moroccan banks[4] compared with only 4.4% for foreign banks. 16% of migrants use the post office and 3.4% private intermediaries (Hamdouch, 2000). The Banque Populaire charges low commission for money transfer (the half of that charged by private companies). However, according to Hamdouch (2000), transfer costs should be further reduced and transfer delays shortened. Table III.2 presents an example of transfer costs charged by different channels from the Netherlands to Morocco. Moreover, the major problem is the lack of transparency on the cost and speed of the transaction: product information can only be obtained through the actual use of the different transfer services. Money transfer organisation are transparent on fee costs and speed prior to the transaction, but only provide exchange rate costs when the transaction takes place. The bank channel seems even less transparent: they do not provide information on total fee costs prior to the transaction nor on exchange rates, and only give an estimate of the transaction time (Barendse et al., 2006).

[4] At present, migrant remittances are monopolised by two main banks: the Banque Populaire and Bank Al Amal. The first one has been the main reference for residents abroad since the 1970s. It charges relatively low commission for money transfer and gives access to normal bank credit with favourable interest rates. Bank Al Amal is an investment bank established in 1989, following the demand by residents abroad to have an Islamic investment bank supporting their entrepreneurial initiatives. It is specialised in financing investments and it does not transfer money and does not open bank accounts. Its main function is to encourage migrants to transfer their money to Morocco in order to invest.

Table III.2: **Cost of remitting 250 euros from the Netherlands to Morocco**

Official channels	**Cost in euros**
Western Union	21.14
MoneyGram	23.95
Postbank (internet)	7.5
ABN Amro (urgent at counter)	39.6
ABN Amro (internet)	16.10

Source: Barendse et al. (2006).

2 Theoretical Framework

As mentioned earlier, I am interested in the impact of remittances on Morocco, a country that has been subject to various surveys on remittances and studies applied to specific regions. The general conclusion is analogous to the one of Hamdouch (2000): given the expected downward trend of remittances due to the restriction of immigration policies in the Western countries and to permanent migration, it is necessary to alleviate in the short run the barriers to remit and make the economy less dependent on this source of foreign currency. This could be done for example by moderating the high cost and the long delay of transfers, by channelling them to productive investments, and by improving the investment climate. Such policies involve all economic agents and sectors: a shock on remittances has its most direct impact on household income. But since remittances are also invested, the shock affects as well the economic sectors, and consequently the demand for production factors and their corresponding prices. In turn, households' income changes because of the wage variation. In addition, remittances contribute to the receipts of the BoP, and therefore induce an appreciation or a depreciation of the exchange rate. The exchange rate variation affects the value in domestic currency of the international wage and thus, the decision to migrate and remit. In sum, this is a general equilibrium problem, requiring a CGE approach to illustrate the linkages that transmit the influence of remittances on economic agents and sectors.

This section provides a short description of the benchmark small open-economy model inspired from Decaluwé et al. (2001) and developed by Cockburn et al. (2006). Very briefly, this version of the model contains 34 mono-productive sectors distributed between two aggregate sectors: a rural sector (agriculture and fishing) and an urban sector (industry, tradable and non-tradable services); five agents (rural and urban households, firms, government, and the RoW). The production process employs two factors of production: labour and capital. The capital is sector-specific. Rural labour is perfectly mobile between rural sectors and urban labour is mobile between urban sectors but urban labour market is considered imperfect due to the existence of unemployment. Finally, labour movement between rural and urban blocks involves transactions costs. The migration block is borrowed from Chapter 2, based on Karam and Decaluwé (2008): migratory flows are triggered by the observed wage differential between the region of destination and the region of origin, net of migration costs. The rural worker has the possibility to migrate abroad or to urban areas. He carries out a choice in two stages: initially, he maximises his expected income considering the choice of staying in Morocco (staying in rural zones or migrating to the cities) or leaving the country. In the second stage, the rural worker who has decided to stay in Morocco carries out the choice of staying in rural areas or migrating to the cities. Similarly, the urban worker maximises his expected income by choosing to stay in Morocco or to migrate abroad. The last model is a static one where remittances are treated as exogenous. Because the impact of remittances is different depending on whether they are spent on consumption or investment, it would be more cautious to adopt a dynamic version of the migration model. The advantage of dynamic models is that they allow to investigate the allocation of investment between sectors. The innovation with respect to traditional dynamic CGE models, and especially the very few ones interested in the impact of remittances, consists in a segmentation of the savings market. In other words, remittances are not invested in the same way as other sources of savings. They mainly finance real estate. On the contrary, the proportion of domestic and foreign savings not funding the public debt is invested in productive sectors, mainly in industry and services. Putting aside the fact that different sources of savings finance different sectors distort the share of investment going to the most or the least productive sectors, and consequently bias the results.

For the sake of brevity, I only deal here with the segmentation of the savings market and the dynamics. All equations can be examined in Appendix B. The model is calibrated on a disaggregated SAM for 1998. Data on migration come from OECD (2006). Appendix A presents a detailed explanation of all data sources. The model is implemented in GAMS (Brooke et al., 1988) and solved with MILES, a solver for mixed complementarity problems.

2.1 The Segmentation of the Savings Market

Traditional dynamic CGE models postulate that total savings are distributed between sectors according to their rental rate of capital, which means that all kinds of savings are identically treated. This would be however contestable when investment by MRA occurs mainly in real estate. Construction has become one of the pillars of the Moroccan economy, not least because of migrant investments. By contrast, FDI and firms' investments take place mostly in productive sectors, particularly in services and industry.

But why is investment in real estate so frowned? In fact, the nature of real estate services limits the scope of supply to local markets. On the contrary, tradable products are offered on international markets and compete with international products. Export expansion has a positive effect on total factor productivity (TFP) growth, through exploiting economies of scale, technology transfer, or increasing competitive incentives. Indeed, openness to international trade enforces the mastering of foreign technology in order to meet world market quality standards, distribution and marketing, and to reduce production costs. Export promotion also accelerates institutional change which contributes to productivity growth by reducing transaction costs for all business activities. This is the relation between exports and growth at the heart of the export-led industrialisation strategy. De Melo and Robinson (1990) captured these effects by introducing an export externality. In their model, exports affect the scale parameter of the CET function between production to domestic and international markets. I follow the specification of Rodrigo and Thorbecke (1997) and add the externality by stating that value added of tradable sectors is an increasing function of exports $EXS_{tr,t}$ beyond some base level volume of exports:

$$VA_{tr,t} = A_{tr,t}[\alpha_{tr} LD_{tr,t}^{(\sigma_{tr}-1)/\sigma_{tr}} + (1-\alpha_{tr}) KD_{tr,t}^{(\sigma_{tr}-1)/\sigma_{tr}}]^{\sigma_{tr}/(\sigma_{tr}-1)}$$

and

$$A_{tr,t} = A_{tr,t-1}\left(\frac{EXS_{tr,t}}{EXS_{tr,t-1}}\right)^{\varsigma} \qquad \text{for } EXS_{tr,t} \succ EXS_{tr,t-1}$$

$$A_{tr,t} = A_{tr,t-1} \qquad \text{for } EXS_{tr,t} \leq EXS_{tr,t-1}$$

where

$VA_{tr,t}$	is the value added of tradable sector tr at period t,
$A_{tr,t}$	the export externality shift parameter in value added at period t,
α_{tr}	the share parameter of the CES function,
$LD_{tr,t}$	the labour demand of sector tr at period t,
$KD_{tr,t}$	the capital demand of sector tr at period t,
σ_{tr}	the elasticity of substitution (positive),
ς	the export externality parameter (positive).

Following the study of de Melo and Robinson (1990) applied to Korea, I choose a fairly small value of 0.1 for ς to describe the export externality for Morocco[5]. Now, it is time to depict the specific use of each source of savings.

[5] Table III.11 in Appendix C shows GDP change for selected values of export externality parameter. As expected, the higher the parameter is, the more GDP grows or the less GDP decreases. However, the results are qualitatively the same as the model simulations reported below.

Scholars and policy makers blame migrants for investing essentially in real estate, what they call a "refugee sector", which reflects a lack of entrepreneurial mentality. Indeed, the first objective of migrants is to meet the household's immediate needs such as space, safety, privacy, fewer conflicts and better health. Second, there are specific social and cultural reasons that explain the priority for housing construction, such as the priority for migrants' wives to have their own house, away from the authority of their parents-in-law, in order to enjoy their personal freedom and privacy. This means that investment in real estate by MRA depends on exogenous personal factors such as the willingness to maintain ties with the country of origin. Consequently, I find it plausible to consider investment in housing as a fixed part of the amount of remittances invested. According to Hamdouch (2000), this proportion represents 80% of investments by MRA in their country of origin. Thus, investment by MRA in real estate is given by the following equation:

$$\sum_h estate(1 - cons_h)(1 - ty_h)(1 - tc)REM_{h,t} = MRA_t PINV_t$$

where

$estate$	is the proportion of remittances after consumption invested in real estate,
$cons_h$	the proportion of remittances consumed by household h,
ty_h	the direct tax rate on household h income,
tc	the transfer cost,
$REM_{h,t}$	the value of remittances received by household h at period t,
MRA_t	the investment in real estate financed by remittances at period t (volume),
$PINV_t$	the aggregate price of investment at period t.

The remainder of remittances not consumed[6] and not invested in real estate, together with households and firms' savings, help finance investment in productive

[6] According to the National Survey on Household Living Standards of 1998-1999, the proportion of remittances going to consumption is the quarter of the total amount of remittances recorded in the BoP (Bourchachen, 2000).

sectors $DINV_t$ according to the differential between the sectoral rental rate of capital and the aggregate price of investment, as well as the domestic public debt: when government savings are negative and the external sources of funding are limited, the government is obliged to borrow from domestic agents, particularly from the urban household and firms[7], in order to finance public investment. This domestic funding of the public debt is positively dependent on the country risk premium ϵ_2. In other words, if the country risk premium rises making domestic agents reluctant to invest, they will opt for a risk-free investment, such as lending to the government, and the latter will have a crowding-out effect on private investment.

$$\begin{aligned} DD_t &= K_t(F \times {\epsilon_2}^{\xi})(S_{\text{``}hu\text{''},t} + (1 - estate)(1 - cons_{\text{``}hu\text{''}}) \\ &\quad (1 - ty_{\text{``}hu\text{''}})(1 - tc)REM_{\text{``}hu\text{''},t} + S_{\text{``}fm\text{''},t}) \end{aligned}$$

where

DD_t	is the domestic public debt at period t financed by urban household and firms,
K_t	an adjustment variable in the debt equation at period t,
F	a scale parameter,
ϵ_2	the country risk premium perceived by domestic investors,
ξ	the elasticity of internal public debt funding with respect to the country risk premium (positive),
$S_{ag,t}$	Agent ag's savings (hu for urban household and fm for firms) at period t.

Public investment is financed by government savings $S_{\text{``}gv\text{''},t}$, if they are positive, and the public debt. It is composed of investment in infrastructure $INVG_t$ and the additional capital required to support the increased production of non-tradable services $VARKD_t$. Public investment in infrastructure $INVG_t$ is treated as exogenous since it comes from a public decision while $VARKD_t$ is endogenously

[7] The data in the SAM show that only urban households and firms lend to the government (Abdelkhalek and Zaoujal, 2004).

determined due to the specification of public sectors where capital stock is supposed endogenous (detailed in the next section).

$$S_{\text{``}gv\text{''},t} + DD_t + e_t FD_t = VARKD_t PINV_t + INVG_t PINV_t$$

where

e_t	is the nominal exchange rate at period t (the price of foreign currency in domestic currency),
FD_t	the foreign public debt at period t.

Foreign savings $S_{\text{``}row\text{''},t}$ finance foreign public debt, as well as foreign investment[8] and a fraction of the stock variation. Foreign investment[9] is triggered by the differential between the rental rate of capital and the international return on capital.

$$e_t(S_{\text{``}row\text{''},t} - FD_t) = \sum_{pro} FDI_{pro,t} PINV_t + FDI_{\text{``}con\text{''},t} PINV_t + \upsilon \sum_i STK_{i,t} PC_{i,t}$$

where

$FDI_{pro,t}$	is the foreign direct investment in productive sector *pro* at period t (volume),
$FDI_{\text{``}con\text{''},t}$	the foreign direct investment in the construction sector at period t (volume),
υ	the fraction of the stock variation at period t financed by foreign savings,
$STK_{i,t}$	the stock variation of product i at period t (volume),
$PC_{i,t}$	the composite price of product i at period t.

[8] Foreign direct investment in Morocco surged in the 90s after the Structural Adjustment Program of 1983 that dismantled the "Moroccanisation" Decree of foreign ownership restriction and promoted trade liberalisation. The government adopted attractive measures of foreign investment such as the possibility of full foreign ownership of local companies, the repatriation of capital and dividends, fiscal incentives, and guaranteed foreign investment against the risks of nationalisation and expropriation.

[9] Foreign direct investment in the construction sector, contrary to MRA's investments in real estate, is motivated by economic factors.

To sum up, each sector receives two kinds of investments: domestic investment funded by firms and households' savings as well as the proportion of remittances not consumed, and foreign investment funded by foreign savings. In addition, the determinants of domestic and foreign investments are different. Domestic investment is motivated by the differential between the sectoral rental rate of capital and the investment aggregate price. In contrast, foreign investment is triggered by the differential between the domestic and international return on capital in the corresponding sector.

The macroeconomic equilibrium should be still verified despite the segmentation of the savings market, in the sense that all savings should match total investment value (gross fixed capital formation + stock variation).

$$\begin{aligned} IT_t + \sum_i STK_{i,t}PC_{i,t} &= e_t S_{\text{"}row\text{"},t} + \sum_{da} S_{da,t} + \\ & \sum_h (1 - cons_h)(1 - ty_h)(1 - tc)REM_{h,t} \end{aligned}$$

where

IT_t	is the gross fixed capital formation at period t (value),
da	for domestic agents.

None of right-hand side values is free to equilibrate aggregate savings-investment balance. Government savings is a fixed share of GDP. Uniform adjustments in the rate of value-added tax across all sectors assure that the government savings target is met. Foreign savings are fixed. A flexible real exchange rate clears the current account balance. For each household category, savings is a fixed share of his disposable income. Hence, the model is savings-driven, in accordance with other studies on Morocco (Agénor et al., 2003; Löfgren et al., 1999): gross fixed capital formation adjusts to achieve savings-investment equilibrium.

The gross fixed capital formation in volume, $ITVOL_t$, is the sum of investments by sectors of destination.

$$ITVOL_t = IT_t/PINV_t$$

$$ITVOL_t = SI_t(\sum_{pro} INVD_{pro,t} + INVD_{\text{“}con\text{”},t} + VARKD_t)$$

where

SI_t is the investment adjustment variable at period t.

$INVD_{pro,t}$ the investment by destination of sector pro at period t given by:

$$INVD_{pro,t} = DINV_{pro,t} + FDI_{pro,t}$$

$INVD_{\text{“}con\text{”},t}$ the investment by destination of the construction sector at period t given by:

$$INVD_{\text{“}con\text{”},t} = MRA_t + DINV_{\text{“}con\text{”},t} + INVG_t + FDI_{\text{“}con\text{”},t}$$

2.2 The Dynamics

I develop a sequential (recursive) dynamic CGE model where agents have myopic behaviour. It consists of multiple static CGE models linked between periods by an exogenous variable updating procedure, mainly for the capital stock and the population. Capital stock is updated endogenously at each period with investment and the population is updated between periods with an exogenous growth rate. It is also possible to add updating mechanisms for other variables, such as public expenditures, transfers and debt if they are supposed fixed in the first period. I begin with the accumulating mechanism of the capital stock. The stock of capital of private sector ps in the following period is equal to the current capital stock net of depreciation, plus current investment in this sector:

$$KD_{ps,t+1} = (1 - dep_{ps})KD_{ps,t} + INVD_{ps,t}$$

where

dep_{ps} is the capital depreciation rate of sector ps (parameter).

In line with the segmentation of the savings market where each source of savings finance a particular investment category, investment by sector of destination $INVD_{ps,t}$ is not homogeneous. It consists of two kinds of investments: foreign investment funded by external savings and domestic investment funded by local savings. The former is stimulated by the differential between the domestic and international rental rate of capital in the corresponding sector whereas the second is triggered by the differential between the rental rate of capital and the aggregate investment price. For both types of investment, I adopt the quadratic form proposed by Bourguignon et al. (1989).

I assume that multinationals first distribute their investment choices between sectors then between countries. In other words, after having selected a sector, the multinational will choose between investing inside or outside Morocco. In line with FDI theories, many factors intervene in the investment decision across countries, such as market size, production costs, the exchange rate, institutional credibility and other factors that affect the country risk premium. For lack of data on the nature of FDI (horizontal/vertical) that occurs in the different sectors, I use the differential between the international and local rental rate of capital as a determinant of FDI in a particular sector, and take into account the negative effect of the exchange rate depreciation on profit repatriation and the positive effect of the country risk premium on the investment decision:

$$\frac{FDI_{pro,t}}{KD_{pro,t}} = D_{1pro}\left(\frac{r_{pro,t}}{e_t r_t^*(i_t + \epsilon_1 + dep_{pro})}\right)^2 + D_{2pro}\left(\frac{r_{pro,t}}{e_t r_t^*(i_t + \epsilon_1 + dep_{pro})}\right)$$

$$\frac{FDI_{\text{``}con\text{''},t}}{KD_{\text{``}con\text{''},t}} = D_{1\text{``}con\text{''}}\left(\frac{r_{\text{``}con\text{''},t}}{e_t r_t^*(i_t + \epsilon_1 + dep_{\text{``}con\text{''}})}\right)^2 + D_{2\text{``}con\text{''}}\left(\frac{r_{\text{``}con\text{''},t}}{e_t r_t^*(i_t + \epsilon_1 + dep_{\text{``}con\text{''}})}\right)$$

where

D_{1pro}	is a scale parameter,
$r_{pro,t}$	the rental rate of capital in sector *pro* at period t,
r_t^*	the international rental rate of capital at period t (exogenous),
i_t	the interest rate on domestic public debt at period t (exogenous),
ϵ_1	the country risk premium perceived by foreign investors (parameter),
D_{2pro}	a scale parameter.

I think that the rental rate of capital is a good determinant of FDI because it incorporates the influence of many FDI determinants identified in the empirical literature such as market size, growth rate or production costs. Indeed, it is given residually after deducing the value of intermediary consumption $\sum_i PC_{i,t}DI_{i,ps,t}$ and labour cost $w_tLD_{ps,t}$ from the value of production $P_{ps,t}XS_{ps,t}$.

$$r_{ps,t} = \frac{P_{ps,t}XS_{ps,t} - \sum_i PC_{i,t}DI_{i,ps,t} - w_tLD_{ps,t}}{KD_{ps,t}}$$

Domestic firms make their investment choice between sectors. Following Bourguignon et al. (1989), domestic investment increases with respect to the ratio of capital rental rate to its user cost:

$$\begin{aligned}\frac{DINV_{pro,t}}{KD_{pro,t}} &= D_{3pro}\left(\frac{r_{pro,t}}{PINV_t(i_t+\epsilon_2+dep_{pro})}\right)^2 + \\ & D_{4pro}\left(\frac{r_{pro,t}}{PINV_t(i_t+\epsilon_2+dep_{pro})}\right)\end{aligned}$$

$$\begin{aligned}\frac{DINV_{``con",t}}{KD_{``con",t}} &= D_{3``con"}\left(\frac{r_{``con",t}}{PINV_t(i_t+\epsilon_2+dep_{``con"})}\right)^2 + \\ & D_{4``con"}\left(\frac{r_{``con",t}}{PINV_t(i_t+\epsilon_2+dep_{``con"})}\right)\end{aligned}$$

where

$DINV_{pro,t}$	represents domestic investment in productive sectors at period t (volume),
D_{3pro}	a scale parameter,
ϵ_2	the country risk premium perceived by domestic investors (parameter). It is convenient to think that it is lower than the one perceived by foreign investors. I assume that ϵ_2 is the half of ϵ_1,
D_{4pro}	a scale parameter.

In tradable sectors, firms maximise their profits. Then, if the capital available is sector-specific, the profit or capital remuneration is residual and varies from a sector to another. This approach is obviously irrelevant in the public sector since the government, as a supplier of non-tradable services, does not have an optimisation behaviour. The cost and thus the price of public services is then the result of the combination of wage and capital costs. Consequently, the rental rate of capital is normalised in the public sector and capital demand is calculated in the following way:

$$KD_{pub,t} = \frac{PV_{pub,t}VA_{pub,t} - wg_tLDG_{pub,t}}{r_{pub,t}}$$

where

$PV_{pub,t}$	is the value added price of sector *pub* at period t,
wg_t	the public wage at period t (exogenous),
$LDG_{pub,t}$	the labour demand of sector *pub* at period t.

Therefore, the evolution of capital stock in public sectors can not agree with the updating mechanism of capital stock in private sectors, and investment in non-tradable sectors is endogenously determined by the model:

$$VARKD_{t+1} = KD_{\text{``}edu\text{''},t+1} - KD_{\text{``}edu\text{''},t}$$

As well, I need to add updating mechanisms for the following exogenous variables. Over time, rural population LSR_t grows at the exogenous population growth rate g_{LSR}, net of migration to urban areas MIG_t and of international migration from rural areas EMR_t.

$$LSR_{t+1} = LSR_t(1 + g_{LSR}) - MIG_t - EMR_t$$

Urban population LSU_t grows at the exogenous growth rate g_{LSU}. It receives internal migrants from rural areas MIG_t and sends migrants abroad EMU_t.

$$LSU_{t+1} = LSU_t(1 + g_{LSU}) + MIG_t - EMU_t$$

Migrant stock at period t is updated periodically with current migrant flows. This means that migrant stock at each period is composed of several generations of migrants that obviously have different remitting behaviours. Assuming that there is only three migrant generations, one should expect that new migrants remit more because they have the strongest ties with the family left behind. In contrast, the second generation that later brought spouses and children in the process of family reunification has lost some of its attachment to the country of origin, but still remits in order to support the parents left behind. The amount remitted is lower than the amount it should remit if all the family was still behind. The third generation of migrants is supposed to be highly integrated in the country of destination and barely remits. To sum up, the remitting behaviour depends on migrant generations that are determined by the length of migration. However, the duration of living abroad can not be reproduced in sequential dynamic models because they do not accommodate calculations that involve variables from an indefinite long past. Therefore, some simplifications need to be done. I present the adjustment mechanism of rural and urban migrant stocks in the following way: I assume that rural and urban migrant stocks of each period are composed of three generations according to the age of migrants and that the first generation always receives current migrants. This assumption is plausible since 74% of current migrant flows are aged between 15 and 29, according to Erf and Heering (2002). And, after years of migration, those young migrants pass to the second and third generations of older migrants. At the base year and for lack of data, I postulate that rural and urban migrant stocks have the same age distribution: 35% of migrants are aged between 15 and 29, 42% between 30 and 44, and 23% more than 45 (Erf and Heering, 2002). At the following period, a fraction of the first generation looses some of its attachment to the home country and is added to the second generation. As well, a fraction of the second generation becomes more disconnected from the family left behind and is added to the third generation.

$$STKR_{1,t+1} = STKR_{1,t}(1 - \chi_1) + EMR_t$$

for the first generation of rural migrants and:

$$STKU_{1,t+1} = STKU_{1,t}(1 - \chi_1) + EMU_t$$

for the first generation of urban migrants, where

$STKR_{1,t}$ is the first generation of rural migrants at period t

EMR_t the flow of rural migrants at period t,

$STKU_{1,t}$ the first generation of urban migrants at period t

EMU_t the flow of urban migrants at period t,

χ_1 the proportion of the first generation that passes periodically to the second generation. Assuming that migrants who are 29 years old at t will pass to the second generation at $t+1$ and that the number of migrants aged between 25 and 29 is equally distributed between age brackets, this parameter will be equal to 13%.

Now, the second generation of migrants at the following period is given by:

$$STKR_{2,t+1} = STKR_{2,t}(1-\chi_2) + \chi_1 STKR_{1,t}$$

for rural migrants and,

$$STKU_{2,t+1} = STKU_{2,t}(1-\chi_2) + \chi_1 STKU_{1,t}$$

for urban ones. where

χ_2 is the proportion of the second generation that passes periodically to the third one. Assuming that migrants who are 44 years old at t will pass to the third generation at $t+1$ and that the number of migrants aged between 30 and 44 is equally distributed between age brackets, this parameter will be equal to 7%.

Finally, the evolution of the third generation is given by:

$$STKR_{3,t+1} = STKR_{3,t} + \chi_2 STKR_{2,t}$$

$$STKU_{3,t+1} = STKU_{3,t} + \chi_2 STKU_{2,t}$$

The first generation of migrants remits to support the family left behind. Since remittances are motivated by altruism, the remittance rate by migrant rises with his income in the country of destination and decreases with the family real disposable income[10]. The remittance rate for rural and urban households is respectively given by:

$$RR_{``hr",t} = V_{1``hr"}(\frac{YD_{``hr",t}}{CPIR_t})^{\gamma_{1``hr"}} wi_t^{\gamma_{2``hr"}}$$

$$RR_{``hu",t} = V_{1``hu"}(\frac{YD_{``hu",t}}{CPIU_t})^{\gamma_{1``hu"}} wi_t^{\gamma_{2``hu"}}$$

where

$RR_{h,t}$	is the remittance rate to household h at period t,
V_{1h}	a scale parameter,
$YD_{h,t}$	the disposable income of household h at period t,
$CPIR_t$	the consumer price index in rural areas at period t,
$CPIU_t$	the consumer price index in urban areas at period t,
$\gamma_{1,h}$	the elasticity of remittance rate with respect to household h's income (-4.2% according to Bouhga-Hagbe, 2004),
wi_t	the international wage rate at period t (exogenous),
$\gamma_{2,h}$	the elasticity of remittance rate with respect to the international wage (1.8% according to Bouhga-Hagbe, 2004).

I arbitrarily assume that an individual belonging to the second generation of

[10] Tables III.12, III.13 and III.14 in Appendix C present some selected results of the sensitivity analysis on selected combinations of remittance elasticities with respect to household real income and with respect to the international wage. As expected, the results are not sensitive to the change of remittance elasticity with respect to the international wage because the latter is kept exogenous all along the model. By contrast, the change of remittance elasticity with respect to household real income alter the results. A lower elasticity implies a smaller reaction of remittances to household real income. Remittances increase or decrease less, for the same change of household real income. A higher elasticity generally increases the reaction of remittances to a change in household real disposable income. However, the results of the forthcoming simulations are qualitatively the same.

migrants remits the half of what it is supposed to remit, i.e. the half of the remittance rate by migrant, and that the third generation does not remit at all. Therefore, the value of remittances $REM_{h,t}$ received by household h at period t is:

$$REM_{\text{``}hr\text{''},t} = RR_{\text{``}hr\text{''},t}STKR_{1,t} + 1/2RR_{\text{``}hr\text{''},t}STKR_{2,t}$$

for the rural household and:

$$REM_{\text{``}hu\text{''},t} = RR_{\text{``}hu\text{''},t}STKU_{1,t} + 1/2RR_{\text{``}hu\text{''},t}STKU_{2,t}$$

for the urban household. The parameters χ_1 and χ_2 will be subject, later on, to a shock (a rise of 20%) in order to reflect how the restriction of Western immigration policies or permanent migration reduce the amount of remittances and thus affect the Moroccan economy.

Migratory movements involve financial costs (travel cost, search for an apartment, search for a job...) and psychological costs (change of the way of life, adaptation to a new culture and a new community...). However, the more people migrate to a particular destination, the more these costs are likely to decline. The existence of migrant networks improves the access to information by potential migrants left behind. For example, old migrants help reducing search costs regarding jobs and housing, providing additional insurance in case of anticipated events... The relation between migration costs and migrant networks is described as follows[11]:

$$MC_t = V_3(TSTK_t)^{\nu}$$

where

[11] Tables III.15, III.16 and III.17 in Appendix C present some results of the sensitivity analysis for selected value of migration cost elasticity with respect the total migrant stock. The higher the elasticity is, the greater migration costs react to the change of migrant stock. With a higher elasticity, migration costs decrease or increase more. The results show that when migration costs fall more, rural and urban emigration flows generally rise more, and *vice versa*. However, the change of migration flows is so close to the results of the model simulations reported below.

MC_t represents migration costs at period t,

V_3 a scale parameter,

$TSTK_t$ the total stock of migrants at period t:

$$TSTK_t = STKR_{1,t} + STKR_{2,t} + STKR_{3,t} + STKU_{1,t} + STKU_{2,t} + STKU_{3,t}$$

ν the elasticity of migration costs with respect to the total stock of migrants (=-1.5).

The stock of internal migrants to urban areas at the following period $ISTK_{t+1}$ is equal to the current stock to which is added the current internal migration flow:

$$ISTK_{t+1} = ISTK_t + MIG_t$$

Another adjustment equation is required for both domestic and external public debts. The stock of domestic public debt at the following period SDD_{t+1} is equal to the current stock SDD_t to which are added the interest rate on the current stock i_t and the accumulated debt during the current period DD_t. Besides, at each period, an adjustment variable for internal debt IA_t is introduced so that to keep the ratio of internal debt to GDP fixed and avoid infinite growth of interest rates paid by the government. The same adjustment mechanism prevails for the external public debt SFD_t[12].

$$SDD_{t+1} = (1 + i_t)SDD_t + DD_t - IA_t$$

$$SFD_{t+1} = (1 + i_t^*)SFD_t + FD_t - EA_t$$

[12] Internal and external public debt are respectively fixed to 56% and 15% of GDP (Ministry of Finance, Rabat).

The remaining exogenous variables evolve according to an average annual growth rate calculated over 5 or 10 years, depending on the availability of the data (See Appendix A). For instance, the evolution of public expenditures and investment is given by:

$$G_{i,t+1} = G_{i,t}(1 + g_G)$$

$$INVG_{t+1} = INVG_t(1 + g_{IG})$$

where

$G_{i,t}$	represents government expenditures on good i at period t,
g_G	the average annual growth rate of government expenditures,
g_{IG}	the average annual growth rate of public investment in infrastructure.

3 Simulation Experiments

The long-term tendency goes against the maintenance or increase of remittances. This is due to restrictive immigration policies especially in Europe and to the basic immigration tendencies: permanent installation of Moroccans in the immigration countries, family reunification, naturalisation, integration, ageing, and the succession of generations living abroad. Is this fear of remittance shortage justified? I answer this question by allowing a reduction in the number of migrants expected to remit. This shock, called SIM1, consists of a 20% rise in the erosion rate of the first and second generation of migrants, χ_1 and χ_2. As long as this fear of remittance scarcity is economically approved, what would be the best policies in order to take profit from current flows? According to Hamdouch (2000), this could be done by channelling remittances away from real estate to productive sectors in order to guarantee the conditions for a sustainable growth. Another option consists of reducing international transfer costs in order to increase the value of remittances received by the economy. SIM2 gives the impact of a 50% drop in the proportion of remittances invested in real estate, represented by the parameter *estate*. SIM3 represents a 20% drop in international transfer costs *tc*. Finally, according to the FEMISE Research Project (2004), the Moroccan government should remedy to the slow bureaucratic system and widespread lack of transparency that hamper migrants' intention to invest. In this context, government's policies to ameliorate the investment climate also affect the country risk premium perceived by domestic and foreign investors. Consequently, I run an additional simulation, SIM4, consisting of a 10% drop in the country risk premium perceived by foreign and domestic investors ϵ_1 and ϵ_2. Simulation experiments are summarised in Table III.3.

Table III.3: **Alternative Simulations**

Item	**Scenario Definitions**
SIM1	Remittance Slowdown: 20% rise in χ_1 and χ_2, the erosion rates of migrant generations
SIM2	Remittance Investment in Productive Sectors: 50% drop in *estate*, the proportion of remittances invested in real estate
SIM3	Lower Transfer Costs: 20% drop in international transfer costs *tc*
SIM4	Better Investment Climate: 10% drop in ϵ_1 and ϵ_2, the country risk premium perceived by foreign and domestic investors

Before displaying the results of the above simulations, let me recall that in dynamic models, the economy grows between periods even without a policy shock due to the updating mechanisms of the first-period exogenous variables. This growth path of the economy in the absence of any shock is called "Business As Usual" (BAU). In this model, updating procedures were added for public investment in infrastructure, public expenditures, transfers between agents, the stock of foreign and domestic public debt, migrant stocks, population and capital stock. How does the economy react to these mechanisms over periods?

The growing population induces a rise in rural and urban households' consumption that affects positively the demand addressed to sectors. Given that other things are equal, prices increase in order to equilibrate the markets. Firms are thus incited to produce more. This is translated in a higher economic growth (Table III.4). The additional demand for labour creates a pressure on rural and urban labour markets. Rural wage adjusts upward in order to balance rural labour market. Surprisingly, unemployment increases in urban areas, in spite of higher labour demand. Indeed, urban population grows not only accordingly to the population natural growth rate, but also due to internal migration from rural areas. In other words, labour supply growth exceeds the increase in labour demand so that unemployment rises. The wage curve insures that real urban wage decreases following the rise of unemployment. Furthermore, increasing prices raise the value of intermediary consumption by sector. Given that wages also increase, production costs grow and *ceteris paribus*, capital remuneration that is calculated residually decreases in most sectors. In sum, total factor remuneration increases in rural areas, inducing a rise in rural household income and a welfare[13] improvement by about 0.5% of his consumption budget. However, starting period 15, the price increase is such that rural household real disposable income decreases as well as rural welfare by 5% of his consumption budget. Despite the lower remuneration of urban labour and capital, urban household income also grows. Indeed, urban household receives interest payments on his lending to the government[14]. Given that other things are equal, the government borrows more in order to meet its investment in infrastructures. This results in higher interest payments to urban household and firms. Urban household welfare increases by about 2% of his consumption budget.

The increasing rural wage dampens migration intentions. On the contrary, urban individuals are motivated to leave the country. Additional migration of urban individuals helps reduce migration costs due to the increased network effect. Besides, urban household receives, as expected, a higher amount of remittances. Rural household also receives migrant remittances, although a lower amount than urban household, mainly because of the altruistic motive. It happens that rural

[13] Households' welfare is given by the equivalent variation (Equation 120 in Appendix C).

[14] Let me recall that in Morocco, only urban households and firms lend to the government (Abdelkhalek and Zaoujal, 2004).

household's real disposable income declines starting period 15, encouraging rural migrants to remit more in order to support their family left behind. The total amount of remittances grows and helps explain, besides economic growth, the rise of GNP. Given that other things are equal, it also induces an appreciation of the real exchange rate[15]. On the one hand, the appreciated real exchange rate hampers exports. On the other hand, it lowers the price of the foreign good in domestic currency and promotes imports. While the "nominal" exchange rate appreciation[16] should stimulate FDI due to profit repatriation, the diminishing rental rate of capital impedes FDI flows in almost all sectors. Domestic investment also decreases for the same reason.

After the shock, the economy will have another growth path due to the simultaneous effect of the shock and the updating mechanisms of the first-period exogenous variables. Consequently, the analysis should be done with respect to the BAU growth path. In other words, the value of a given variable at period t after the shock should be compared to its value at period t before the shock.

3.1 SIM1: Remittance Slowdown

A 20% rise in the erosion rate of migrant stocks has its first immediate impact on household income. When migrant stock is eroded, fewer rural and urban migrants will remit in the following period, leading, *ceteris paribus*, to a drop in rural and urban households' income (Table III.5). In addition, a part of remittances enters households' total savings and helps fund the domestic public debt. Since the amount of money remitted decreases, the government will be less able to borrow domestically and thus will have to pay a smaller amount of interest rates to the urban household and firms. Consequently, urban household income decreases after the

[15] The price of a unit of foreign currency in domestic currency.

[16] Let me recall that this is a real model. All variables are expressed in terms of GDP deflator that stands for the *numéraire*. I only use the term "nominal exchange rate" for convenience to outline the conversion unit of profits in foreign currency. However, since the real exchange rate (in terms of the *numéraire*) appreciates, it is also true to say that the "nominal" exchange rate or the conversion unit decreases.

Table III.4: **The BAU Growth Path**

Percentage Change with Respect to the Base Year

	t	**t+5**	**t+10**	**t+15**	**t+20**
Economic growth					
Real GDP at factor cost	0.00	1.47	3.46	4.71	5.13
Real GNP	0.00	4.99	10.07	15.09	20.16
Real wage					
Rural	0.00	11.84	14.39	13.76	10.76
Urban	0.00	-1.15	-1.47	-1.85	-2.64
Unemployment	0.00	26.12	40.94	52.64	62.53
Migration flows					
Rural	0.00	-12.01	-13.68	-13.42	-11.61
Urban	0.00	29.12	63.28	94.68	128.02
Internal	0.00	-40.04	-53.42	-59.02	-61.59
Migration costs	0.00	-30.78	-53.28	-66.84	-75.59
Households' real disposable income					
Rural	0.00	2.14	1.51	-0.08	-2.54
Urban	0.00	1.50	2.98	3.73	3.59
Remittances					
To rural household	0.00	7.94	22.95	40.04	62.84
To urban household	0.00	17.25	47.78	84.22	129.34
External trade					
Total export volume	0.00	-5.13	-9.19	-15.92	-25.80
Total import volume	0.00	4.69	6.73	7.51	7.26
Real exchange rate	0.00	-2.18	-2.32	-2.16	-1.77
Total investment volume					
Average rental rate of capital	0.00	-6.28	-10.31	-14.15	-18.12
FDI	0.00	-0.02	-0.05	-0.08	-0.12
Domestic investment	0.00	-5.82	-12.64	-21.81	-32.68

Source: Author's calculations.

simultaneous drop of remittances and interest rates received from the government. Given this evolution of households' income, it is not surprising to see households' consumption budget and welfare reduced. Rural and urban households' welfare maximum decreases with respect to the BAU growth path at the last period, respectively by 0.64% and 0.85% of their consumption budget. If all prices remain constant with respect to the BAU growth path, households will consume less goods and services, inducing *ceteris paribus* a drop in total internal demand addressed to each industry. Producers should reduce their production in order to meet the falling demand.

Since the proportion of remittances not consumed is saved and channelled to investment, one should expect, after the fall in the number of migrants who remit, a drop in domestic investments by destination of all sectors, and especially in real estate. Since the real estate sector is so integrated in the economy by highly consuming intermediate inputs from other sectors, the real estate contraction further helps reduce the demand addressed to sectors. However, domestic investment becomes more profitable in some sectors because, as it will be shown below, the rental rate of capital increases with respect to the investment aggregate price (agriculture, mining industry, textile and clothing, leather industry, chemistry, rubber and plastic, metallurgy, radios and TV, medical instruments, manufacture of other transport means). In these sectors, domestic investment increases, and consequently the volume of production, in spite of lower domestic demand. But finally, the overall economic activity slows down with respect to the BAU growth path. GNP decreases more than GDP due to lower remittances. On the one hand, the contraction of the overall urban activity induces a drop of urban labour demand. Consequently, urban unemployment rate increases, inducing a drop in urban real wage. On the other hand, the expansion of the agricultural sectors stimulates rural labour demand. Rural wage adjusts upward in order to balance the market.

Remittances to Morocco are computed in the BoP as current transfers. Since external savings are constant for a given period, the drop in remittances should be compensated by a decrease of the payments to the rest of the world. Therefore, a depreciation of the real exchange rate is necessary. On the one hand, the depreciated real exchange rate boosts exports. On the other hand, it raises the price of imports in domestic currency and thus affects upward the composite price of tradable goods. This results in higher consumer price indexes in rural and urban areas. Domestic agents prefer then to rely on domestic products. Total import volume decreases. It happens that the above-expanding sectors compete the most with imports. Therefore, when imports become more expensive, domestic agents consume mostly domestic products and sectors that initially highly compete with imports expand. In those sectors, labour demand thus increases and, given that other things are equal, the physical marginal productivity of capital as well as capital remuneration increases.

The rise in rural consumer price index decreases rural real wage. The depreciated "nominal" exchange rate also raises the wage of international migrants in domestic currency. With the "nominal" exchange rate depreciation and the real wage drop, rural and urban people are motivated to migrate. At each period, the network effect increases with the accumulation of migrant flows, and reduces migration costs. This further stimulates migration in the following period. Despite the increase of migration flows, the total value of remittances continues to shrink because at each period, fewer migrants are supposed to remit. Internal migration first decreases because the rural real wage increases with respect to the urban expected real wage. However, it starts increasing after period 15 when the rural real wage further decreases.

The "nominal" exchange rate depreciation reduces the value of repatriated profits in foreign currency and consequently discourages FDI. After few periods, the increasing domestic investment in some of the above-mentioned sectors (agriculture, leather industry, rubber and plastic, metallurgy) is more than compensated by falling FDI. In total, the aggregate volume of capital invested in these sectors decreases. Given that other things are equal, the initially expanded sectors shrink. In sum, it turns out that the drop in capital invested in the different sectors is higher than the fall in labour demand so that the marginal productivity of capital, and *ceteris paribus* the return on capital, increases.

The segmentation of the savings market better draws the allocation of investment between sectors, by allowing different types of savings to finance different investments. While domestic investment is driven by the differential between the sectoral rental rate of capital and the aggregate price of investment, foreign investment is triggered by the differential between the domestic and international rental rate of capital, and public investment is exogenous because it stems from a public decision. Therefore, there is no reason at all to have the same evolution for these different types of investments with respect to the BAU growth path. Domestic investment could be rising in some sectors and foreign investment decreasing due to the “nominal” exchange rate depreciation (such as agriculture, textile and clothing, chemistry, rubber and plastic, metallurgy, manufacture of other transport means). Therefore, the evolution of total investment in these sectors is ambiguous: it depends on the magnitude of each investment flow. The results show that the change in domestic investment outweighs the change in foreign investment. Without a segmentation of the savings market, investment by destination of all sectors will have the same determinants and the results will absolutely be different from above because investment determines the volume of capital used in the production process and, *ceteris paribus*, the volume of production. Depending on the evolution of the production in the different sectors, the economy will grow or shrink, affecting the demand for labour and factor remuneration.

Table III.5: **SIM1: Remittance Slowdown**

Percentage Change with Respect to the BAU Growth Path

	t	**t+5**	**t+10**	**t+15**	**t+20**
Economic growth					
Real GDP at factor cost	0.00	-0.04	-0.13	-0.27	-0.46
Real GNP	0.00	-0.08	-0.17	-0.29	-0.47
Real wage					
Rural	0.00	-0.03	-0.15	-0.32	-0.54
Urban	0.00	-0.04	-0.07	-0.10	-0.17
Unemployment	0.00	0.24	0.31	0.42	0.55
Migration flows					
Rural	0.00	0.42	0.75	1.01	1.29
Urban	0.00	0.71	1.15	1.55	2.01
Internal	0.00	-0.24	-0.17	-0.05	0.05
Migration costs	0.00	-0.06	-0.30	-0.58	-0.88
Households’ real disposable income					
Rural	0.00	-0.31	-0.65	-0.99	-1.33
Urban	0.00	-0.32	-0.59	-0.85	-1.13
Remittances					
To rural household	0.00	-3.05	-5.24	-6.28	-6.49
To urban household	0.00	-2.77	-4.12	-4.37	-4.01
External trade					
Total export volume	0.00	0.40	0.93	1.16	1.21
Total import volume	0.00	-0.42	-0.73	-1.04	-1.37
Real exchange rate	0.00	0.28	0.42	0.53	0.64
Total investment volume					
Average rental rate of capital	0.00	0.04	0.22	0.47	0.59
FDI	0.00	-0.55	-0.85	-1.18	-1.59
Domestic investment	0.00	-0.30	-0.61	-1.02	-1.55

Source: Author’s calculations.

3.2 SIM2: Remittance Investment in Productive Sectors

As mentioned earlier, the proportion of remittances invested in real estate is considered exogenous because the main purpose of sending money to Morocco is to support the family left behind and/or to build a large new house offering the family more convenient living, privacy and safety that were virtually absent in traditional dwellings (de Haas, 2003; FEMISE, 2004). This means that investment in real estate is driven by altruistic motives and not by profitability, like investment in other sectors. Real estate absorbs 80% of investments by MRA in their country of origin. However, Hamdouch (2000) noticed a change in the investment intentions of the migrants interviewed, who plan to accord, from now on, only 36% of their investment projects to real estate, mainly because they have intensively invested in real estate. How does this change in MRA's investment behaviour affect the Moroccan economy?

A 50% drop in the proportion of remittances invested in real estate should raise the proportion of remittances going to productive sectors and thus, domestic investment in productive sectors. Given that other things are equal, this should lead to a contraction of the construction sector and to a expansion of productive sectors. Surprisingly, the vast majority of productive sectors shrink, negatively affecting the overall economic activity (Table III.6). But this does not look odd anymore when one looks deeply to the structure of the construction sector: intermediary consumption accounts for 66% of the production value. So, when investment is reduced, inducing *ceteris paribus* a contraction of this sector, producers cut down their consumption of intermediary inputs, given the existing complementarity between production and intermediary consumption. Thus, internal demand addressed to the different sectors decreases, and producers choose to restrain their production. Only the following sectors (agriculture, food industry, editing, furniture and non financial services) are not affected because they offer no or little intermediary inputs to the real estate sector.

The expanding sectors increase rural and urban labour demand. This causes rural wage to rise and urban unemployment rate to fall in order to balance rural and urban labour markets. The wage curve guarantees that real urban wage increases following the lower unemployment rate. Given that other things are equal, the lower labour demand in the contracted sectors induces a drop in the marginal productivity of capital, and *ceteris paribus* a fall in the rental rate of capital that negatively affects overall capital remuneration. The downward evolution of capital remuneration reduces rural household income, consumption budget and welfare. Welfare deterioration with respect to the BAU growth path reaches -0.68% of rural household's consumption budget. However, urban household income rises and his welfare maximum improves at period 6 by 0.08% of his consumption budget. Lower consumption further depresses the demand addressed to the different sectors, whatever the goods are imported or produced domestically. Given that other things are equal, producers lower their prices. After some periods, agriculture is also affected by diminishing consumption. Labour demand decreases in rural areas and rural wage falls in order to equilibrate the market. Later on, the initially expanding urban sectors are touched as well. Urban labour demand then decreases and unemployment increases. Real urban wage falls, as expected. Now, urban household income also decreases with respect to the BAU growth path, and so does his welfare. Welfare deterioration reaches 0.21% of his conusmption budget at the final period.

Migration intentions to foreign countries are dampened with the wage improvement. When fewer people migrate, in comparison with the BAU growth path, the network effect is lessened and migration becomes more expensive. This further discourages international migration. However, since internal migration costs are supposed constant, the wage differential between rural and urban areas stimulates internal migration. Although lower migration is expected to reduce the amount of money remitted, this is only true, over some periods, for urban household. Indeed, in accordance with the altruistic motive, rural migrants remit a greater amount because rural household's real disposable income falls. But in sum, the total amount of remittances increases, inducing an appreciation of the real exchange rate in order to maintain external savings fixed. The competitiveness of local producers on international markets is thus deteriorated. While one expects that the "nominal" exchange rate appreciation would have a stimulating effect on FDI, the results show that this positive effect is counterbalanced by the detrimental role of a lower rental rate of capital on FDI intentions in the different sectors. By contrast, the drop of the aggregate price of investment compensates the negative evolution of the rental rate of capital over some periods, so that domestic investment increases until period 15. The positive evolution of remittances also induces a lower drop of GNP, when compared to GDP.

The predictions of this shock are unexpected. Scholars think that the allocation of migrant investment to productive sectors should promote economic growth by allowing a better productivity growth. However, it appears that there is a strong demand effect that comes into play. This demand effect is related to the linkages that transmit the negative impact of a particular shock on the production of the real estate sector to the other ones, through lower intermediary consumption.

3.3 SIM3: Lower Transfer Costs

As shown in section 2, the cost and delay of transfers are high. I evaluate here the impact of a 20% drop in international transfer costs and look if this could constitute a good opportunity to take the maximum profit from remittances before their long-term downward evolution.

When transfer costs decrease, households receive a larger value of remittances with respect to the BAU growth path, that increases their income, consumption budget and welfare (Table III.7). Welfare improvement is maximum at the last period, reaching 0.16% of the consumption budget for rural household and 0.2% for urban household.

Furthermore, as long as a fraction of remittances is invested, the drop in transfer costs should, *ceteris paribus*, boost domestic investment in all sectors, and mostly

Table III.6: **SIM2: Remittance Investment in Productive Sectors**

Percentage Change with Respect to the BAU Growth Path

	t	**t+5**	**t+10**	**t+15**	**t+20**
Economic growth					
Real GDP at factor cost	0.00	-0.13	-0.39	-0.69	-1.01
Real GNP	0.00	-0.09	-0.28	-0.48	-0.67
Real wage					
Rural	0.00	0.00	-0.11	-0.32	-0.62
Urban	0.00	0.05	0.04	0.01	-0.03
Unemployment	0.00	-0.51	-0.44	-0.11	0.30
Migration flows					
Rural	0.00	-0.30	-0.65	-0.91	-1.18
Urban	0.00	-0.71	-1.23	-1.31	-1.27
Internal	0.00	0.47	0.83	1.01	1.18
Migration costs	0.00	0.04	0.29	0.56	0.78
Households' real disposable income					
Rural	0.00	-0.03	-0.15	-0.32	-0.50
Urban	0.00	0.06	-0.02	-0.16	-0.26
Remittances					
To rural household	0.00	0.08	0.43	0.96	1.53
To urban household	0.00	-0.34	-0.51	-0.33	0.04
External trade					
Total export volume	0.00	-0.13	-0.57	-1.32	-2.39
Total import volume	0.00	-0.15	-0.43	-0.74	-1.00
Real exchange rate	0.00	-0.20	-0.39	-0.55	-0.76
Total investment volume					
Average rental rate of capital	0.00	-0.29	-0.69	-1.09	-1.49
FDI	0.00	-0.26	-0.61	-0.99	-1.33
Domestic investment	0.00	0.17	0.16	0.02	-0.09

Source: Author's calculations.

in real estate. However, domestic investment by destination of some sectors shrinks (agriculture, mining industry, textile and clothing, leather and shoes industry, chemistry, rubber industry, metallurgy, machines and equipment, radios and TV, medical instruments and manufacture of other transport means) because the rental rate of capital in these sectors decreases with respect to the aggregate price of investment. At the next period, the volume of capital follows, *ceteris paribus*, the evolution of domestic investment. When it rises, the corresponding sectors produce more and vice versa. Since the majority of sectors expand, the GDP grows, dragging in its way the GNP.

Producers ask for additional rural and urban labour. Thus, rural wage adjusts upward in order to balance rural labour market. In urban areas, unemployment decreases and the wage curve insures that real urban wage increases. Therefore, migration flows are dampened. The network effect is then reduced, inducing a rise in migration costs. Moreover, when the economy receives a larger amount of remittances, an appreciation of the real exchange rate is necessary in order to increase the payments to the rest of the world and maintain external savings constant. The "nominal" exchange rate appreciation reduces the value of the international wage in domestic currency and besides higher migration costs, further discourages international migration. Fewer people migrate, and the less will be the amount of remittances in the following period.

On the one hand, the real exchange rate appreciation restrains export competitiveness on international markets, inducing a drop in total export volume. On the other hand, it decreases the relative price of imports in domestic currency, and thus encourages domestic agents to consume cheaper imported products. It happens that the above-contracted sectors compete the most with imports. Given that other things are equal, producers facing lower internal demand are obliged to reduce their sales. The contracted sectors release labour, and *ceteris paribus*, the marginal productivity of capital as well as the rental rate of capital go down. This explains the drop of investment by destination of these sectors.

FDI, triggered by the differential between the domestic and international return on capital, is more profitable in almost all sectors (in comparison with the BAU growth path) due to the "nominal" exchange rate appreciation. This is however not the case of domestic investment that rises only in some sectors. Therefore, the total volume of capital invested in each sector depends on the magnitude of each kind of investment financed by different sources of savings. This is how the assumption about a segmentation of the savings market affects the result.

Now, should transfer costs be reduced in the short run? What about the effect of a late implementation of this measure? I answer this question by simulating an additional shock, SIM3B, that explores the simultaneous impact of permanent migration and lower international transfer costs, i.e the combination of SIM1 and SIM3 (Table III.8). I find that permanent migration reduces the positive effect

Table III.7: **SIM3: Lower Transfer Costs**

Percentage Change with Respect to the BAU Growth Path

	t	t+5	t+10	t+15	t+20
Economic growth					
Real GDP at factor cost	0.02	0.04	0.07	0.11	0.14
Real GNP	0.04	0.05	0.07	0.09	0.11
Real wage					
Rural	0.01	0.04	0.08	0.11	0.15
Urban	0.03	0.01	0.02	0.02	0.03
Unemployment	-0.22	-0.10	-0.11	-0.13	-0.15
Migration flows					
Rural	0.00	-0.18	-0.18	-0.19	-0.21
Urban	0.00	-0.27	-0.26	-0.31	-0.36
Internal	0.00	0.03	-0.03	-0.05	-0.05
Migration costs	0.00	0.07	0.13	0.18	0.22
Households' real disposable income					
Rural	0.14	0.15	0.18	0.21	0.25
Urban	0.16	0.15	0.17	0.21	0.24
Remittances					
To rural household	-0.59	-0.69	-0.86	-1.02	-1.19
To urban household	-0.66	-0.73	-0.91	-1.09	-1.29
External trade					
Total export volume	-0.11	-0.19	-0.17	-0.12	-0.05
Total import volume	0.23	0.16	0.19	0.22	0.26
Real exchange rate	-0.18	-0.08	-0.07	-0.08	-0.08
Total investment volume					
Average rental rate of capital	0.04	-0.04	-0.09	-0.09	-0.15
FDI	0.36	0.18	0.21	0.26	0.32
Domestic investment	0.16	0.15	0.21	0.28	0.36

Source: Author's calculations.

of lower transfer costs on household income. Rural and urban households' income increase over the first periods by less than SIM3 and so does households' consumption budget. Households' demand motivates producers to adjust upward their production and this promotes economic growth. Economic performance is however inferior to the one obtained when SIM3 is run alone. In addition, the negative effect of permanent migration on the amount remitted compensates the positive effect of lower transfer costs. On the BoP level, the drop in the amount remitted induces a depreciation of the real exchange rate that encourages exports and discourages more expensive imports. The "nominal" exchange rate depreciation dampens FDI because of lower profit repatriation. On the household level, decreasing remittances reduce households' income and welfare. On the one hand, domestic investment financed by remittances falls. On the other hand, private consumption decreases. Producers adjust their production downward in order to meet the lower demand. But the slowdown of economic activity is lower than SIM1. Wages decrease following the lower demand for labour and people are motivated to leave the country. In sum, if this option should be undertaken, this has to be done before the slowdown of remittances.

Table III.8: **SIM3B: Remittance Slowdown and Lower Transfer Costs**
Percentage Change with Respect to the BAU Growth Path

	t	**t+5**	**t+10**	**t+15**	**t+20**
Economic growth					
Real GDP at factor cost	0.02	0.00	-0.06	-0.17	-0.32
Real GNP	0.04	-0.04	-0.10	-0.20	-0.30
Real wage					
Rural	0.01	0.01	-0.07	-0.21	-0.39
Urban	0.03	-0.03	-0.05	-0.08	-0.13
Unemployment	-0.22	0.15	0.20	0.29	0.40
Migration flows					
Rural	0.00	0.24	0.57	0.83	1.08
Urban	0.00	0.45	0.90	1.24	1.65
Internal	0.00	-0.21	-0.20	-0.09	0.00
Migration costs	0.00	0.02	-0.17	-0.41	-0.67
Households' real disposable income					
Rural	0.14	-0.17	-0.48	-0.79	-1.09
Urban	0.16	-0.18	-0.42	-0.65	-0.90
Remittances					
To rural household	-0.59	-3.71	-6.04	-7.21	-7.58
To urban household	-0.66	-3.47	-4.98	-5.41	-5.24
External trade					
Total export volume	-0.11	0.22	0.70	1.01	1.17
Total import volume	0.23	-0.26	-0.55	-0.82	-1.12
Real exchange rate	-0.18	0.21	0.35	0.45	0.55
Total investment volume					
Average rental rate of capital	0.04	0.00	0.13	0.37	0.49
FDI	0.36	-0.38	-0.64	-0.93	-1.28
Domestic investment	0.16	-0.15	-0.41	-0.75	-1.20

Source: Author's calculations.

3.4 SIM4: Better Investment Climate

There is a widespread perception that migrants might invest in their country of origin if they possessed the necessary information and were encouraged to do so. The increased allocation of remittances for private investment could then contribute to sustained and higher economic growth. In this regard, measures to enhance the investment climate characterised by a slow bureaucratic system and widespread lack of transparency should help (FEMISE, 2004). Such measures influence the country risk premium. Its improvement can perfectly reflect the policies adopted by the government in order to attract investments. For this reason, I assess the impact of a 10% drop in the country risk premium perceived by domestic investors. As pointed out earlier, the risk premium perceived by local investors is lower than the one perceived by foreign investors because the formers are more familiar with investment procedures and business atmosphere in their country. However, when the country risk premium perceived by local investors is improved, foreigners will also have a better perception of the investment climate that should trigger foreign investment.

As expected, foreign and domestic investors have greater confidence in investment: this is reflected by a simultaneous increase of domestic and foreign investments in comparison with the BAU growth path (Table III.9). Given that other things are equal, the capital used in the production of all sectors rises in the next period. The production follows, *ceteris paribus*, the evolution of the capital volume. This is translated in higher GDP and GNP. Since domestic producers offer their production on local and international markets, the production growth should be reflected in increased exports and local supply. A depreciation of the real exchange rate is therefore necessary to guarantee the competitiveness of local producers on international markets and stimulate exports. I recall that export expansion increases total factor productivity growth in the corresponding sectors. Imports also increase in order to maintain external savings fixed.

Rural and urban labour demand increase with the expansion of rural and urban sectors. Rural wage rises, as expected in order to balance rural labour market. In urban areas, unemployment falls and real urban wage rises, as predicted by the wage curve. While one should expect a drop in international migration from rural and urban areas after the increase in rural and urban wages, it seems that the exchange rate depreciation counterbalances the downward effect of the wage improvement on migration intentions. However, this is only true over the first periods. Later on, international migration flows decrease. The network effect strengthens with migrant number and is inversely related to migration costs. Internal migration is dampened, as expected. Households' income and welfare increase following the improvement of labour remuneration. Welfare improvement is the greatest here, reaching respectively about 2% and 1.55% of rural and urban hoseholds' consumption budget at the last period. Since remittances are motivated by altruism, migrants remit a smaller amount. That is why GNP grows less than GDP. Households consumption further stimulates the economic activity. The growing labour demand is such that the marginal productivity of capital increases as well as, *ceteris paribus*, capital remuneration. This further encourages FDI and domestic investment.

The improvement of the risk premium reduces the possibilities for the government to borrow domestically by channelling a part of local savings to investment. But the government's investment objective in infrastructures is met thanks to the improvement of public savings. Indeed, the amount of direct taxes and imports tariffs collected by the government induces a rise in public savings. This leads to a downward adjustment of the indirect tax rate in order to keep the ratio of government savings to GDP fixed.

I should also point out that this policy needs to be settled before the cut down in remittances. Indeed, I run SIM4B that is a combination of SIM1 and SIM4 (Table III.10) and find that permanent migration reduces the economic performance due to the improvement of the country risk premium, because permanent migration is translated in lower remittances, and thus, lower domestic investment. It also reduces households' welfare with respect to SIM4: permanent migration causes a negative economic growth that induces a lower labour demand. Consequently, wages fall down in comparison to SIM4, dragging in their way households' income and welfare. The economy receives now a smaller amount of remittances because of permanent migration (SIM1) and the altruistic motive (SIM4). Therefore, the real exchange

Table III.9: **SIM4: Better Investment Climate**
Percentage Change with Respect to the BAU Growth Path

	t	**t+5**	**t+10**	**t+15**	**t+20**
Economic growth					
Real GDP at factor cost	0.00	0.49	1.12	1.67	2.12
Real GNP	0.00	0.22	0.68	1.05	1.29
Real wage					
Rural	0.00	0.60	1.14	1.64	2.09
Urban	0.00	0.00	0.00	0.04	0.10
Unemployment	0.00	-0.65	-1.64	-2.22	-2.47
Migration flows					
Rural	0.00	0.34	0.13	-0.03	-0.01
Urban	0.00	0.43	-0.64	-1.50	-1.93
Internal	0.00	-0.84	-0.77	-0.81	-0.97
Migration costs	0.00	-0.16	-0.16	0.05	0.33
Households' real disposable income					
Rural	0.00	0.38	0.78	1.12	1.37
Urban	0.00	0.21	0.62	0.92	1.11
Remittances					
To rural household	0.00	-1.47	-3.06	-4.43	-5.48
To urban household	0.00	-0.61	-2.46	-4.18	-5.48
External trade					
Total export volume	0.00	1.23	2.89	4.89	7.27
Total import volume	0.00	0.01	0.46	0.81	0.93
Real exchange rate	0.00	0.35	0.36	0.39	0.52
Total investment volume					
Average rental rate of capital	0.00	0.09	0.31	0.66	1.08
FDI	2.73	3.28	4.00	4.59	4.96
Domestic investment	1.56	2.52	3.67	4.64	5.45

Source: Author's calculations.

rate depreciates more in order to maintain external savings fixed. On the one hand, the real exchange rate depreciation further boosts exports. On the other hand, it raises the price of imported products in domestic currency. This is translated in higher composite prices of tradable goods. Real urban wage decreases because the wage increase is more than compensated by the growth of the urban consumer price index.

4 Conclusion

This chapter tackles a debatable issue regarding the impact of remittances on the Moroccan economy. Policy makers in less developed as well as developed countries have implicitly assumed that remittances benefit the country of origin. Morocco has

Table III.10: **SIM4B: Permanent Migration and Better Investment Climate**

Percentage Change with Respect to the BAU Growth Path

	t	**t+5**	**t+10**	**t+15**	**t+20**
Economic growth					
Real GDP at factor cost	0.00	0.45	0.99	1.40	1.67
Real GNP	0.00	0.14	0.52	0.77	0.89
Real wage					
Rural	0.00	0.56	1.00	1.33	1.57
Urban	0.00	-0.07	-0.06	-0.06	-0.06
Unemployment	0.00	-0.41	-1.34	-1.83	-1.94
Migration flows					
Rural	0.00	0.75	0.85	0.94	1.21
Urban	0.00	1.14	0.46	-0.05	-0.06
Internal	0.00	-1.08	-0.93	-0.85	-0.92
Migration costs	0.00	-0.21	-0.45	-0.51	-0.51
Households' real disposable income					
Rural	0.00	0.07	0.14	0.15	0.06
Urban	0.00	-0.11	0.05	0.09	0.00
Remittances					
To rural household	0.00	-4.50	-8.21	-10.56	-11.81
To urban household	0.00	-3.37	-6.56	-8.55	-9.53
External trade					
Total export volume	0.00	1.63	3.77	6.04	8.53
Total import volume	0.00	-0.42	-0.24	-0.19	-0.39
Real exchange rate	0.00	0.63	0.76	0.89	1.12
Total investment volume					
Average rental rate of capital	0.00	0.09	0.54	1.12	1.67
FDI	2.73	2.71	3.16	3.42	3.38
Domestic investment	1.56	2.23	3.06	3.64	3.90

Source: Author's calculations.

even used these possible benefits to underpin its emigration policy. But now, this is not the main question. Surveys on Morocco showed that remittances have most of the time been beneficial. The question is how to take the maximum profit from this external source of funding in a way to enhance the development of this country and cushion its transition to be gradually less dependent on remittances.

This chapter fills the gap in the Moroccan literature on remittances by assessing the impact of remittances and their alternative uses. In this sense, it differs from the work on Morocco that consists of surveys and studies on particular regions. It also adds to the literature on MENA countries that have been generally ruled out in this context, in spite of their high dependency on remittances. The main contribution of this chapter is to model a segmentation of the savings market, where remittances do not finance the same sectors as domestic investment or FDI. This is supposed to better draw the reality since different sources of investment do not have the same determinants and affect differently the sectors of destination.

The fear from the cut down of remittances seems to be justified. The overall economic growth and households' welfare are reduced. I use a dynamic CGE model of the Moroccan economy, calibrated on the SAM of the year 1998, to investigate policies allowing to take the best profit from current remittance flows. I simulate the effects of a 50% drop in the proportion of remittances invested in real estate, a 20% drop in transfer costs and a 10% drop in the country risk premium perceived by investors. Nonetheless, not all the policies proposed by surveys are advantageous. Surprisingly, it turns out that the drop of the proportion of remittances invested in real estate reduces economic growth and welfare. Indeed, the linkages between construction and other sectors appear to be important so that a negative shock on real estate production also affects others sectors through a drop in intermediary demand addressed to them. Lower transfer costs and the improvement of the country risk premium both lead to an overall activity growth and to welfare improvement, still more pronounced in the second case.

III.A Appendix A: Data

The model is calibrated on the Moroccan SAM described in Appendix A of Chapter 1. I further decompose the SAM in order to distinguish between rural and urban areas and take into account two categories of household: a rural household offering his working hours to rural sectors and an urban household offering his working hours to urban sectors[17].

FDI flows are distributed between sectors according to data from the Moroccan BoP of 1998. Even though the number of sectors considered in the SAM does not match those of the BoP, the correspondence between sectors is easy to establish. The repartition of the gross fixed capital formation between aggregate sectors is derived from national accounts. The difference between total gross fixed capital formation and FDI volume gives the volume of investment by domestic agents (households, firms and the government). Public investment in infrastructure represents 3.5% of GDP (author's calculation from national accounts). In 1998, the public debt represented 89% of GDP with 51% of GDP external and 38% internal (Ministry of Finance, Rabat).

Finally, migration data are taken from several sources:

1- To quantify Moroccan emigration, I resort to the data published by the OECD in 2006 on immigrant inflows by nationality in some OECD countries. I approximate Moroccan emigration by the flows of Moroccan migrants to their traditional destinations in 1999, such as Belgium, France, Italy, the Netherlands and Spain. The sum of these flows (63,200 migrants) is reported to the Moroccan working population of 1999 in order to calculate the annual percentage of emigrants (0.6%). I also use the stocks of Moroccan migrants in the previous selected countries in order to approximate the stock of migrants necessary to the adjustment of the model in the dynamic framework.

2- According to a report of the International Organisation of Migration (Erf and

[17] For further details, see Appendix A in Chapter 2.

Heering, 2002), Moroccan emigration to European countries is more originated from rural areas. Therefore, I suppose that 60% of the national emigration flow/stock take place from rural areas and 40% from urban areas.

3- Agénor and El Aynaoui (2003) point out that each year, around 200,000 workers migrate from rural to urban areas. This corresponds approximately to 4% of the 1999 rural working population.

For the majority of exogenous variables, I observed their evolution over 5 or 10 years, according to data availability, and calculated their average annual growth rate. I retained respectively the following values for public expenditures and public investment in infrastructure: 2.9%, 2.3%. The rural population natural growth rate (2.6%) is taken from Agénor and El Aynaoui (2003). The urban population natural growth rate (0.8%) is based on author's calculations. For lack of data, minimum consumption and exogenous transfers to and from households are updated according to the population growth rate.

Finally, I report the values of some parameters imported from external sources: the absolute value of the wage elasticity with respect to unemployment is fixed to 0.1 (See Chapter 2), transfer costs represent 9% of the amount of the transaction (Barendse, Hiddink, Janszen and Stavast, 2006), the risk premium is fixed at 4.88% (United States Agency for International Development (USAID)) and the capital depreciation rate at 8% (Agénor and El Aynaoui, 2003). Armington and exports elasticities, respectively 2 and -5, are borrowed from the literature on Morocco (Löfgren et al., 1999; Rutherford et al., 1997).

III.B Appendix B: Mathematical Statement of the Model

Set indices are given by lower-case Latin letters as subscripts to variables and parameters. Parameters are represented with lower-case Latin letters or lower-case Greek letters, endogenous variables with upper-case Latin letters without a bar, exogenous variables with upper-case Latin letters with a bar.

Sets

$j \in J$	Sectors
$i \in I$	Products (=J)
$tr \in TR \subset J$	Tradable sectors
$ntr \in NTR \subset J$	Non-tradable sectors
$ps \in PS \subset J$	Private sectors
$pub \in PUB \subset J$	Public sectors
$pro \in PRO \subset PS$	Productive sectors
$ru \in RU \subset PS$	Rural private sectors
$up \in UP \subset PS$	Urban private sectors
$ag \in AG$	Agents
$da \in DA \subset AG$	Domestic agents
$h \in H \subset AG$	Households
$t \in T$	Time period

Parameters

α_{ps}	Share parameter of the CES value added of sector ps
σ_{ps}	Elasticity of substitution between labour and capital (positive)
l_{pub}	Labour share in public value added (Leontief)
k_{pub}	Capital share in public value added (Leontief)
io_j	Share of intermediary consumption in the production (Leontief) of sector j
v_j	Share of value added in the production (Leontief) of sector j
$aij_{i,j}$	Intermediary consumption of good i by unit of production of sector j
B_1	Scale parameter of the CET function of the rural population
ϖ_1	Share parameter of this function
ε_1	Elasticity of transformation between international rural migrants and national workers (negative)

B_2	Scale parameter of the CET function of the rural population that decides to stay in Morocco
ϖ_2	Share parameter of this function
ε_2	Elasticity of of transformation between internal migrants and rural workers (negative)
B_3	Scale parameter of the CET function of the urban population
ϖ_3	Share parameter of this function
ε_3	Elasticity of of transformation between international urban migrants and urban workers (negative)
imc	Internal migration costs
η_{ag}	Share of capital remuneration received by agent ag
ϕ_{ag}	Share of labour remuneration received by agent ag
tc	transfer costs
ϑ_{ag}	Part of interest rates on domestic public debt going to agent ag
V_{1h}	Parameter in the international remittance rate function of household h
υ	Part of stock variation financed by foreign firms
$\gamma_{1,h}$	Elasticity of international remittance rate with respect to household h's real income
$\gamma_{2,h}$	Elasticity of international remittance rate to household h with respect to the international wage
V_2	Parameter in the remittance rate function from urban to rural household
γ_3	Elasticity of internal remittance rate with respect to rural household real income
ψ_h	Household's h propensity to save
ty_h	Direct tax rate on household h's income
tye	Direct tax rate on firms' income
tx_j	Indirect tax rate on sector j products
tm_{tr}	Import tariff rate on product tr
te_{tr}	Export tariff rate on product tr
ς	Export externality parameter (positive)
C_{1tr}	Scale parameter of the CET production function
δ_{1tr}	Share parameter of this function
κ_{1tr}	Transformation elasticity of the CET production function (negative)
φ_{tr}	Price elasticity of export demand
C_{2tr}	Scale parameter of the Armington CES function
δ_{2tr}	Share parameter of this function
κ_{2tr}	Substitution elasticity of the Armington function (positive)
$\beta_{i,h}$	Budgetary share of good i in the supernumerary income of household h
μ_i	Share of product i in total investment value
D	Scale parameter of the wage curve
ζ	The absolute value of the wage elasticity with respect to unemployment
θ_{1i}	Weight of commodity i in the consumer price index
$\theta_{2i,\text{“}hr\text{”}}$	Weight of commodity i in rural consumer price index
$\theta_{2i,\text{“}hu\text{”}}$	Weight of commodity i in urban consumer price index

θ_j	Share of sector j value added in GDP at factor cost
χ_1	Erosion rate of the first generation of migrants
χ_2	Erosion rate of the second generation of migrants
dep_{ps}	Capital depreciation rate of sector ps
D_{1ps}	Parameter in the FDI equation
D_{2ps}	Parameter in the FDI equation
ϵ_1	The country risk premium perceived by foreign investors
ϵ_2	The country risk premium perceived by domestic investors
D_{3ps}	Parameter in the equation of domestic investment by households and firms
D_{4ps}	Parameter in the equation of domestic investment by households and firms
V_3	Parameter in the international migration cost function
ν	Elasticity of international migration costs to the stock of international migrants (negative)
g_G	Growth rate of government expenditures
g_{IG}	Growth rate of public investment in infrastructure
g_{LSR}	Natural growth rate of rural population
g_{LSU}	Natural growth rate of urban population
F	Parameter in the domestic public debt function
ξ	Elasticity of domestic public debt financed by households and firms with respect to the risk factor (positive)
$cons$	Part of international remittances going to consumption
$estate$	Part of international remittances (net of the amount consumed) going to real estate

Endogenous Variables

a) **Prices**

wr_t	Rural wage rate
wu_t	The wage rate paid by urban private sectors
wg_t	The wage rate paid by urban public sectors
wi_t	International wage rate, in foreign currency
wn_t	National wage rate
wug_t	Average urban wage rate
wa_t	Expected urban wage rate
$r_{j,t}$	Capital return in sector j
r_t^*	International average rate of capital
$PV_{j,t}$	Value added price of sector j
$PL_{j,t}$	Producer price of local product j
$PD_{j,t}$	Market price of local product j sold on the domestic market
$P_{j,t}$	Production price of sector j
$PC_{j,t}$	Market price of the composite good belonging to sector j
$Pwm_{tr,t}$	International import price of product tr, in foreign currency

$Pwe_{tr,t}$	International export price of product tr, in foreign currency
$PM_{tr,t}$	Domestic price of the imported good tr
$PE_{tr,t}$	Producer price of the exported good tr
$Pfob_{tr,t}$	FOB price of the exported good tr
$PINV_t$	Aggregate price of investment
e_t	Nominal exchange rate (the price of a unit of foreign currency in domestic currency)
i_t	Interest rate on domestic public debt
i_t^*	Interest rate on foreign public debt
CPI_t	Consumer price index
$CPIR_t$	Consumer price index in rural areas
$CPIU_t$	Consumer price index in urban areas
$Pindex_t$	GDP deflator, *numéraire*

b) **Production**

$XS_{j,t}$	Production of sector j (volume)
$A_{ps,t}$	Export externality shift parameter in the production of sector ps
$VA_{j,t}$	Value added of sector j (volume)
$DI_{i,j,t}$	Intermediary demand of product i by sector j (volume)
$CI_{j,t}$	Total intermediary consumption of sector j (volume)

c) **Factors of production**

$KD_{j,t}$	Capital demand by sector j (volume)
$LDR_{ru,t}$	Labour demand by rural sector ru (volume)
$LDU_{up,t}$	Labour demand by urban private sector up (volume)
$LDG_{pub,t}$	Labour demand by public sector pub (volume)
LSR_t	Rural population
LSU_t	Urban population
u_t	Urban unemployment rate

d) **Migration**

NAT_t	Rural workers who decide to stay in Morocco
EMR_t	Rural emigrant flow
$NATR_t$	Rural workers who decide to stay in rural areas
MIG_t	Rural migrant flow towards urban areas
$NATU_t$	Urban workers who decide to stay in urban areas
EMU_t	Urban emigrant flow
$STKR_{1,t}$	The first generation of rural migrants
$STKU_{1,t}$	The first generation of urban migrants

$STKR_{2,t}$	The second generation of rural migrants
$STKU_{2,t}$	The second generation of urban migrants
$STKR_{3,t}$	The third generation of rural migrants
$STKU_{3,t}$	The third generation of urban migrants
$TSTK_t$	Total stock of international migrants
$ISTK_t$	Stock of internal migrants from rural to urban areas
MC_t	International migration costs

e) **Income/Savings**

$Y_{ag,t}$	Agent ag's income
$YWR_{h,t}$	Income of household h, excluding remittances
$YD_{h,t}$	Disposable income of household h
$YDWR_{h,t}$	Disposable income of household h, excluding remittances
$PROF_t$	The proportion of capital remuneration repatriated by foreign firms
$S_{ag,t}$	Agent ag's savings
$T_{ag,ag,t}$	Transfers between agents
$RR_{h,t}$	Remittance rate to household h
IR_t	Internal remittance rate from urban to rural household
$REM_{h,t}$	Migrant remittances
DD_t	Domestic public debt
K_t	Adjustment variable in the debt equation
FD_t	Foreign public debt
SDD_t	Stock of domestic public debt
SFD_t	Stock of foreign public debt
IA_t	Internal debt reimbursement
EA_t	External debt reimbursement

f) **Tax revenues**

$TI_{j,t}$	Indirect taxes on product j
$TIM_{tr,t}$	Import tariffs on product tr
$TIE_{tr,t}$	Export tariffs on product tr
adj_t	Compensatory tax

g) **External trade**

$EXS_{tr,t}$	Export supply of product tr (volume)
$DOM_{j,t}$	Domestic production of sector j sold on the domestic market (volume)
$Q_{j,t}$	Supply of composite product belonging to sector j (volume)
$EXD_{tr,t}$	Export demand of product tr (volume)
$M_{tr,t}$	Import demand of product tr (volume)

h) **Final demand**

$CT_{i,h,t}$	Consumption of good i by household h (volume)
$CMIN_{i,h,t}$	Minimum consumption of good i by household h (volume)
$BC_{h,t}$	Consumption budget of household h
$G_{i,t}$	Public consumption of product i (volume)
$DIT_{i,t}$	Total intermediary consumption of product i (volume)
$INV_{i,t}$	Investment demand of product i (volume)
$STK_{i,t}$	Stock variation of product i (volume)
$NGDP_t$	Nominal GDP

i) **Investment**

$ITVOL_t$	Gross fixed capital formation (volume)
IT_t	Gross fixed capital formation (value)
SI_t	Savings-investment adjustment variable
$INVD_{ps,t}$	Investment in sector ps (volume)
$FDI_{ps,t}$	FDI in sector ps (volume)
$DINV_{ps,t}$	Investment in sector ps financed by households and firms (volume)
$INVG_t$	Public investment in the construction sector (volume)
MRA_t	Investment by MRA in the real estate sector (volume)
$VARKD_t$	Capital demand variation in the public sector (volume)

$CLOSE_t$	Closure

Exogenous Variables

wg_t	Wage rate in the urban public sector
wi_t	International wage rate, in foreign currency
$r_{pub,t}$	Capital return of public sector pub
r_t^*	International rental rate of capital
i_t	Domestic interest rate
i_t^*	International interest rate
$Pwm_{tr,t}$	International import price of product tr, in foreign currency
$Pwe_{tr,t}$	International export price of product tr, in foreign currency
$KD_{ps,\text{“1”}}$	Capital demand by sector ps at the first period (volume)

$CMIN_{i,h,``1"}$	Minimum consumption of product i by household h (volume)
$G_{i,``1"}$	Public consumption of product i, at the first period (volume)
$STK_{i,t}$	Stock variation of product i (volume)
$S_{row,t}$	External savings
$LSR_{``1"}$	Rural population, at the first period
$LSU_{``1"}$	Urban population, at the first period
$STKR_{1,``1"}$	The first generation of rural migrants, at the first period
$STKU_{1,``1"}$	The first generation of urban migrants, at the first period
$STKR_{2,``1"}$	The second generation of rural migrants, at the first period
$STKU_{2,``1"}$	The second generation of urban migrants, at the first period
$STKR_{3,``1"}$	The third generation of rural migrants, at the first period
$STKU_{3,``1"}$	The third generation of urban migrants, at the first period
$TSTK_{``1"}$	Total stock of international migrants, at the first period
$ISTK_{``1"}$	Stock of internal migrants, at the first period
$SDD_{``1"}$	Stock of internal public debt, at the first period
$SFD_{``1"}$	Stock of external public debt, at the first period
$INVG_{``1"}$	Public investment in the construction sector, at the first period (volume)
$CLOSE_t$	Closure
$Pindex_t$	GDP deflator, numéraire

All transfers between agents except direct taxes paid by households and firms. Transfers to and from households as well as minimum consumption by product are fixed at the first period and updated exogenously between periods with the population growth rate.

Equations

Rural Sectors

$$XS_{ru,t} = VA_{ru,t}/v_{ru} \tag{A1}$$

$$CI_{ru,t} = io_{ru}XS_{ru,t} \tag{A2}$$

$$DI_{i,ru,t} = aij_{i,ru}CI_{ru,t} \tag{A3}$$

$$VA_{ru,t} = A_{ru,t}[\alpha_{ru}LDR_{ru,t}^{(\sigma_{ru}-1)/\sigma_{ru}} + (1-\alpha_u)\overline{KD}_{ru,t}^{(\sigma_{ru}-1)/\sigma_{ru}}]^{\sigma_{ru}/(\sigma_{ru}-1)} \tag{A4}$$

$$LDR_{ru,t}/\overline{KD}_{ru,t} = (\frac{\alpha_{ru}}{1-\alpha_{ru}}\frac{r_{ru,t}}{wr_t})^{\sigma_{ru}} \tag{A5}$$

Urban Private Sectors

$$XS_{up,t} = VA_{up,t}/v_{up} \tag{A6}$$

$$CI_{up,t} = io_{up}XS_{up,t} \tag{A7}$$

$$DI_{i,up,t} = aij_{i,up}CI_{up,t} \tag{A8}$$

$$VA_{up,t} = A_{up,t}[\alpha_{up}LDU_{up,t}^{(\sigma_{up}-1)/\sigma_{up}} + (1-\alpha_{up})\overline{KD}_{up,t}^{(\sigma_{up}-1)/\sigma_{up}}]^{\sigma_{up}/(\sigma_{up}-1)} \tag{A9}$$

$$LDU_{up,t}/\overline{KD}_{up,t} = (\frac{\alpha_{up}}{1-\alpha_{up}}\frac{r_{up,t}}{wu_t})^{\sigma_{up}} \tag{A10}$$

Public Sectors

$$XS_{pub,t} = VA_{pub,t}/v_{pub} \tag{A11}$$

$$CI_{pub,t} = io_{pub}XS_{pub,t} \tag{A12}$$

$$DI_{i,pub,t} = aij_{i,pub}CI_{pub,t} \tag{A13}$$

$$VA_{pub,t} = KD_{pub,t}/k_{pub} \tag{A14}$$

$$LDG_{pub,t} = l_{pub}VA_{pub,t} \tag{A15}$$

$$KD_{pub,t} = \frac{PV_{pub,t}VA_{pub,t} - \overline{wg_t}LDG_{pub,t}}{\overline{r_{pub,t}}} \tag{A16}$$

Migratory Flows

$$\overline{LSR}_t = B_1[\varpi_1 NAT_t^{(\varepsilon_1-1)/\varepsilon_1} + (1-\varpi_1)EMR_t^{(\varepsilon_1-1)/\varepsilon_1}]^{\varepsilon_1/(\varepsilon_1-1)} \tag{A17}$$

$$\frac{EMR_t}{NAT_t} = (\frac{\varpi_1}{1-\varpi_1}\frac{\overline{wi_{t-1}}e_{t-1}(1-MC_{t-1})}{wn_{t-1}/CPI_{t-1}})^{-\varepsilon_1} \tag{A18}$$

$$NAT_t = B_2[\varpi_2 NATR_t^{(\varepsilon_2-1)/\varepsilon_2} + (1-\varpi_2)MIG_t^{(\varepsilon_2-1)/\varepsilon_2}]^{\varepsilon_2/(\varepsilon_2-1)} \tag{A19}$$

$$\frac{MIG_t}{NATR_t} = (\frac{\varpi_2}{1-\varpi_2}\frac{wa_{t-1}(1-imc)/CPIU_{t-1}}{wr_{t-1}/CPIR_{t-1}})^{-\varepsilon_2} \tag{A20}$$

$$\overline{LSU}_t = B_3[\varpi_3 NATU_t^{(\varepsilon_3-1)/\varepsilon_3} + (1-\varpi_3)EMU_t^{(\varepsilon_3-1)/\varepsilon_3}]^{\varepsilon_3/(\varepsilon_3-1)} \tag{A21}$$

$$\frac{EMU_t}{NATU_t} = (\frac{\varpi_3}{1-\varpi_3}\frac{\overline{wi_{t-1}}e_{t-1}(1-MC_{t-1})}{wa_{t-1}/CPIU_{t-1}})^{-\varepsilon_3} \tag{A22}$$

Households and Firms

$$\begin{aligned} Y_{\text{“}hr\text{”},t} &= \sum_{ru} wr_t LDR_{ru,t} + \eta_{\text{“}hr\text{”}} \sum_j r_j \overline{KD}_{j,t} + \sum_{da} \overline{T}_{\text{“}hr\text{”},da,t} + \\ & e_t \overline{T}_{\text{“}hr\text{”},\text{”}row\text{”},t} + IR_t \overline{ISTK}_t + (1-tc)REM_{\text{“}hr\text{”},t} \end{aligned} \tag{A23}$$

$$\begin{aligned} Y_{\text{“}hu\text{”},t} &= (1-\phi_{row})[\sum_{up} wu_t LDU_{up,t} + \sum_{pub} \overline{wg_t} LDG_{pub,t}] + \\ & \eta_{\text{“}hu\text{”}} \sum_j r_{j,t} \overline{KD}_{j,t} + \sum_{da} \overline{T}_{\text{“}hu\text{”},da,t} + e_t \overline{T}_{\text{“}hu\text{”},\text{”}row\text{”},t} + \\ & \vartheta_{\text{“}hu\text{”}}(\overline{i_t SDD_t}) + (1-tc)REM_{\text{“}hu\text{”},t} \end{aligned} \tag{A24}$$

$$\begin{aligned} YWR_{\text{“}hr\text{”},t} &= \sum_{ru} wr_t LDR_{ru,t} + \eta_{\text{“}hr\text{”}} \sum_j r_j \overline{KD}_{j,t} + \sum_{da} \overline{T}_{\text{“}hr\text{”},da,t} + \\ & e_t \overline{T}_{\text{“}hr\text{”},\text{”}row\text{”},t} + IR_t \overline{ISTK}_t \end{aligned} \tag{A25}$$

$$\begin{aligned} YWR_{\text{“}hu\text{”},t} &= (1-\phi_{row})[\sum_{up} wu_t LDU_{up,t} + \sum_{pub} \overline{wg_t} LDG_{pub,t}] + \eta_{\text{“}hu\text{”}} \sum_j r_{j,t} \overline{KD}_{j,t} + \\ & \sum_{da} \overline{T}_{\text{“}hu\text{”},da,t} + e_t \overline{T}_{\text{“}hu\text{”},\text{”}row\text{”},t} + \vartheta_{\text{“}hu\text{”}}(\overline{i_t SDD_t}) \end{aligned} \tag{A26}$$

$$\begin{aligned} YDWR_{\text{“}hr\text{”},t} &= YWR_{\text{“}hr\text{”},t}(1-ty_{\text{“}hr\text{”}}) - \overline{T}_{\text{“}hr\text{”},\text{“}hr\text{”},t} - \\ & \overline{T}_{\text{“}hu\text{”},\text{“}hr\text{”},t} - \overline{T}_{\text{“}fm\text{”},\text{“}hr\text{”},t} - e_t \overline{T}_{\text{“}row\text{”},\text{“}hr\text{”},t} \end{aligned} \tag{A27}$$

$$\begin{aligned} YDWR_{\text{“}hu\text{”},t} &= YWR_{\text{“}hu\text{”},t}(1-ty_{\text{“}hu\text{”}}) - \overline{T}_{\text{“}hr\text{”},\text{“}hu\text{”},t} - \overline{T}_{\text{“}hu\text{”},\text{“}hu\text{”},t} - \\ & \overline{T}_{\text{“}fm\text{”},\text{“}hu\text{”},t} - e_t \overline{T}_{\text{“}row\text{”},\text{“}hu\text{”},t} - IR_t \overline{ISTK}_t \end{aligned} \tag{A28}$$

$$\begin{aligned} YD_{\text{“}hr\text{”},t} &= Y_{\text{“}hr\text{”},t}(1-ty_{\text{“}hr\text{”}}) - \overline{T}_{\text{“}hr\text{”},\text{“}hr\text{”},t} - \\ & \overline{T}_{\text{“}hu\text{”},\text{“}hr\text{”},t} - \overline{T}_{\text{“}fm\text{”},\text{“}hr\text{”},t} - e_t \overline{T}_{\text{“}row\text{”},\text{“}hr\text{”},t} \end{aligned} \tag{A29}$$

$$\begin{aligned} YD_{“hu”,t} &= Y_{“hu”,t}(1 - ty_{“hu”}) - \overline{T}_{“hr”,“hu”,t} - \overline{T}_{“hu”,“hu”,t} - \\ &\quad \overline{T}_{“fm”,“hu”,t} - e_t\overline{T}_{“row”,“hu”,t} - IR_t\overline{ISTK}_t \end{aligned} \tag{A30}$$

$$REM_{“hr”,t} = RR_{“hr”,t}\overline{STKR}_{1,t} + 1/2RR_{“hr”,t}\overline{STKR}_{2,t} \tag{A31}$$

$$REM_{“hu”,t} = RR_{“hu”,t}\overline{STKU}_{1,t} + 1/2RR_{“hu”,t}\overline{STKU}_{2,t} \tag{A32}$$

$$RR_{“hr”,t} = V_{1“hr”}(\frac{YD_{“hr”,t}}{CPIR_t})^{\gamma_{1“hr”}}\overline{wi_t}^{\gamma_{2“hr”}} \tag{A33}$$

$$RR_{“hu”,t} = V_{1“hu”}(\frac{YD_{“hu”,t}}{CPIU_t})^{\gamma_{1“hu”}}\overline{wi_t}^{\gamma_{2“hu”}} \tag{A34}$$

$$IR_t = V_2(\frac{YD_{“hr”,t}}{CPIR_t})^{\gamma_3} \tag{A35}$$

$$S_{h,t} = \psi_h YDWR_{h,t} \tag{A36}$$

$$\begin{aligned} BC_{“hr”,t} &= Y_{“hr”,t}(1 - ty_{“hr”}) - \overline{T}_{“hr”,“hr”,t} - \overline{T}_{“hu”,“hr”,t} - \\ &\quad \overline{T}_{“fm”,“hr”,t} - e_t\overline{T}_{“row”,“hr”,t} - S_{“hr”,t} - \\ &\quad (1 - cons_{“hr”})(1 - ty_{“hr”})(1 - tc)REM_{“hr”,t} \end{aligned} \tag{A37}$$

$$\begin{aligned} BC_{“hu”,t} &= Y_{“hu”,t}(1 - ty_{“hu”}) - \overline{T}_{“hr”,“hu”,t} - \overline{T}_{“hu”,“hu”,t} - \\ &\quad \overline{T}_{“fm”,“hu”,t} - e_t\overline{T}_{“row”,“hu”,t} - IR_t\overline{ISTK}_t - S_{“hu”,t} - \\ &\quad (1 - cons_{“hu”})(1 - ty_{“hu”})(1 - tc)REM_{“hu”,t} \end{aligned} \tag{A38}$$

$$\begin{aligned} Y_{“fm”,t} &= (1 - \eta_{“hr”} - \eta_{“hu”} - \eta_{“gv”} - \eta_{“row”} - PROF_t)\sum_j r_{j,t}\overline{KD}_{j,t} + \\ &\quad \sum_{da}\overline{T}_{“fm”,da,t} + e_t\overline{T_{“fm”,”row”,t}} + (1 - \vartheta_{“hu”})(\overline{i_t SDD_t}) \end{aligned} \tag{A39}$$

$$PROF_t = \frac{\sum_{ps} FDI_{ps,t}}{ITVOL_t} \tag{A40}$$

$$\begin{aligned} S_{“fm”,t} &= Y_{“fm”,t}(1 - tye) - \overline{T}_{“hr”,“fm”,t} - \overline{T}_{“hu”,“fm”,t} - \\ &\quad \overline{T_{“fm”,“fm”,t}} - e_t\overline{T_{“row”,“fm”,t}} \end{aligned} \tag{A41}$$

The Government

$$\begin{aligned} TI_{tr,t} &= tx_{tr}adj_t(P_{tr,t}XS_{tr,t} - PE_{tr,t}EXS_{tr,t}) + \\ &\quad tx_{tr}adj_t(1+tm_{tr})e_t\overline{Pmw_{tr,t}}M_{tr,t} \end{aligned} \tag{A42}$$

$$TI_{ntr,t} = tx_{ntr}adj_t PL_{ntr,t}XS_{ntr,t} \tag{A43}$$

$$TIM_{tr,t} = tm_{tr}e_t\overline{Pwm_{tr,t}}M_{tr,t} \tag{A44}$$

$$TIE_{tr,t} = te_{tr}PE_{tr,t}EXS_{tr,t} \tag{A45}$$

$$T_{\text{“}gv\text{”},h,t} = ty_h Y_{h,t} \tag{A46}$$

$$T_{\text{“}gv\text{”},\text{“}fm\text{”},t} = tyeY_{\text{“}fm\text{”},t} \tag{A47}$$

$$\begin{aligned} Y_{\text{“}gv\text{”},t} &= \eta_{\text{“}gv\text{”}}\sum_j r_{j,t}\overline{KD}_{j,t} + \sum_{tr} TIM_{tr,t} + \sum_{tr} TIE_{tr,t} + \sum_j TI_{j,t} + \\ &\quad \sum_h T_{\text{“}gv\text{”},h,t} + T_{\text{“}gv\text{”},\text{“}fm\text{”},t} + \overline{T_{\text{“}gv\text{”},\text{“}gv\text{”},t}} + e_t\overline{T_{\text{“}gv\text{”},\text{“}row\text{”},t}} \end{aligned} \tag{A48}$$

$$\begin{aligned} S_{\text{“}gv\text{”},t} &= Y_{\text{“}gv\text{”},t} - \sum_i PC_{i,t}\overline{G}_{i,t} - \sum_{da}\overline{T}_{da,\text{“}gv\text{”},t} - \\ &\quad e_t\overline{T_{\text{“}row\text{”},\text{“}gv\text{”},t}} - \overline{i_t SDD_t} - e_t\overline{i^*_t SFD_t} \end{aligned} \tag{A49}$$

External Trade

If $EXS_{tr,t} \succ EXS_{tr,t-1}$,

$$A_{tr,t} = A_{tr,t-1}\left(\frac{EXS_{tr,t}}{EXS_{tr,t-1}}\right)^{\varsigma} \tag{A50}$$

If $EXS_{tr,t} \leq EXS_{tr,t-1}$

$$A_{tr,t} = A_{tr,t-1} \tag{A51}$$

$$XS_{tr,t} = C_{1tr}[\delta_{1tr}EXS_{tr,t}^{(\kappa_{1tr}-1)/\kappa_{1tr}} + (1-\delta_{1tr})DOM_{tr,t}^{(\kappa_{1tr}-1)/\kappa_{1tr}}]^{\kappa_{1tr}/(\kappa_{1tr}-1)} \tag{A52}$$

$$XS_{ntr,t} = DOM_{ntr,t} \tag{A53}$$

$$\frac{EXS_{tr,t}}{DOM_{tr,t}} = (\frac{\delta_{1tr}}{1-\delta_{1tr}}\frac{PL_{tr,t}}{PE_{tr,t}})^{\kappa_{1tr}} \tag{A54}$$

$$EXD_{tr,t} = EXD_{tr,t-1}(\frac{\overline{Pwe_{tr,t}}}{Pfob_{tr,t}})^{\varphi_{tr}} \tag{A55}$$

$$Q_{tr,t} = C_{2tr}[\delta_{2tr}M_{tr,t}^{(\kappa_{2tr}-1)/\kappa_{2tr}} + (1-\delta_{2tr})DOM_{tr,t}^{(\kappa_{2tr}-1)/\kappa_{2tr}}]^{\kappa_{2tr}/(\kappa_{2tr}-1)} \tag{A56}$$

$$Q_{ntr,t} = DOM_{ntr,t} \tag{A57}$$

$$\frac{M_{tr,t}}{DOM_{tr,t}} = (\frac{\delta_{2tr}}{1-\delta_{2tr}}\frac{PD_{tr,t}}{PM_{tr,t}})^{\kappa_{2tr}} \tag{A58}$$

$$\begin{aligned}\overline{S_{\text{“}row\text{”},t}} = \sum_{tr}\overline{Pwm_{tr,t}}M_{tr,t} + \phi_{row}\frac{\sum_{up} wu_t LDU_{up,t} + \sum_{pub}\overline{wg_t}LDG_{pub,t}}{e_t} \\ +(\eta_{\text{“}row\text{”}} + PROF_t)\frac{\sum_j r_{j,t}\overline{KD}_{j,t}}{e_t} + \sum_{ag}\overline{T}_{\text{“}row\text{”},ag,t} + \overline{i_t^*SFD}_t \\ -\sum_{tr}Pfob_{tr,t}EXS_{tr,t} - \sum_{ag}\overline{T}_{ag,row,t} - \frac{\sum_h(1-tc)REM_{h,t}}{e_t}\end{aligned} \tag{A59}$$

Final Demand

$$CT_{i,\text{“}hr\text{”},t} = \overline{CMIN}_{i,\text{“}hr\text{”},t} + \frac{\beta_{i,\text{“}hr\text{”}}}{PC_{i,t}}(BC_{\text{“}hr\text{”},t} - \sum_i PC_{i,t}\overline{CMIN}_{i,\text{“}hr\text{”},t}) \tag{A60}$$

$$CT_{i,\text{“}hu\text{”},t} = \overline{CMIN}_{i,\text{“}hu\text{”},t} + \frac{\beta_{i,\text{“}hu\text{”}}}{PC_{i,t}}(BC_{\text{“}hu\text{”},t} - \sum_i PC_{i,t}\overline{CMIN}_{i,\text{“}hu\text{”},t}) \tag{A61}$$

$$INV_{i,t} = \mu_i IT_t/PC_{i,t} \tag{A62}$$

$$DIT_{i,t} = \sum_i aij_{i,j}CI_{j,t} \tag{A63}$$

$$ITVOL_t = IT_t/PINV_t \tag{A64}$$

$$\begin{aligned} NGDP_t \;=\;& \sum_i PC_{i,t}\overline{G}_{i,t} + \sum_h \sum_i PC_{i,t}CT_{i,h,t} + \sum_i PC_{i,t}INV_{i,t} + \sum_i PC_{i,t}\overline{STK_{i,t}} + \\ & \sum_{tr} e_t Pfob_{tr,t}EXD_{tr,t} - \sum_{tr} \overline{Pwm_{tr,t}}e_t M_{tr,t} \end{aligned} \tag{A65}$$

Prices

$$\ln \frac{wu_t}{CPIU_t} = D - \zeta \ln u_t \tag{A66}$$

$$\overline{wg_t} \succ wu_t \tag{A67}$$

$$wn_t = \frac{wr_t \sum_{ru} LDR_{ru,t} + wu_t \sum_{up} LDU_{up,t} + \overline{wg_t} \sum_{pub} LDG_{pub,t}}{\sum_{ru} LDR_{ru,t} + \sum_{up} LDU_{up,t} + \sum_{pub} LDG_{pub,t}} \tag{A68}$$

$$wug_t = \frac{wu_t \sum_{up} LDU_{up,t} + \overline{wg_t} \sum_{pub} LDG_{pub,t}}{\sum_{up} LDU_{up,t} + \sum_{pub} LDG_{pub,t}} \tag{A69}$$

$$wa_t = wug_t(1 - u_t) \tag{A70}$$

$$r_{ru,t} = \frac{PV_{ru,t}VA_{ru,t} - wr_t LDR_{ru,t}}{\overline{KD}_{ru,t}} \tag{A71}$$

$$r_{up,t} = \frac{PV_{up,t}VA_{up,t} - wu_t LDU_{up,t}}{\overline{KD}_{up,t}} \tag{A72}$$

$$PV_{j,t} = \frac{P_{j,t}XS_{j,t} - \sum_i PC_{i,t}DI_{i,j,t}}{VA_{j,t}} \tag{A73}$$

$$PM_{tr,t} = e_t\overline{Pwm_{tr,t}}(1 + tm_{tr})(1 + tx_{tr}adj_t) \tag{A74}$$

$$PE_{tr,t} = \frac{e_t Pfob_{tr,t}}{(1 + te_{tr})} \tag{A75}$$

$$PC_{tr,t} = \frac{DOM_{tr,t}PD_{tr,t} + M_{tr,t}PM_{tr,t}}{Q_{tr,t}} \tag{A76}$$

$$PC_{ntr,t} = PD_{ntr,t} \tag{A77}$$

$$PD_{j,t} = PL_{j,t}(1 + tx_j adj_t) \tag{A78}$$

$$P_{tr,t} = \frac{PL_{tr,t}DOM_{tr,t} + PE_{tr,t}EXS_{tr,t}}{XS_{tr,t}} \tag{A79}$$

$$P_{ntr,t} = PL_{ntr,t} \tag{A80}$$

$$PINV_t = \prod_i \left(\frac{PC_{i,t}}{\mu_i}\right)^{\mu_i} \tag{A81}$$

$$CPI_t = \sum_i \theta_{1i} PC_{i,t} \tag{A82}$$

$$CPIR_t = \sum_i \theta_{2i,\text{``}hr\text{''}} PC_{i,t} \tag{A83}$$

$$CPIU_t = \sum_i \theta_{2i,\text{``}hu\text{''}} PC_{i,t} \tag{A84}$$

$$\overline{Pindex_t} = \sum_j \theta_j PV_{j,t} \tag{A85}$$

Dynamics

$$STKR_{1,t+1} = \overline{STKR}_{1,t}(1 - \chi_1) + EMR_t \tag{A86}$$

$$STKU_{1,t+1} = \overline{STKU}_{1,t}(1 - \chi_1) + EMU_t \tag{A87}$$

$$STKR_{2,t+1} = \overline{STKR}_{2,t}(1 - \chi_2) + \chi_1 \overline{STKR}_{1,t} \tag{A88}$$

$$STKU_{2,t+1} = \overline{STKU}_{2,t}(1 - \chi_2) + \chi_1 \overline{STKU}_{1,t} \tag{A89}$$

$$STKR_{3,t+1} = \overline{STKR}_{3,t} + \chi_2 \overline{STKR}_{2,t} \tag{A90}$$

$$STKU_{3,t+1} = \overline{STKU}_{3,t} + \chi_2 \overline{STKU}_{2,t} \tag{A91}$$

$$\begin{aligned} TSTK_t &= \overline{STKR}_{1,t} + \overline{STKR}_{2,t} + \overline{STKR}_{3,t} + \\ &\quad \overline{STKU}_{1,t} + \overline{STKU}_{2,t} + \overline{STKU}_{3,t} \end{aligned} \tag{A92}$$

$$ISTK_{t+1} = \overline{ISTK}_t + MIG_t \tag{A93}$$

$$KD_{ps,t+1} = (1 - dep_{ps})\overline{KD}_{ps,t} + INVD_{ps,t} \tag{A94}$$

$$\begin{aligned} \frac{FDI_{ps,t}}{KD_{ps,t}} &= D_{1ps}\left(\frac{r_{ps,t}}{e_t\overline{r_t^*}(\overline{i_t} + \epsilon_1 + dep_{ps})}\right)^2 + \\ &\quad D_{2ps}\left(\frac{r_{ps,t}}{e_t\overline{r_t^*}(\overline{i_t} + \epsilon_1 + dep_{ps})}\right) \end{aligned} \tag{A95}$$

$$\begin{aligned} \frac{DINV_{ps,t}}{KD_{ps,t}} &= D_{3ps}\left(\frac{r_{ps,t}}{PINV_t(i_t + \epsilon_2 + dep_{ps})}\right)^2 + \\ &\quad D_{4ps}\left(\frac{r_{ps,t}}{PINV_t(i_t + \epsilon_2 + dep_{ps})}\right) \end{aligned} \tag{A96}$$

$$VARKD_t = KD_{\text{“}edu\text{”},t} - KD_{\text{“}edu\text{”},t-1} \tag{A97}$$

$$INVD_{pro,t} = DINV_{pro,t} + FDI_{pro,t} \tag{A98}$$

$$INVD_{\text{“}con\text{”},t} = MRA_t + DINV_{\text{“}con\text{”},t} + \overline{INVG}_t + FDI_{\text{“}con\text{”},t} \tag{A99}$$

$$SDD_{t+1} = (1 + \overline{i_t})\overline{SDD}_t + DD_t - IA_t \tag{A100}$$

$$SFD_{t+1} = (1 + \overline{i_t^*})\overline{SFD}_t + FD_t - EA_t \tag{A101}$$

$$MC_t = V_3(TSTK_t)^{\nu} \tag{A102}$$

$$G_{i,t+1} = \overline{G}_{i,t}(1 + g_G) \tag{A103}$$

$$INVG_{t+1} = \overline{INVG}_t(1 + g_{IG}) \tag{A104}$$

$$LSR_{t+1} = \overline{LSR}_t(1 + g_{LSR}) - MIG_t - EMR_t \tag{A105}$$

$$LSU_{t+1} = \overline{LSU}_t(1 + g_{LSU}) + MIG_t - EMU_t \tag{A106}$$

Equilibrium Conditions and Closure

$$NATR_t = \sum_{ru} LDR_{ru,t} \tag{A107}$$

$$(NATU_t + (1-imc)MIG_t)(1-u_t) = \sum_{up} LDU_{up,t} + \sum_{pub} LDG_{pub,t} \tag{A108}$$

$$Q_{i,t} = \overline{G}_{i,t} + DIT_{i,t} + \sum_{h} CT_{i,h,t} + INV_{i,t} + \overline{STK_{i,t}} \tag{A109}$$

$$EXS_{tr,t} = EXD_{tr,t} \tag{A110}$$

$$S_{``gv",t} + DD_t + e_t FD_t = VARKD_t PINV_t + \overline{INVG}_t PINV_t \tag{A111}$$

$$\begin{aligned} DD_t \;\; = \;\; & K_t(F \times \epsilon_2^{\xi})(S_{``hu",t} + (1-estate)(1-cons_{``hu"}) \\ & (1-ty_{``hu"})(1-tc)REM_{``hu",t} + S_{``fm",t}) \end{aligned} \tag{A112}$$

$$\sum_{h} estate(1-cons_h)(1-ty_h)(1-tc)REM_{h,t} = MRA_t PINV_t \tag{A113}$$

$$\begin{aligned} e_t(S_{``row",t} - FD_t) \;\; = \;\; & \sum_{pro} FDI_{pro,t} PINV_t + \\ & FDI_{``con",t} PINV_t + \upsilon \sum_{i} \overline{STK_{i,t}} PC_{i,t} \end{aligned} \tag{A114}$$

$$\begin{aligned} IT_t + \sum_{i} \overline{STK_{i,t}} PC_{i,t} \;\; = \;\; & e_t \overline{S_{"row",t}} + \sum_{da} S_{da,t} + \\ & \sum_{h} (1-cons_h)(1-ty)(1-tc)REM_{h,t} \end{aligned} \tag{A115}$$

$$ITVOL_t = SI_t(\sum_{pro} INVD_{pro,t} + INVD_{``con",t} + VARKD_t) \tag{A116}$$

$$\overline{CLOSE_t} = S_{``gv",t} / NGDP_t \tag{A117}$$

$$SDD_{t+1} = share_1 NGDP_{t+1} \tag{A118}$$

$$e_t SFD_{t+1} = share_2 NGDP_{t+1} \tag{A119}$$

$$\begin{aligned} EV_h &= (BC_{h,t} - \sum_i PC_{i,t} CMIN_{i,h,t})\left(\frac{\prod_i PCO_i}{\prod_i PC_{i,t}}\right)^{\beta_{i,h}} - \\ &\quad (BCO_h - \sum_i PCO_i CMINO_{i,h}) \end{aligned} \tag{A120}$$

III.C Appendix C: Sensitivity Analysis

Table III.11: **Real GDP at Factor Cost For Selected Values of Export Externality Parameter**

Percentage Change with Respect to the BAU Growth Path

Externality	Scenario	**t**	**t+5**	**t+10**	**t+15**	**t+20**
0.2	SIM1	0.00	-0.03	-0.07	-0.18	-0.34
	SIM2	0.00	-0.13	-0.38	-0.67	-0.98
	SIM3	0.02	0.04	0.08	0.11	0.16
	SIM4	0.00	0.57	1.37	2.12	2.80
0.05	SIM1	0.00	-0.06	-0.17	-0.33	-0.52
	SIM2	0.00	-0.13	-0.39	-0.70	-1.02
	SIM3	0.02	0.04	0.07	0.10	0.14
	SIM4	0.00	0.44	0.97	1.41	1.75

Source: Author's calculations.

Table III.12: **Real GDP at Factor Cost For Selected Combinations of Remittance Elasticities**

Percentage Change with Respect to the BAU Growth Path

$\gamma_{1,h}$	$\gamma_{2,h}$	Scenario	**t**	**t+5**	**t+10**	**t+15**	**t+20**
-4.2	0.9	SIM1	0.00	-0.04	-0.13	-0.27	-0.46
		SIM2	0.00	-0.13	-0.39	-0.69	-1.01
		SIM3	0.02	0.04	0.07	0.11	0.14
		SIM4	0.00	0.49	1.12	1.67	2.12
-4.2	3.6	SIM1	0.00	-0.04	-0.13	-0.27	-0.46
		SIM2	0.00	-0.13	-0.39	-0.69	-1.01
		SIM3	0.02	0.04	0.07	0.11	0.14
		SIM4	0.00	0.49	1.12	1.67	2.12
-2.1	1.8	SIM1	0.00	-0.05	-0.16	-0.34	-0.58
		SIM2	0.00	-0.13	-0.40	-0.71	-1.05
		SIM3	0.02	0.05	0.09	0.13	0.18
		SIM4	0.00	0.50	1.14	1.73	2.23
-8.4	1.8	SIM1	0.00	-0.03	-0.10	-0.20	-0.32
		SIM2	0.00	-0.13	-0.38	-0.66	-0.95
		SIM3	0.01	0.03	0.05	0.08	0.10
		SIM4	0.00	0.48	1.09	1.60	2.00

Notes: (1) $\gamma_{1,h}$: Elasticity of international remittance rate with respect to household h's real income.
(2) $\gamma_{2,h}$: Elasticity of international remittance rate with respect to the international wage.
Source: Author's calculations.

Table III.13: **Household Real Disposable Income For Selected Combinations of Remittance Elasticities**

Percentage Change with Respect to the BAU Growth Path

$\gamma_{1,h}$	$\gamma_{2,h}$	Scenario	Household	**t**	**t+5**	**t+10**	**t+15**	**t+20**
-4.2	0.9	SIM1	Rural	0.00	-0.31	-0.65	-0.99	-1.33
			Urban	0.00	-0.32	-0.59	-0.85	-1.13
		SIM2	Rural	0.00	-0.03	-0.15	-0.32	-0.50
			Urban	0.00	0.06	-0.02	-0.16	-0.26
		SIM3	Rural	0.14	0.15	0.18	0.21	0.25
			Urban	0.16	0.15	0.17	0.21	0.24
		SIM4	Rural	0.00	0.38	0.78	1.12	1.37
			Urban	0.00	0.21	0.62	0.92	1.11
-4.2	3.6	SIM1	Rural	0.00	-0.31	-0.65	-0.99	-1.33
			Urban	0.00	-0.32	-0.59	-0.85	-1.13
		SIM2	Rural	0.00	-0.03	-0.15	-0.32	-0.50
			Urban	0.00	0.06	-0.02	-0.16	-0.26
		SIM3	Rural	0.14	0.15	0.18	0.21	0.25
			Urban	0.16	0.15	0.17	0.21	0.24
		SIM4	Rural	0.00	0.38	0.78	1.12	1.37
			Urban	0.00	0.21	0.62	0.92	1.11
-2.1	1.8	SIM1	Rural	0.00	-0.38	-0.80	-1.22	-1.66
			Urban	0.00	-0.39	-0.73	-1.09	-1.49
		SIM2	Rural	0.00	-0.03	-0.17	-0.39	-0.65
			Urban	0.00	0.07	-0.01	-0.17	-0.35
		SIM3	Rural	0.17	0.18	0.23	0.27	0.33
			Urban	0.19	0.18	0.22	0.27	0.33
		SIM4	Rural	0.04	0.45	0.93	1.37	1.76
			Urban	0.00	0.25	0.74	1.13	1.42
-8.4	1.8	SIM1	Rural	0.00	-0.17	-0.40	-0.60	-0.78
			Urban	0.00	-0.18	-0.33	-0.45	-0.55
		SIM2	Rural	0.00	-0.15	-0.36	-0.57	-0.74
			Urban	0.00	-0.08	-0.23	-0.37	-0.49
		SIM3	Rural	0.07	0.09	0.11	0.13	0.14
			Urban	0.08	0.09	0.10	0.11	0.12
		SIM4	Rural	0.10	0.46	0.72	0.87	0.92
			Urban	0.01	0.25	0.48	0.58	0.57

Notes: (1) $\gamma_{1,h}$: Elasticity of international remittance rate with respect to household h's real income.
(2) $\gamma_{2,h}$: Elasticity of international remittance rate with respect to the international wage.
Source: Author's calculations.

Table III.14: **Households' Remittances For Selected Combinations of Remittance Elasticities**

Percentage Change with Respect to the BAU Growth Path

$\gamma_{1,h}$	$\gamma_{2,h}$	Scenario	To Household	**t**	**t+5**	**t+10**	**t+15**	**t+20**
-4.2	0.9	SIM1	Rural	0.00	-3.05	-5.24	-6.28	-6.49
			Urban	0.00	-2.77	-4.12	-4.37	-4.01
		SIM2	Rural	0.00	0.08	0.43	0.96	1.53
			Urban	0.00	-0.34	-0.51	-0.33	0.04
		SIM3	Rural	-0.59	-0.69	-0.86	-1.02	-1.19
			Urban	-0.66	-0.73	-0.91	-1.09	-1.29
		SIM4	Rural	0.00	-1.47	-3.06	-4.43	-5.48
			Urban	0.00	-0.61	-2.46	-4.18	-5.48
-4.2	3.6	SIM1	Rural	0.00	-3.05	-5.24	-6.28	-6.49
			Urban	0.00	-2.77	-4.12	-4.37	-4.01
		SIM2	Rural	0.00	0.08	0.43	0.96	1.53
			Urban	0.00	-0.34	-0.51	-0.33	0.04
		SIM3	Rural	-0.59	-0.69	-0.86	-1.02	-1.19
			Urban	-0.66	-0.73	-0.91	-1.09	-1.29
		SIM4	Rural	0.00	-1.47	-3.06	-4.43	-5.48
			Urban	0.00	-0.61	-2.46	-4.18	-5.48
-2.1	1.8	SIM1	Rural	0.00	-3.55	-6.22	-7.69	-8.30
			Urban	0.00	-3.27	-4.93	-5.42	-5.25
		SIM2	Rural	0.00	0.03	0.17	0.44	0.79
			Urban	0.00	-0.24	-0.52	-0.52	-0.27
		SIM3	Rural	-0.35	-0.46	-0.60	-0.73	-0.88
			Urban	-0.40	-0.51	-0.68	-0.85	-1.04
		SIM4	Rural	0.00	-0.80	-1.79	-2.77	-3.67
			Urban	0.00	-0.27	-1.51	-2.90	-4.14
-8.4	1.8	SIM1	Rural	0.00	-2.41	-4.01	-4.55	-4.39
			Urban	0.00	-2.13	-3.15	-3.19	-2.73
		SIM2	Rural	0.00	0.15	0.77	1.55	2.25
			Urban	0.00	-0.48	-0.51	-0.13	0.34
		SIM3	Rural	-0.90	-0.97	-1.16	-1.33	-1.49
			Urban	-0.99	-1.00	-1.17	-1.35	-1.53
		SIM4	Rural	0.00	-2.41	-4.72	-6.34	-7.24
			Urban	0.00	-1.02	-3.71	-5.82	-7.03

Notes: (1) $\gamma_{1,h}$: Elasticity of international remittance rate with respect to household h's real income.
(2) $\gamma_{2,h}$: Elasticity of international remittance rate with respect to the international wage.
Source: Author's calculations.

Table III.15: **Migration Costs**
For Selected Values of Migration Cost Elasticity ν

Percentage Change with Respect to the BAU Growth Path

ν	Scenario	**t**	**t+5**	**t+10**	**t+15**	**t+20**
-0.75	SIM1	0.00	-0.03	-0.15	-0.28	-0.43
	SIM2	0.00	0.02	0.14	0.27	0.38
	SIM3	0.00	0.04	0.06	0.09	0.11
	SIM4	0.00	-0.08	-0.08	0.02	0.17
-3	SIM1	0.00	-0.11	-0.61	-1.17	-1.77
	SIM2	0.00	0.09	0.59	1.14	1.61
	SIM3	0.00	0.15	0.27	0.36	0.45
	SIM4	0.00	-0.32	-0.32	0.08	0.65

Notes: ν: Elasticity of international migration costs to the stock of international migrants.
Source: Author's calculations.

Table III.16: **Rural Emigration Flow**
For Selected Values of Migration Cost Elasticity ν

Percentage Change with Respect to the BAU Growth Path

ν	Scenario	**t**	**t+5**	**t+10**	**t+15**	**t+20**
-0.75	SIM1	0.00	0.41	0.74	1.01	1.29
	SIM2	0.00	-0.30	-0.65	-0.90	-1.16
	SIM3	0.00	-0.17	-0.17	-0.19	-0.21
	SIM4	0.00	0.33	0.12	-0.04	-0.04
-3	SIM1	0.00	0.42	0.74	1.00	1.28
	SIM2	0.00	-0.30	-0.66	-0.91	-1.19
	SIM3	0.00	-0.18	-0.18	-0.19	-0.21
	SIM4	0.00	0.35	0.14	-0.01	-0.02

Notes: ν: Elasticity of international migration costs to the stock of international migrants.
Source: Author's calculations.

Table III.17: **Urban Emigration Flow**
For Selected Values of Migration Cost Elasticity ν

Percentage Change with Respect to the BAU Growth Path

ν	Scenario	**t**	**t+5**	**t+10**	**t+15**	**t+20**
-0.75	SIM1	0.00	0.71	1.15	1.55	2.02
	SIM2	0.00	-0.71	-1.22	-1.29	-1.23
	SIM3	0.00	-0.27	-0.26	-0.31	-0.37
	SIM4	0.00	0.42	-0.66	-1.53	-1.99
-3	SIM1	0.00	0.71	1.15	1.53	2.00
	SIM2	0.00	-0.71	-1.23	-1.32	-1.29
	SIM3	0.00	-0.27	-0.26	-0.31	-0.36
	SIM4	0.00	0.44	-0.63	-1.46	-1.87

Notes: ν: Elasticity of international migration costs to the stock of international migrants.
Source: Author's calculations.

Chapter IV

On The Relation Between Trade Liberalisation and Migration in Morocco

Morocco is in the bulk of the trade liberalisation process. The country is about to achieve a free trade area with the EU by 2012 and has signed free trade agreements with the US, Turkey and other Arab countries, at the same time as it adjusts its trade policies to match the WTO rules. In this context, the major concern stems from the potential labour market effects of integration and enlargement. A sketchy analysis suggests that trade liberalisation should expand the low protected sectors and contract the highly protected ones. If the expanding sectors are labour-intensive, trade liberalisation will dampen unemployment rates. Given that unemployment is the most important cause for migration in Morocco, it is true to think that trade liberalisation may reduce migration incentives. This issue is of prime importance at a time industrialised countries closed their doors to Southern workers for economic, social and security reasons. Another concern is whether and to what extent Morocco should pursue additional trade liberalisation: does the FTA with the EU promote enough growth and employment in Morocco so that migration incentives decrease or should the country carry on additional efforts for multilateral liberalisation?

This chapter explores the link between trade liberalisation and migration in Morocco. Because trade agreements involve substantial changes in prices, resource allocation and income, and affect capital stock through savings as well as human capital and technology, the analysis is done with a dynamic CGE model of the Moroccan economy. Based on a robust and widely accepted modelling of agents' behaviour, CGE models are able to provide a detailed description of the impact of such shocks on the economy. A particular attention is given to Morocco and the Euro-Mediterranean partnership at a time where illegal migration is a matter of discordance between the EU and South-Mediterranean countries. Two trade liberalisation scenarios are considered, the first corresponding to the FTA creation, and the second dealing with multilateral liberalisation.

The relation between trade and migration has extensively been analysed on both theoretical and empirical grounds. Factor mobility is a substitute for trade if trade liberalisation allows factor price equalisation. Mundell (1957) showed that trade and migration are substitutes in the standard HO model of trade with two production factors under the usual assumptions: if labour migrates from the labour-abundant country, the production of the exportable good will fall and the output of the importable one will increase along traditional Rybczynski lines. Consequently, trade will decline. Similarly, in the labour-scarce country, migration will boost the production of the importable good and lead to a decline in the output of the exportable one, and hence to a reduction in trade. However, the Mundell model (1957) and related evidence have been questioned both at the theoretical and empirical levels. In their literature review, Faini et al. (1999) clearly explain how the conclusions of Mundell (1957) can be reversed simply by using more realistic assumptions[1].

Empirically, little is known about the effects of trade liberalisation on emigration flows in developing countries. The available computational literature has focused, for the most part, on US-Mexico migration patterns after the creation of the North American Free Trade Agreement (NAFTA). Hill and Mendez (1984) show that a removal of trade barriers reduces migration flows from Mexico to the US, but that the reduction is fairly modest. By contrast, Robinson et al. (1993) argue that trade liberalization in agriculture greatly increases rural-urban migration within Mexico and migration from Mexico to the US, and that lower migration is only possible if Mexico grows relative to the US and if it retains farm support programs. Melchor del Rio and Thorwarth (2006) give support to Robinson et al. (1993) by showing, using monthly data from 1966 to 2004, that greater trade flows cause larger illegal migration from Mexico to the US. More recent works were interested in the relation between trade liberalisation and emigration in Morocco. The CGE analyses of Bouzahzah et al. (2007) and Cogneau and Tapinos (1995), based respectively on 1985 and 1980[2] data, both conclude that trade liberalisation did not help reduce migration flows. By contrast, Faini and de Melo (1995) develop a macroeconometric model calibrated for the year 1988 and show that trade liberalisation induces a real exchange rate depreciation that, on the one hand, results in higher production costs and lower supply, and on the other hand, boosts labour-intensive exports and

[1] For example, when the difference in technology is allowed in a Ricardian framework and if the rich country is more productive in the labour-intensive sector, it will export the labour intensive good, and then display a higher wage. If labour mobility is now allowed, labour will migrate from the poor to the rich country, and, through standard Rybczynski effects, this will strengthen the specialisation of the rich country in the labour-intensive sector. Specific-factors models can also induce a relation between trade liberalisation and migration that is different from the standard HO model. Trade liberalisation reduces the price of the importable good and then depresses the demand for labour, the mobile factor, in the import sector. Both the nominal wage and the real wage in terms of the exportable good fall. However, the real wage in terms of the importable good will increase and this will be translated to the whole wage only if the weight of importable goods in the consumption budget is high. Without being exhaustive, a final example concern financial-constraints models. Lopez and Schiff (1998) show that, when migrants are financially constrained and unable to migrate due to migration costs, and if trade liberalisation raises the wage in the labour-abundant sending country according to the HO model, financial constraints will be relaxed and, paradoxically, migration will increase.

[2] Nevertheless, the SAM of Cogneau and Tapinos (1995) was updated by data on external trade and taxation in 1990.

labour demand. The second effect dominates so that trade liberalisation is found to promote employment creation and thus discourage migration.

However, none of the previous works investigated the different impacts of trade liberalisation on skilled and unskilled migration. In the standard HO model, and given that Morocco is unskilled-labour abundant, it must export unskilled-labour intensive goods and import skilled-labour intensive ones. In order to meet increasing exports, labour demand of unskilled workers must rise and unskilled wage must adjust upward to balance the labour market. In this context, international labour mobility and trade liberalisation are substitutes. By contrast, if Moroccan imports are skilled-labour intensive and when imports replace domestic production, skilled labour demand decreases and so does the wage of skilled workers. Consequently, skilled workers choose to leave. In this context, migration and trade liberalisation are complements. Given that Morocco's main trading partners are developed skilled-abundant countries and since Moroccan imports mainly consist of capital and technology goods, it is true to think that they are skilled-labour intensive. Therefore, one would expect that unskilled migration decreases and skilled migration increases, following tariff removal.

This chapter looks at the labour-market effects of Moroccan trade liberalisation with a special interest in its impact on the skill-composition of migration. The analysis is done with a CGE framework adapted to migration and trade liberalisation. International and internal migration are motivated by wage differentials and the effect of urban unemployment rate on migration incentives is taken into consideration. A sequential dynamic module is added making possible the allocation of savings, including remittances, to investment. Therefore, the evolution of migration flows also affects capital accumulation through skilled and unskilled migrants' abilities to remit. The model is calibrated on a disaggregated SAM of 2003, thus offering an updated analysis of this subject, in contrast to the previous works. Indeed, the structure of Moroccan external trade displayed many changes between the 1980s, where the country was still in the bulk of structural adjustment, and 2000. Besides, the previous studies are characterised by a sectoral aggregation level that is likely to hide the diversity of protection applied to the disaggregated sectors, and thus affect winners and losers from liberalisation. Finally, and limiting the comparison to the works using the same methodology, it is worth mentioning that Bouzahzah et al. (2007) may have underestimated the impact of trade liberalisation because their analysis was done in a static framework, neglecting the dynamic effects of liberalisation coming from physical and human capital accumulation. Nevertheless, the analysis was made in an imperfect competition framework with scale economies, according to the new CGE literature following the work of Harris (1984). Dynamic effects of trade liberalisation are deeply examined in Cogneau and Tapinos (1995), but in a perfect competition framework.

Two trade liberalisation scenarios are considered, the first consisting of the Morocco-EU FTA and the second of multilateral liberalisation. The simulations are run twice, in a perfect and imperfect competition commodity market structure. The results of the perfect competition model show that trade liberalisation is complement to migration, as it is the case in Bouzahzah et al. (2007) and Cogneau and Tapinos (1995). This complementarity prevails for both skilled and unskilled individuals. However, in urban areas, migration is explained by pull factors and not by push factors, as it is the case in the two previously mentioned works. By contrast, the results of the imperfect competition model show that trade liberalisation is a substitute for migration in the medium and long run, as Faini and de Melo (1995) pointed out, for both skilled and unskilled workers.

The chapter is organised as follows: Section 1 provides a brief background of the Moroccan economy, with a focus on trade policy. Section 2 depicts the theoretical framework. Section 3 discusses the results of the simulation experiments and Section 4 concludes.

1 Background

The structure of Moroccan trade is analogous to a developing country one. Table IV.1 summarises the structure of Moroccan foreign trade in 2003, with a particular description of the relations with the EU. Morocco's comparative advantage resides in the following sectors: wearing apparel, phosphates and derivatives, Mediterranean agricultural products (fresh and canned). Exports of phosphates and derivatives continue to be important, but the strategy of the 1970s focusing on phosphate exports after the boom of primary material prices was replaced by industrial exports. Industrial products constitute more than half of Moroccan exports. They mainly concern light industries such as wearing apparel and electronics. Agricultural products, including fruits, vegetables and seafood, fresh or canned, are also important, representing about 25% of exports. Comparative disadvantages are concentrated in capital goods, consumption goods of large and medium value-added, intermediary products, food and oil products. Many intermediary products, such as textile, electronic components and agricultural products, are temporarily imported, transformed and then re-exported. Imports of agricultural products reflect a food shortage situation in the country, and are heavily dependent on climate change. Imports of products with high value added, such as machines, aviation and transport equipments or consumer electronic products reflect the country's technological gap.

Since 1993, Morocco has dramatically liberalised its foreign trade. By 1993, the maximum rate for customs duties had been lowered to 45% and, most impressively, no imports required a license (other than for health and safety reasons). On the export side only minor restraints remain. Therefore, a trade regime free of non-tariff barriers is taken as a departure point. Morocco has also completed its tariff binding and transformed quantitative restriction on agricultural products in equivalent tariffs. However, 30% of tariff lines are higher than maximum tariff negotiated at WTO. The unweighted average tariff is around 25%, which is favourable with respect to Mediterranean partners: only Jordan and Lebanon have lower rates, while Egypt, Tunisia and Libya rates are 10 percentage points above the Moroccan one. Yet, the comparison of Morocco with Gulf countries, South-East Asia or Latin America is much less favourable, with import duty of 20 points more on average (Escribano and Lorca, 2003). Tariff rates of 2003 by sector are presented in column 5 of Table IV.1. High tariffs are applied on products that closely enter in competition with Moroccan products such as agriculture[3], food industry, tobacco, wood products, rubber and plastics, cars and other industries. The lowest tariffs are applied on intermediary products, capital goods and high value added consumption products that are not produced in Morocco such as machines and equipment, office machinery, electrical machines, radio and TV, medical instruments, mining, chemicals, oil refining, other transport means.

The EU(27) is Morocco's major trading partner, representing in 2003 60% of Moroccan imports and 75% of exports (Ministry of Foreign Trade, Rabat). In 1996, Morocco signed an association agreement with the EU to establish a free trade area between the two partners over a transitional period lasting a maximum of twelve years. The agreement entered into force in March 2000 and the free trade area has to be achieved in 2012. For industrial imports from EU, Morocco is committed to a gradual elimination of tariff rates, and the abolishment of any quantitative restrictions, taxes, and other measures that have the same effect as tariffs. In return, Morocco will receive aid for education and infrastructure projects over a period of five years (Caupin, 2005) and with few exceptions, Morocco's non-agricultural exports will continue to enjoy unrestrained access to the EU. As expected, the last column of Table IV.1 shows zero tariff rates on most industrial products, mainly intermediary products, capital goods and high value-added consumption goods. Tariff rates remain particularly high on agriculture, food and tobacco products, wood products, rubber and plastics, non-metallic minerals and car industry. The average tariff on agriculture is slightly higher than the rate applied on agricultural imports from the RoW. This can be explained by the fact that the RoW contains all

[3] The highest tariffs are applied on cereals and meat and they result from the transformation of quantitative restrictions in equivalent tariffs. For animals, the tariff rate reaches 300% and is often higher for meat (Escribano and Lorca, 2003).

non-EU countries, including Arab ones, who signed several agreements with Morocco (such as the Agadir agreement and the Arab FTA).

Table IV.1: **External Trade and Import Tariffs, in 2003**

Tradable Sectors	**Imports (MAD bn)**	**% from EU**	**Exports (MAD bn)**	**% to EU**	**Tariff Rate (%)**	**Tariff from EU (%)**
Agriculture	3.32	60	36.69	80	72	74
Fishing	0.06	66	2.11	54	3	4
Coal mining	10.83	8	0.00	0	3	0
Metal ore mining	0.16	87	0.46	81	0	0
Other ore	1.66	8	4.12	51	0	0
Food industry	6.91	54	11.07	96	43	40
Tobacco industry	0.50	77	0.00	67	24	21
Textile industry	16.45	71	3.56	61	1	0
Clothing industry	2.21	87	25.20	94	2	0
Leather industry	1.28	90	2.45	72	6	0
Wood products	2.11	31	0.52	84	12	10
Paper industry	2.45	47	0.59	69	5	5
Editing	0.73	47	0.04	68	3	3
Oil refining	10.27	52	0.89	84	5	7
Chemical industry	14.93	67	10.85	29	3	3
Rubber and plastics	3.75	74	0.34	20	10	9
Non-metallic minerals	1.42	77	0.66	45	13	12
Metallurgy	7.32	63	2.08	79	6	0
Metal processing	2.81	63	0.41	79	8	8
Machines and equip.	13.36	70	0.23	80	3	0
Office machinery	2.16	50	0.00	0	2	0
Electrical machines	5.73	67	5.29	66	4	0
Radio and TV	6.60	67	5.99	66	3	0
Medical instruments	1.54	50	0.21	50	3	0
Car industry	6.82	62	0.49	66	11	9
Other transport means	3.74	62	0.12	66	1	0
Other industries	1.84	77	0.53	45	10	0
Electricity and water	0.29	70	0.73	57	0	0
Hotels and restaurants	2.12	70	0.37	57	0	0
Transports Services	10.78	70	8.82	57	0	0
Post and telecom.	0.47	70	3.23	57	0	0
Financial activities	0.35	70	0.34	57	0	0
Rental services	3.46	70	6.00	57	0	0
Non-financial services	0.20	70	0.01	54	0	0

Source: Author's calculations and SAM (See Appendix A).

2 Model Structure

There are some crucial features to be incorporated in the conceptualised model for assessing the effects of trade liberalisation on migration incentives. First of all, migratory flows must be endogenised so that to depend on wage differentials between the host and the home countries. Undoubtedly, trade liberalisation is able to influence migration incentives through its labour market effects. Secondly, since the tariff rate on agricultural products is the highest and given that agriculture employs more than 80% of rural workers, any liberalisation scenario affecting agriculture has its most direct effects on the rural labour market, and indirectly via internal migration, on the urban labour market. Internal migration needs to be included, first because it moslty fuels Morocco's urban population growth[4], then because it is important for the incidence of changes in agricultural protection. Thirdly, urban unemployment, accounting for 18.3% of the working population in 2003, is the principal cause for emigration in Morocco (Hamdouch, 2000). It should be then taken into consideration in the analysis especially when massive internal migration may exert upward pressures on unemployment in urban areas, depite urban emigration to foreign countries (Karam and Decaluwé, 2008). Fourthly, a distinction should be made between skilled and unskilled workers because the labour market effects of tariff removal are different for these types of workers and should then have different consequences on migration incentives. Lastly, the time dimension should be introduced in order to describe adjustment periods, and the corresponding dynamic effects of trade liberalisation.

The present model is a real small open-economy one that draws on existing economy-wide models of Morocco (Agénor and El Aynaoui, 2003; Karam and Decaluwé, 2008; Karam, 2008; Löfgren et al., 1999; Rutherford et al., 1997). The model parameters are calibrated on a disaggregated SAM for 2003 provided by Touhami Abdelkhalek. The disaggregated version of the SAM gathers three

[4] According to Agénor and El Aynaoui (2003), approximately 200,000 migrants move annually into urban areas, which is equivalent to 40% of the total increase in urban population.

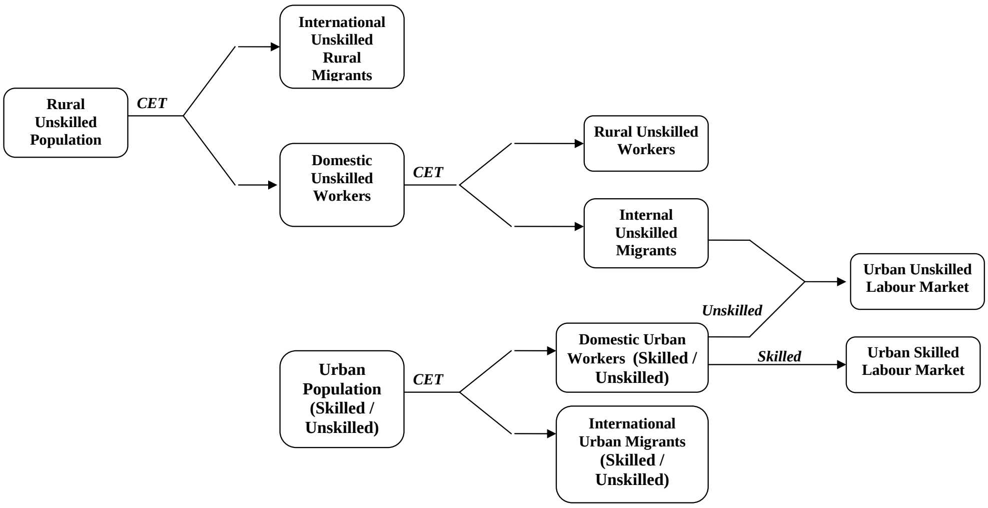
production factors: rural and urban labour as well as capital; 39 multi-productive sectors distributed between rural and urban areas; five agents (rural and urban households, firms, the government, and the RoW). Appendix A and B give more information about the data. The model is implemented in GAMS (Brooke et al., 1988) and solved with NLP, a non-linear programming solver. The following presentation uses a minimum of mathematical formulations. Appendix C includes the mathematical statement of the model.

2.1 Migration Flows

The model allows international migration from rural and urban areas as well as internal migration from rural to urban areas. Migration flows are determined by observed real wage differentials between the region of destination and the region of origin, net of migration costs. Urban unemployment is also able to affect the determinants of internal migration from rural to urban areas, as well as the determinants of international migration from urban areas. Following Karam and Decaluwé (2008), migration from rural areas is modelled as a two-stage decision process: the rural worker first maximises his expected income considering the choice of staying in Morocco (staying in rural zones or migrating to the cities) or leaving the country. Then, the rural worker who has decided to stay in Morocco carries out the choice of staying in rural areas or migrating to the cities. Similarly, the urban worker maximises his expected income by choosing to stay in Morocco or migrate abroad. Migration decisions are summarised in Figure IV.1.

Note that only urban population is composed of skilled and unskilled workers and then any possible migration of skilled workers only occurs from urban areas. This assumption is not contestable as soon as unskilled labour accounted for 90% of rural working population in 2003 (Royaume du Maroc, 2003). As it is highlighted in the “brain drain” literature, skilled workers contribute to innovation, technological adaptation and adoption, and are able to raise productivity through mutual interaction. The negative externality of skilled migration on skilled labour

Figure IV.1:
Migration Flows



supply is represented by the following equation:

$$A_{2up,t} = A_{2up,t-1} \frac{NATU_{\text{“}sk\text{”},t}}{NATU_{\text{“}sk\text{”},t-1}}^{ske}$$

where

$A_{2up,t}$	is the total productivity of the composite factor (See below) at period t,
$NATU_{\text{“}sk\text{”},t}$	urban skilled labour supply at period t,
ske	the positive externality parameter of skilled workers.

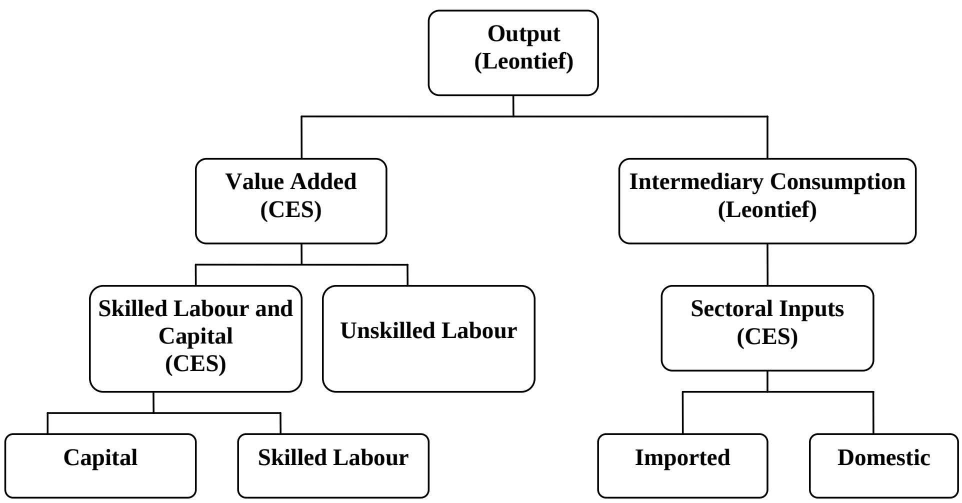
The externality parameter is fixed to 0.1, a fair low value. Table IV.12 in Appendix D shows that GDP growth is hardly affected by reasonable values for this parameter.

The distinction between skilled and unskilled labour sounds important for this analysis. Indeed, if Moroccan trade is governed by comparative advantage, and since Morocco is unskilled-labour abundant, trade liberalisation should induce the expansion of unskilled-labour intensive sectors, and the contraction of skilled-labour intensive ones. Therefore, unskilled labour demand should rise and unskilled wage should adjust upward, reducing migration incentives. By contrast, skilled labour demand as well as skilled wage should decrease, stimulating skilled migration. In other words, unskilled migration would be a substitute for trade liberalisation while skilled migration and trade would be complements.

2.2 Production Activities

Producers maximise profits for a given technology and input and output prices. The production function is described in Figure IV.2. Perfect complementarity is assumed between value added and intermediate consumption. Intermediate consumption aggregate is, in turn, a Leontief function of sectoral inputs, imported or locally produced. Value added is a CES function of unskilled labour and a composite factor, that is, in turn, a CES bundle of capital and skilled labour. This structure is intended to take into account the well documented skill-capital relative complementarity. Following the MIRAGE model (Bchir et al., 2002), the elasticity of substitution between capital and skilled labour is set to 0.6 while the elasticity between this bundle and unskilled labour is set to 1.1.

Figure IV.2:
Technology for Production Activities



The model is distinguished by an explicit separation of activities and households into rural and urban. Rural sectors consist of agriculture and fishing. The non-agricultural and non-fishing sectors of the economy are urban. Rural activities only use unskilled labour. Rural value added is thus a CES combination of unskilled labour and capital. In urban areas, the labour force of each activity includes both skilled and unskilled labour and urban value added has the form described in Figure IV.2.

Production functions display constant returns to scale. Producers, operating in competitive markets, are price-takers and do not earn pure profits. However, the new CGE literature since Harris (1984) argues that features of industrial organisations such as economies of scale and imperfect competition may play a significant role in determining the extent of the effects of trade policy shocks. For instance, according to Harris (1984), the estimated static long-run gains to Canada of free trade are in the range of 8-12%, considerably larger than suggested by conventional methods. In line with the new CGE literature, the simulations are run twice, first in a perfect commodity structure, then in an oligopolistic competition structure. Oligopolistic competition with increasing returns to scale is only assumed to hold in urban industrial sectors (Bouzahzah et al., 2007). Every industry consists of N identical firms, each producing a single commodity that is a close substitute for the products of its domestic competitors. In the short run, the number of firms is held constant and profits may vary. In the long run, the free entry-exit of firms brings profits back to their benchmark value[5]. The marginal production cost is constant at given factor prices, and production involves each year a fixed cost, expressed as a fixed quantity of capital. The scale economies referred to in this chapter are at the level of the individual plant in the manufacturing sector and hence internal to the firm. Thus, average cost exceeds marginal cost, so that perfectly competitive, marginal

[5] The common case would be to consider a long run equilibrium in the base year (with zero benchmark profits) and suppose that the free entry-exit of firms generated by the model brings back profits to zero. In this model, profits are supposed to be equal to 10% of the base year capital remuneration by sector and the free entry-exit of firms brings profits back to their benchmark value. Indeed, Morocco, like other developing countries, is subject to barriers to firm entries. Therefore, profits can hardly be brought back to zero. However, the last two lines of Table IV.13 in Appendix D show that the change of GDP when profits are brought back to zero is close to the results reported for the model simulations below. Table IV.13 shows as well that GDP changes for selected benchmark profit values are close to the results of the present model.

cost pricing would result in losses. In other words, firms enjoy some market power, enabling them to price over marginal cost[6].

2.3 Institutions

Rural and urban households receive the bulk of their incomes from labour remuneration in their respective regions. Urban household's labour income is composed of both skilled and unskilled labour remunerations. In addition to labour income, households receive capital remuneration, migrant remittances and constant transfers from the government (such as interests on domestic public debt) and the other agents. Total household income is used to pay direct taxes and fixed amounts of transfers to other agents, to save and consume. Direct tax rates are fixed shares of households' income. Savings are fixed shares of households' disposable income. Consumption demand is determined by a linear expenditure system. In addition to capital remuneration, government income consists of direct taxes, production and sales taxes as well as import and export tariffs (with different rates applying to EU and non-EU products). All taxes are *ad-valorem*. Besides transfers to the other agents (interests on domestic public debt to households and firms, on foreign public debt to the RoW...), the government uses its income to buy a fixed quantity of consumption goods. Firms' income is composed of capital remuneration and fixed transfers. The RoW receives import sales and transfers (such as interests paid by firms and the government, distributed profits from local firms ..., fixed in foreign currency), and pays the FOB value of exports in addition to remittances and

[6] Introducing imperfect competition with increasing returns to scale raises problems when a single activity produces many commodities. Indeed, as far as imperfect competition is concerned, it relates to commodities not activities. Increasing returns to scale however relate to activities. If a single activity produces two commodities, one in a perfect competition structure and the other with an imperfect competition structure, different pricing rules should be adopted for the two commodities. This also means that different technologies should be used inside a single activity. However, this raises the problem of factor intensity to be used for calibration of labour and capital by technology at the base year. For lack of data, it is supposed here that good *imc* is produced in an imperfect market structure, independently of the activity that produces it, but fixed costs required for production are only financed by activity *imc* (Activity *imc* is the one with at least 80% of production devoted to commodity *imc*). In exchange, the latter earns all profits coming from market power. Average cost of producing one unit of *imc* is approximated by the average cost of producing the composite commodity in sector *imc*.

transfers (such as interests paid to the government and firms, distributed profits paid to local firms and aid for the government..., also fixed in foreign currency).

2.4 System Constraints

System constraints or "closure rules" describe on the one hand the behaviour of labour and commodity markets and on the other hand, the macroeconomic aggregates like the government and RoW accounts and savings-investment adjustment mechanisms. These constraints have to be satisfied by the economic system, but are not considered in the decisions of any microeconomic agent.

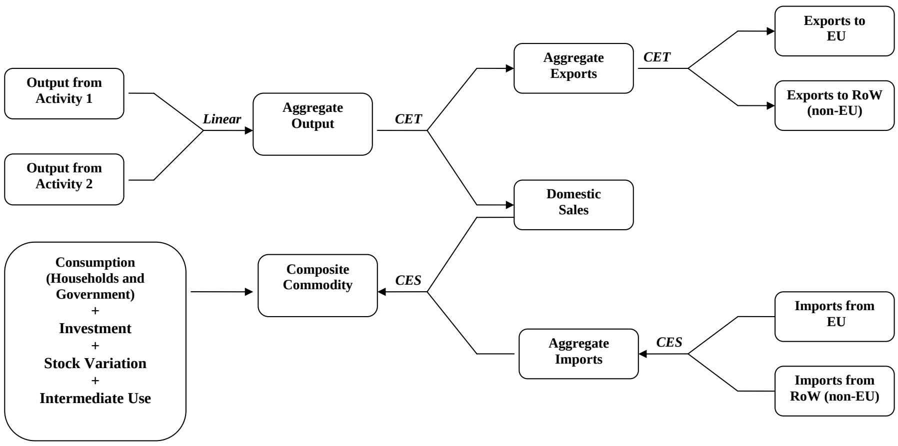
2.4.1 Commodity Markets

Figure IV.3 summarises the commodity flows underlying the market for a given product that is produced by two activities and is traded in both directions, with EU and non-EU countries. Tradable sectors sell their production on domestic and international markets, according to a CET function. Export supply depends on domestic and export FOB prices, the export capacity of the firm represented by the share of production exported, and the degree of transformation of domestic sales into international exports represented by the elasticity of transformation. As well, exports to EU vs. non-EU countries are imperfectly transformable. Exports of domestic firms face the economic constraints of international markets materialised by a finite export elasticity. Consequently, increasing exports is not achievable without a drop in FOB prices so that to balance export supply and demand.

Domestic demand for goods and services is satisfied by local production and imports. These are supposed to be imperfect substitutes for local products, following the Armington assumption (Armington, 1969). Thus, domestic agents make a choice between local and imported products according to a CES function. The relative demand for local and imported products depends on their relative prices, import penetration rate and the elasticity of substitution between imported and locally produced commodities. Imperfect substitutability is also assumed for imports from different regions (here EU and non-EU countries).

Each type of consumption is a vertical combination of goods and services and a horizontal combination of local and imported products. Given the lack of data on the horizontal combination of commodities for different consumption types, the horizontal structure of each composite product is supposed to be identical for final consumption by households and the government, intermediary consumption, investment demand by firms and stock variation.

Figure IV.3:
Commodity flows



2.4.2 Factor Markets

Installed capital is sector-specific, so that the rental rate of capital varies across sectors. Therefore and given that other things are equal, capital will be invested in sectors where it is highly remunerated. Rural labour is unskilled and perfectly mobile between rural sectors. It is assumed to be fully employed: a market-clearing price generates demand-supply balance. Skilled and unskilled urban workers are mobile between urban sectors but urban labour markets are imperfect due to the existence of unemployment. In this case, the unemployment rate is the clearing variable. The wage curve insures a negative relation between urban real wage and unemployment rate. Finally rural and urban labour are also mobile between regions but labour mobility across countries and between rural and urban areas occurs at transaction costs.

2.4.3 Macroeconomic Constraints

The macroeconomic closure adopted here is the one found in the literature on Morocco. This closure fits Moroccan reforms after the structural adjustment period: government savings are a fixed share of GDP. Uniform adjustments in the rate of sales tax insure that the government savings target is met. Foreign savings are fixed. A flexible real exchange rate clears the balance of the RoW. For each household, savings are a fixed share of his disposable income. Firms' savings are also determined by the model. Hence, none of savings sources is free to equilibrate the aggregate savings-investment balance: the model has a savings-driven determination of investment.

2.4.4 The Dynamic Module

The model is a sequential (recursive) dynamic one where agents have myopic behaviour. Between the static-model solutions, selected first-period exogenous variables are updated between periods, either by using lagged endogenous variables (from solutions in previous periods) or exogenous trends. Public expenditures, total factor productivity by activity, minimum consumption as well as transfers to and from households are all updated exogenously (See Appendix A). Capital stock is updated endogenously on the basis of previous investment and depreciation.

The evolution of migration flows affects capital accumulation through skilled and unskilled migrants' abilities to remit. Following Karam (2008), remittances are motivated by altruism. They decrease with households' real wage and increase with migrant wage. Unskilled and skilled migrants have different remitting behaviours (Faini, 2007): the elasticity of skilled remittances with respect to households' real income is lower than unskilled labour elasticity[7], because skilled migrants spend more time and reunite with their family in the host country. Conversely, since skilled migrants earn more, they are expected to remit more. This is reflected by a higher international skilled wage[8]. Remittances enter households' income and are allocated to investment through households' savings.

Rural and urban populations are updated between periods according to an exogenous natural population growth rate as well as migration flows. More specifically, rural population LSR_t (unskilled) grows at the exogenous population growth rate g_{LSR}, net of migration to urban areas MIG_t and of international migration from rural areas EMR_t.

$$LSR_{t+1} = LSR_t(1 + g_{LSR}) - MIG_t - EMR_t$$

Following Agénor et al. (2003), I make the assumption that urban individuals are born unskilled, so that urban unskilled population grows according to the natural urban population growth rate g_{LSU} and migration of unskilled labour from rural areas. Moreover, at each period, an exogenous fraction of urban unskilled workers ska acquires skills and leaves the unskilled labour force to increase the supply of skilled labour. In other words, I do not take into account the induced effect of skilled migration on the education of those left behind. Indeed, it is true to think

[7] The elasticity is equal to -4.2 for unskilled migrants, following Bouhga-Hagbe (2004), and to -2.2 for skilled ones. Tables IV.14, IV.15 and IV.16 in Appendix D give the change in GDP, remittances and households' real disposable income for different combinations of skilled and unskilled migrant elasticities with respect to households' real disposable income. As expected, the higher the elasticity is, the more remittances increase for the same drop in households' real disposable income or the more they decrease for the same increase of this income. The opposite occurs when the elasticity is lower. As soon as remittances affect in turn households' income, one would expect them to significantly alter this income. However, the changes in households' real disposable income illustrated in Table IV.16 are generally close to the results of the model because households' income is mainly driven by labour remuneration. Since remittances affect as well capital accumulation, one would also expect GDP to be altered. However, Table IV.14 shows that GDP change is also close to the results of the model. Remittance change following different combinations of skilled and unskilled elasticities are not strong enough to reverse the results.

[8] Following Bouhga-Hagbe (2004), the elasticity of skilled and unskilled workers with respect to their international wage is set to 1.8. This elasticity is not supposed to alter the results because the international wage is kept constant in all scenarios.

that migration prospects may foster investment in education because of higher return to education abroad. However, estimates about the elasticity of induced education with respect to skilled migration are not available for Morocco[9]. Finally, there are international migration flows of skilled and unskilled urban workers $EMU_{qu,t}$. Thus, the evolution of urban unskilled and skilled population is given respectively by:

$$LSU_{``un",t+1} = LSU_{``un",t}(1 + g_{LSU}) - skaLSU_{``sk",t} + MIG_t - EMU_{``un",t}$$

$$LSU_{``sk",t+1} = LSU_{``sk",t}(1 + ska) - EMU_{``sk",t}$$

Following Chapter 3 based on Karam (2008), I also distinguish between different migrant generations having different remitting behaviours. The first generation of migrants still has strong ties with the family left behind and remits more. The second generation that later brought spouses and children in the process of family reunification has lost some of its attachment to the country of origin, but still remits (lower amounts than the first generation) in order to support the parents left behind. The third generation of migrants is supposed to be highly integrated in the country of destination and barely remits. The first generation of migrants receives, at each period, current flows. Also, a fraction of the first generation looses, at each period, some of its attachment to the home country and joins the second generation. As well, a fraction of the second generation becomes more disconnected from the family left behind and joins the third generation.

3 Simulation Experiments

The simulations explore the impact of two scenarios for trade liberalisation on migration incentives. The first simulation FTA defines the commitment made

[9] Beine et al. (2001) use cross-section data to estimate the impact of skilled migration on investment in education. However, they do not take into consideration country heterogeneity. Given the potential high impact of the elasticity choice on skilled formation and thus on skilled labour market, this feature is not taken into account.

with the EU to gradually implement a free trade area by 2012. The second simulation MULTI assumes that Morocco gradually liberalises its external trade with all partners, including EU countries. Both simulations are run in a competitive and imperfect competitive framework, with a quick look to the effects of the liberalisation calendar on the results. Trade liberalisation with the EU does not exactly obey to the FTA agenda by product because the commodity classification in the agreement does not match the sectoral classification of the SAM. Instead, tariffs are gradually removed until free trade takes place in 2012. It should be also pointed out that the analysis focuses on a reduction of protection in Morocco. In other words, imports tariffs are unilaterally removed in Morocco. Tariff removal means free access to the Moroccan market of industrial and agricultural products originated from EU(27). Multilateral liberalisation of Moroccan imports in agriculture and industry also occurs gradually until 2012. Complete liberalisation in agriculture is a strong assumption as soon as agriculture is a sensitive topic in trade negotiations between developing and developed countries. However, it is adopted here like in Bouzahzah et al. (2007) and Cogneau et Tapinos (1995) so that to make the results comparable with their works. The results are summarised in tables in Appendix D.

What is the expected relation between labour mobility and trade liberalisation? As pointed out earlier, this relationship is different for skilled and unskilled workers. In the standard HO model, and given that Morocco is abundant in unskilled labour[10], it must export unskilled-labour intensive goods and import skilled-labour intensive ones. In order to meet increasing exports, labour demand of unskilled workers must rise and unskilled wage must adjust upward in order to balance the labour market. By contrast, labour demand of unskilled workers must decrease in countries that import unskilled-labour intensive goods. This wage evolution of unskilled workers inside and outside Morocco reduces migration incentives of Moroccan unskilled workers. In this context, labour mobility and trade liberalisation are substitutes.

[10] Skilled workers (with tertiary education) only account for 10% of Moroccan working population (Royaume du Maroc, 2003).

By contrast, if Moroccan imports are skilled-labour intensive and when imports replace domestic production, skilled labour demand decreases and so does the wage of Moroccan skilled workers. Consequently, skilled workers choose to leave. In this context, migration and trade liberalisation are complements. Indeed, as soon as Morocco's main trading partners are developed skilled-labour abundant countries (France, Spain, Italy, Germany) and since Moroccan imports mainly consist of capital and technology goods, it is true to think that they are skilled-labour intensive. In this model, the "other economies" are composed of two regions: the EU(27) and the RoW. Each region consists of countries with different technologies, sometimes skilled-labour intensive, sometimes unskilled-labour intensive. In other words, the evolution of the international wage following imports of unskilled-labour intensive products is ambiguous. Therefore, I normalise the international wage in foreign currency and let migration incentives only depend on the real wage differential, migration costs and the exchange rate in Morocco.

Before looking at the effects of the above-mentioned shocks, I present the evolution of the economy in the absence of any shock, what is called "Business as Usual" (BAU). This growth path results from the updating mechanisms, between periods, of the first-period exogenous variables. How does the economy react to these mechanisms over periods?

3.1 The BAU Growth Path

The growing urban population over periods is translated, *ceteris paribus*, in higher consumption by urban household, that in turn affects positively the demand addressed to sectors. Given that other things are equal, prices rise and incite firms to produce more. In the imperfect competition model, the price increase means positive profits that encourage new firms to enter the market in the long run in order to bring profits back to their benchmark value. The perceived price elasticity of demand by a single firm thus increases. Consequently, an individual firm should lower its price in order to sell more. Non-efficient firms leave the market and the remaining firms benefit from scale economies. In the short run, when the number of firms is fixed, positive profits emerge. Since only a part of those profits is distributed to households, households' income increases *ceteris paribus*, further stimulating the demand addressed to sectors. In the perfect and imperfect competition models, higher production is translated in a higher economic growth, still more pronounced in the imperfect competition case (on average 3.3% by year in perfect competition, 3.6% in imperfect competition - long run (LR) and 3.5% in the short run (SR)). This is due to the fact that lower prices in the long run and positive profits in the short run enhance household consumption. To this is added increasing demand for intermediary inputs by expanding sectors.

In spite of population growth, the rising demand for production factors necessary to achieve sectoral expansion, is high enough to increase the wage in rural areas, and reduce skilled and unskilled unemployment in urban areas. Urban unemployment rates decrease more, as expected, in the imperfect competition model. The wage curve insures that skilled and unskilled real wage rise in urban areas following lower unemployment rates. Despite the positive evolution of rural consumer price index in the perfect competition model, the rural wage increases enough so that rural real wage also rises. Given that other things are equal, the real wage increase explains the improvement of rural and urban households' real disposable income. Rural household income increases the most in the perfect competition model (PC) because the rural wage rises the most in that model. By contrast, urban household real income increases more in the imperfect competition model where urban real wages rise more. Given that other things are equal, rising labour demand increases the marginal productivity of capital as well as capital remuneration. This helps explain why the income of the other agents also increases.

Since internal demand is composed of domestically produced and imported products, rising demand is translated in higher imports. The macroeconomic closure that maintains external savings fixed induces, *ceteris paribus*, a depreciation of the real exchange rate[11] in order to boost exports. But since non-competitive sectors sell their production on foreign markets due to lower domestic prices, the real exchange rate needs to depreciate less in the imperfect competition model to maintain foreign savings fixed. In terms of GDP deflator that stands here for the *numéraire*, the "nominal"[12] exchange rate also depreciates.

The exchange rate depreciation raises the value of the foreign wage in domestic currency and hence motivates rural and urban emigration, despite higher real wages. Migration flows are lower in the imperfect competition case because real wages are higher and the depreciation of the real exchange rate is lower. Besides, starting period 5 in the imperfect competition model and period 10 in the perfect competition one, rising real wages compensate the exchange rate depreciation and dampen migration incentives for rural and urban workers. In rural areas, unskilled wage strongly rises due to the expansion of the agricultural sector, that has an important weight in households' consumption. Finally, internal migration is reduced due the increase of rural real wage, in comparison to urban expected real wage of unskilled workers.

Two factors determine the evolution of remittances: migration flows and the altruistic motive. Households' real disposable income increases over periods. Therefore, according to the altruistic motive, remittances by rural and urban migrants must decrease. The results show that the evolution of migration flows dominates the altruistic effect until period 5 for rural migrants and urban unskilled migrants in the imperfect competition model, and until period 10 for urban unskilled migrants in the perfect competition case. Remittances received by urban households are even lower in the imperfect competition model where the higher real income of urban household reduces the altruistic motive. The lower amount of remittances received by the economy as well as terms of trade deterioration due to the real

[11] The price of a unit of foreign currency in domestic currency.

[12] Let me recall that this is a real model. All variables are expressed in terms of GDP deflator that stands for the *numéraire*. I only use the term "nominal exchange rate" for convenience to outline the conversion unit of the international wage in domestic currency. However, since the real exchange rate (in terms of the *numéraire*) depreciates, it is also true to say that the "nominal" exchange rate or the conversion unit rises.

exchange rate depreciation both explain why GNP increases less than GDP.

Recall that remittances affect capital accumulation through households' savings. Despite lower remittances, households' income increases due to higher factor remuneration[13]. Therefore, households' savings increase too. It is also the case of firms and government's savings. In sum, the investment capacity of the economy grows, with greater extent in the imperfect competition model.

After the shock, the economy will have another growth path due to the simultaneous effect of the shock and the updating mechanisms of the first-period exogenous variables. Consequently, the analysis should be done with respect to the BAU growth path.

3.2 FTA: The Morocco-EU Free Trade Area

A gradual tariff removal on EU products induces lower import prices from the EU relatively to the RoW. Given that other things are equal, imports of EU products increase and imports from the RoW decrease. In addition, the price of domestic products increases relatively to imports from the EU, encouraging the consumption of European products. Imports are greater from period to period because import duties are gradually reduced, until the 10th period of the model (year 2012). Since the macroeconomic closure considers external savings fixed, higher import volume should be compensated, *ceteris paribus*, by higher exports. This is made possible by a depreciation of the real exchange rate. Total import volume increases more in the imperfect competition model because in most sectors, the pro-competitive effect of trade liberalisation is offset by lower demand for local products after tariff removal. However, the real exchange rate is unexpectedly lower in the imperfect competition model. Indeed, besides the real exchange rate depreciation that boosts exports, the drop of domestic prices in non-competitive sectors so that to meet

[13] It was pointed out earlier that urban real wages (in terms of the urban consumer price index) increase. Despite the positive evolution of urban consumer price index in the perfect competitive case, what I call here for convenience the "nominal" wage, i.e. the wage not corrected with the consumer price index, also increases.

import competition makes exports more attractive. Hence, export expansion is much higher than imports, so that the real exchange rate depreciates less in the imperfect competition model than in the perfect competition case. In addition, in the short run imperfect competition simulation, the number of firms is fixed. So even if lower demand for local products offsets the pro-competitive effect, firms do not leave the market. They produce, even if profits are negative in the short run. In other words, imports need not to increase as much as in the long run simulation, and the real exchange rate depreciates less.

According to the standard HO model, trade liberalisation should boost exports of unskilled-intensive products, those where Morocco has a comparative advantage. By contrast, imports must increase in skilled-intensive disadvantaged sectors and, given that other things are equal, depress local production. It is indeed the case of capital and technology goods such as machines (in both models) as well as cars (only in the perfect competition model) and medical instruments. Nevertheless, the results also show a contraction of some unskilled-labour intensive sectors: agriculture, food (in the perfect competition model), tobacco, rubber and plastic industry, non-metallic minerals, metallurgy, metal processing, furniture and other industries. According to Table IV.1, those sectors are the most protected ones. Therefore, they experience the greatest competition from European products after tariff removal and imports replace domestic production. However, the negative demand effect in food and car industries is more than compensated by the pro-competitive effect in the imperfect competition model. In the expanding sectors, production growth is made possible by increased exports to foreign countries stimulated by the depreciation of the real exchange rate and cheaper intermediary inputs. The expansion of these activities offsets the negative effect of the contracted ones on GDP so that the overall economic activity grows over the five first periods. GDP growth is even higher when the shock is run with an imperfect commodity market structure because the pro-competitive effect in many sectors compensates the lower demand addressed to local producers and enhances production growth (food and wood industries, paper industry, edition, chemicals, radio and equipment and car industry). This pro-competitive effect is also responsible for lower rural and urban consumer price indexes in comparison to the perfect competition model. In the imperfect competition model, GDP grows less in the short run simulation because lower prices induce lower profits that negatively affect households' income and consumption, given that other things are equal. However, after two periods of tariff removal, the negative effect of losses on households' income is offset by better factor remuneration, as it will be shown below. Besides, a single firm that faces the same negative demand effect in the short and the long run simulations, can choose to leave the market in the long run. By contrast, in the short run, it produces even if profits are negative. That is why GDP grows more in the short run simulation (Figure IV.4). Despite GDP growth, the GNP decreases due to terms of trade deterioration following the real exchange rate depreciation.

Labour demand of skilled and unskilled workers evolves according to the skill intensity of the contracted and expanded sectors. If the contracted ones are skilled-labour intensive sectors in which Morocco is disadvantaged, skilled labour demand will decrease and so will the skilled wage. Skilled workers will then be motivated to leave the country. On the other hand, the demand for unskilled labour used intensively in the expanded sectors will increase and so will the unskilled wage. Consequently, unskilled workers will choose to stay at home. This is what the comparative advantage theory predicts. However, as pointed out earlier, the results also depend on the initial tariff structure. For example, agriculture and food products are highly protected and still unskilled-labour intensive. Consequently, when those sectors contract following tariff removal, the decreasing unskilled labour demand could compensate the increasing unskilled labour demand from the expanded sectors and induce a drop in unskilled wage, with what follows in terms of higher migration incentives. Symmetrically, if the initial tariff on skilled-labour intensive sectors was close to zero in the base year, as it is the case for example in office machinery and financial services, the FTA creation will not necessarily induce a contraction of those sectors, nor a lower skilled labour demand. Then, if other things are equal, skilled wage needs not to decrease and skilled workers to leave. In other words, the initial tariff structure could reverse the results. Does the comparative advantage theory or the initial tariff structure effect dominate?

In rural areas, the high protection level of agricultural products makes them less competitive with European goods, once tariffs are removed. Agricultural imports replace then domestic production and the agricultural sector shrinks. Consequently, unskilled labour demand decreases in rural areas and, given that other things are equal, rural unskilled wage falls in order to balance the market. Let me point out that the consumer price index increases in the perfect competition model despite lower tariff rates, due to the exchange rate depreciation that increases the value of import prices in domestic currency. That is why rural real wage decreases more in the perfect competition case. The agricultural sector shrinks less in the imperfect competition short run model because the expansion of the food sector that mostly uses agricultural inputs is higher. That is why the rural wage decreases the less in comparison with the two other simulations. While the initial protection effect dominates in rural areas, the results show a little bit of both effects in urban areas. Labour demand for unskilled workers increases, following the prediction of the comparative advantage theory. Unskilled unemployment then falls and the wage curve insures that urban unskilled real wage increases. By contrast, for skilled workers, the low protection structure of skilled-labour intensive sectors does not induce a sharp competition with EU products after tariff removal. Instead, on the one hand, higher exports made possible by the real exchange rate depreciation and cheaper inputs, allow the expansion of those sectors. On the other hand, the CES value added insures that expanding urban sectors raise the demand for the composite factor. Given the relative complementarity between capital and skilled labour, the increasing demand for the composite factor induces a rise of skilled labour demand. This is able to reduce skilled unemployment and raise the skilled real wage[14]. The

[14] In this simulation, “nominal” wages follow the evolution of real wages (in terms of rural/urban consumer price index).

drop of unemployment rates are even greater with the imperfect competition model where the pro-competitive effect of trade liberalisation further stimulates production growth.

Household real disposable income follows the evolution of rural and urban real wages. Higher urban wages in the imperfect competition framework induce higher urban household real income and, *ceteris paribus*, higher urban consumption, when compared to the perfect competition model. As expected, rural household real disposable income decreases less and urban household real disposable income increases more in the short run model due to higher real wages. When greater intermediary consumption by expanding sectors is added to higher urban household consumption with respect to the perfect competition model, total demand increases more in the imperfect competition case. Because demand is satisfied by local and imported products, imports from the EU further increase in the imperfect competition simulations with respect to the perfect competition model.

Here, it is brought to attention how real wages affect migration flows. In rural areas, the deterioration of rural real wage motivates people to leave. Migration flows are particularly important in the perfect competition model where the real rural wage degenerates more in comparison with the imperfect competition case. Internal migration flows are the highest with the long run imperfect competition model because the real rural wage decreases the most with respect to the urban unskilled expected real wage. While urban migration flows are expected to decrease following real wage improvement, the results show higher migration incentives because the exchange rate depreciation raises the value of the international wage in domestic currency. Migration flows are however lower in the long run imperfect competition model because unskilled real wage is higher in comparison to the perfect competition case. Most importantly, unskilled urban migration decreases in the short run imperfect competition case. However, migration of skilled individuals increases until period 5 because the exchange rate depreciation compensates the higher skilled real wage. Migration of skilled individuals negatively affects the productivity of the composite factor, because skilled workers contribute to innovation, technological adaptation and adoption, and are able to raise productivity through mutual interaction. Furthermore, if one looks at the composition of migrant flows, it is possible to notice that the proportion of unskilled migrants increases with respect to skilled ones. This result is contradictory to the HO theory.

Remittances are motivated by altruism, they depend on households' real disposable income. The amount remitted to the rural household increases, as expected more in the perfect competition model. While urban migrants are expected to remit less, in the perfect competition model, due to higher urban household real disposable income, the results show that remittances received by urban household increase due higher migration flows. However, with the imperfect competition model, urban household receives less remittances because urban migration flows are lower and urban household real income is greater. Note that the drop of the amounts remitted by skilled migrants is lower than those remitted by unskilled migrants because skilled individuals have a lower elasticity of remittances with respect to urban household real disposable income, as argued in Section 2. In sum, the total amount of remittances increases, more with the perfect competition model. However, the greater amount of remittances received by the economy does not compensate the negative effect of the terms of trade deterioration on GNP. The evolution of remittances is also important because they affect capital accumulation through their impact on household savings. Indeed, the overall value of savings increases, allowing more investment capacity. It should be pointed out here that public savings increase, in spite of lower import tariffs. This is particularly coming from the savings-driven macroeconomic closure: in order to maintain fixed the share of public savings in nominal GDP, the rate of sales tax should adjust upward (uniform across sectors) to compensate import tariff loss.

At the beginning of period 5, with increasing tariff removal, the contracted sectors are unable to resist to EU product competition. The above-mentioned contracting sectors shrink more as soon as tariffs are cut and compensate the positive effect of expanding sectors on GDP growth. The negative GDP growth occurs later on in the long run imperfect competition model, starting period 8, and in the short run model starting period 12. In the last case, lower GDP growth is explained by a negative demand effect stemming from lower rural household consumption and lower intermediary consumption by the contracted sectors. The increasing contraction of highly protected unskilled-labour intensive sectors explains the drop of unskilled labour demand, after period 5 in the perfect competition case and after period 10 in the long run imperfect competition model. Also, the increasing contraction of disadvantaged skilled-labour intensive sectors explains the drop of skilled labour demand, starting period 10. Unemployment then rises and the wage curve insures that urban real wages fall. This causes urban household income to decrease. All along the periods, household welfare[15] follows the evolution of households' real disposable income. That is why rural and urban household welfare finally decrease by about 0.5% of their consumption budget. It becomes clear now why migration flows are further motivated. Skilled migration decreases after period 5 in the short run imperfect competition model because the exchange rate depreciation is not strong enough to stimulate migration, in presence of a higher real wage. Even when the real wage decreases, skilled migration decreases because it is discouraged by the exchange rate appreciation.

However, after the transition period, when all tariffs are removed (period 10 of the model), some contracting sectors (machines and equipment, furniture and other industries) grow again in the perfect competition case. The logic is as follows: total factor productivity improves exogenously between periods, allowing those sectors to better face foreign competition after tariff removal. This is also made possible by cheaper intermediary products. Finally, it is worth mentioning that rural wage increases again starting period 10: first, because the fishing sector expansion compensates the contraction of agriculture, then because labour supply decreases in rural areas due higher migration flows. Rural real wage also increases due to

[15] Welfare is given by the equivalent variation of household's consumption budget, see equation A126 in Appendix C.

tariff removal, reducing internal migration incentives. In the imperfect competition model, rural real wage decreases less after tariff removal but does not turn positive in the long run simulation. Surprisingly, rural emigration change becomes negative starting period 10 in the imperfect competition framework, despite the negative change of real rural wage in the long run simulation. This is explained by the fact that rural migration is affected by the observed national unskilled wage, because the rural worker makes a choice of migrating to urban areas or to foreign countries. It happens that the national unskilled wage is driven up by the urban unskilled wage. At present, the composition of migrants is skilled-biased.

Bouzahzah et al. (2007) are interested, like in this chapter, by the impact of Moroccan-EU FTA on migration incentives. They find that trade liberalisation is complementary to migration because it induces a drop of the wage rate, that in turn stimulates migration. In this chapter, the results of the perfect competition model show that trade liberalisation is also complementary to migration. However, the transmission channels here are different. The real wage only decreases in rural areas until period 10 and since period 8 for unskilled urban workers. By contrast, the purchasing power of urban workers improves and it is the exchange rate depreciation, that motivates skilled migration. Migration is thus due to a pull factor and not a push factor like in Bouzahzah et al. (2007). Furthermore, in the short run imperfect competition case, both rural and urban migration decrease.

Recall that the results of the long run imperfect competition framework are more comparable to those of Bouzahzah et al. (2007) who make use of an imperfect competition commodity market structure. The authors found that the agricultural sector expands while industry and services shrink. Exports sharply decrease and, besides higher imports, deteriorate the current account. The sectoral impacts of the FTA creation found here are different: the results show a depression of the agricultural sector and an expansion of many industrial and service sectors where Morocco is advantaged, or that were not highly protected in the base year. One possible explanation of this difference is that the authors use an aggregated SAM of

1985, while the FTA trade agreement entered into force in march 2000. First, sectoral aggregation hides the diversity of protection applied to the disaggregated sectors and then affects losers and winners from liberalisation. Secondly, in 1985, tariff and non-tariff barriers were still high and Morocco was in the midst of structural adjustment. Thirdly, the international market shares of Moroccan main exports changed in 15 years. The part of Moroccan exports in international export value passed from 0.27 to 0.35% for food industry, from 0.34 to 0.66% for textile and leather, from 0.47 to 0.19% for chemicals. But the big change concerned the Moroccan export shares in European markets (from 0.22% to 0.25%): the Moroccan market share raised from 0.46% to 0.53% in the food sector and from 0.68% to 1.74% in textile and leather industry, while the part of chemicals fell from 0.58% to 0.16% (Moroccan Ministry of Finance and Privatization, 2005). Another explanation is that Bouzahzah et al. (2007) did not take into account the dynamic effects of trade liberalisation and the possibility of different behaviours for skilled and unskilled labour.

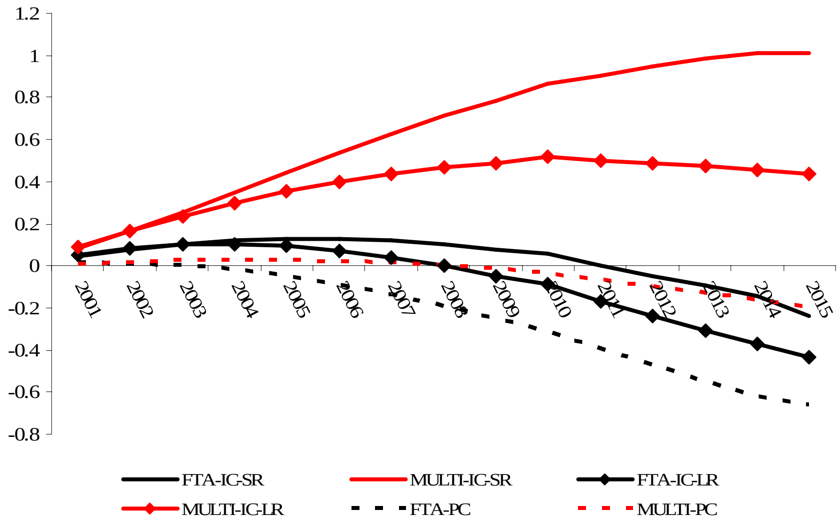
What about the liberalisation calendar? Should tariffs be gradually removed? How does the economy react to the immediate tariff removal? I briefly display here some results of the instantaneous liberalisation shock. The transmission channels are analogous to the FTA gradual establishment but the reaction of variables is always greater at the first period. After the shock, the variables evolve according to some dynamic effects. An immediate tariff abolition sharply increases imports of EU products, since the first period, at the expense of domestic production and imports from the RoW. Consequently, the real exchange rate highly depreciates in the first period of the model, in order to increase exports and keep external savings fixed. The above contracted sectors sharply shrink immediately after tariff removal, due to higher import competition. Therefore, the overall economy activity decreases since period 1. Only in the imperfect competition framework, the economy grows over the 3 first periods of the model because of the pro-competitive effect of trade liberalisation. Later on, the negative demand effect stemming from lower household consumption and lower intermediary demand by the contracting sectors further induces sectoral contraction, so that GDP growth becomes negative. The GNP sharply decreases due to the simultaneous effect of higher terms of trade deterioration and lower GDP. In the short run imperfect competition model, the real exchange rate appreciates starting period 3 because non-competitive sectors channel their production abroad after the drop of domestic prices following the pro-competitive effect of trade liberalisation. However, the appreciation is not strong enough to increase GNP, in presence of negative GDP growth. Because most of the contracted sectors are unskilled-labour intensive, unskilled labour demand decreases, leading to higher unemployment and lower real wage. Surprisingly, skilled labour demand also decreases starting period 10, because household consumption and intermediary input demand of the contracting sectors fall enough so that the overall economic contraction worsens. Besides, when the production of unskilled-intensive sectors decreases, the drop of the composite factor demand induces a drop of skilled labour demand too. With instantaneous liberalisation, the push factors exist in rural and urban areas, like in Bouzahzah et al. (2007).

In sum, the results show that a gradual creation of the FTA is better because it cushions the transition of the economy by exposing gradually Moroccan products to European competition. Meanwhile, capital accumulation and total factor productivity growth as well as cheaper intermediary inputs improve the competitiveness of domestic sectors.

3.3 MULTI: Multilateral Liberalisation

This shock consists of a gradual tariff removal affecting all Moroccan imports, including those originated from non-European countries. If Morocco has the same trade characteristics with the EU and the RoW, then the transmission channels of this shock must be the same as before but with greater magnitude because all import tariffs are now removed. As expected, multilateral liberalisation further reduces the aggregate import price by product and boosts imports from the EU and the RoW in both models, in comparison to the FTA case. Surprisingly, imports of the

Figure IV.4:
GDP Growth with Gradual Liberalisation



Notes: (1) PC: Perfect competition.
(2) IC: Imperfect competition.
(3) LR: Long run.
(4) SR: Short run.
Source: Author's calculations.

following European products fall: fishing, mining, tobacco, textile, clothing, leather, wood, paper, chemistry, metallurgy, machines and equipment, office machinery, electrical machines, radio and TV, medical instruments, car industry, manufacture of other transport means, furniture and other industries. This is mainly explained by increased competition of South-East Asia and Arab countries. The macroeconomic closure that considers external savings fixed imposes that additional exports should compensate, *ceteris paribus*, the higher import volume. This means that the real exchange rate should depreciate more than the FTA case. This is true to a lesser extent in the imperfect competition model. Indeed, later on, the sharper the competition becomes, the more non-competitive sectors reduce their prices, and the more they prefer to sell on foreign markets. Export expansion is high enough to compensate the previous depreciation of the real exchange rate, partly or completely. Besides, higher imports from the RoW and from the EU replace domestic production on local markets.

Highly protected sectors shrink more, because all import tariffs are now lowered, including those on imports from the RoW. The remaining sectors profit from the stronger real exchange rate depreciation and cheaper inputs in order to channel their production to foreign markets. Higher export growth with respect to the gradual FTA case induces a greater expansion of production and insures a growth of the overall economic activity (Figure IV.4). GDP growth is higher than the gradual FTA case and the GNP decreases more due to greater terms of trade deterioration. In the imperfect competition model, the low depreciation or sometimes the appreciation of the real exchange rate explains the positive evolution of GNP starting period 5. However, as soon as tariffs are further lowered, increasing import competition induces a greater contraction of highly protected sectors. The sharp contraction of those sectors is no more compensated by the expansion of the remaining sectors at period 9, so that GDP growth becomes negative in the perfect competition model. But the GDP drop is lower than the gradual FTA case because the greater depreciation of the real exchange rate induces higher export expansion. By contrast, in the imperfect competition model, GDP grows over all periods. Indeed, additional tariff removal is accompanied by increasing import competition so that efficient firms reduce their prices and sell more.

Before period 9, the higher expansion of the low protected urban sectors is translated in greater demand of urban skilled and unskilled workers. Skilled and unskilled unemployment rates thus decrease and real wages increase according to the wage curve. The drop of unemployment is even higher in the imperfect competition model, as it was the case in the FTA shock. Note that in contrast to the FTA case, skilled and unskilled unemployment do not increase with additional liberalisation because the overall activity now grows more and released workers from contracted activities are employed in the expanding sectors. In rural areas, multilateral liberalisation is more harmful to the agricultural sector than partial liberalisation, due to Arab competition. Consequently, labour demand of unskilled rural workers decreases with respect to the FTA shock as well as the rural wage. This result is contradictory to what Cogneau and Tapinos (1995) found: according to the authors, multilateral trade liberalisation reduces the overall economic activity and induces a specialisation of the economy in agriculture. Households' real income follows the evolution of rural and urban real wages. Rural household income then decreases and urban household income increases with respect to the FTA shock.

Again, the negative influence of increasing urban real wages on migration incentives is outweighed by the stimulating effect of the exchange rate depreciation. In the perfect competition model, migration flows are greater, when compared to the FTA shock, due to the higher exchange rate depreciation. It is worth mentioning that the proportion of skilled migrants in total migrant flow decreases with respect to the growth BAU path, and this could be seen as a contradiction with the HO model. However, when multilateral liberalisation is completed, migration flows increase at a slower pace than the FTA case, because lower prices further decrease urban and rural consumer price indexes, making real wages higher. Their evolution even becomes negative with the imperfect competition model, where prices further decrease following the pro-competitive effect of trade liberalisation. But the drop of migration flows in the short run imperfect competition model is greater than the FTA case because now real wages are higher. Even rural emigration becomes negative due to the improvement of the rural wage. Indeed, the greater expansion of the food sector increases the demand for agricultural inputs, hence the lower contraction of the agricultural sector. In the perfect and imperfect models, internal migration increases motivated by higher urban expected real wage for unskilled workers. As expected, the better welfare improvement occurs in the short run imperfect competition model where rural and urban household real incomes increase. Rural and urban household welfare increase by about 1% and 3.2% of their consumption budget, respectively.

The more people migrate, the more households receive remittances, in spite of urban household's higher income. Like in the FTA shock, the amount received by urban household decreases in the imperfect competition model. But with multilateral liberalisation, they decrease more due to lower migration flows and higher household real income.

Let me point out that the skilled wage improves more than the unskilled one after period 10 because, in the perfect competition model, skilled migration exacerbates the scarcity of skilled workers in the economy. However, skilled migration continues to rise in the perfect competition model due the stimulating effect of the exchange rate depreciation, but at a slower pace. At present, the evolution of migrant flow composition becomes skilled-biased, and this gives support to the HO model.

In sum, the results of the perfect competition framework show that multilateral trade liberalisation is complementary to migration, as it is found in Cogneau and Tapinos (1995). However, Cogneau and Tapinos (1995) argue about the existence of a push factor for migration. In their model, only internal migration is modelled endogenously, according to wage differentials. The conclusion of the authors concerning the relation between migration and trade is a logical implication of the fact that gradual multilateral trade liberalisation did not succeed to reduce poverty and unemployment. In the present chapter, urban unemployment rates of skilled and unskilled workers decrease reflecting the absence of any push factor. Migration is only motivated by the high exchange rate depreciation that improves the value of international wage in domestic currency. This however does not mean that the previous studies are wrong, but shows how some complications to the model are likely to reverse the results. For instance, the adoption of the imperfect competition framework comes out with a reduction of both skilled and unskilled flows, because the pull factor, here the depreciation of the exchange rate, is weaker.

What about an instantaneous liberalisation? Like it was the case with the instantaneous FTA shock, the results of an instantaneous multilateral liberalisation are analogous to the gradual liberalisation case, but of greater amplitude since the first period. Indeed, total tariff abolition increases import competition of products originated from the EU and the RoW. Reliance on imports sharply increases at the expense of domestic production. That is why the real exchange rate depreciates more since the first period, in order to increase exports and keep external savings fixed.

As expected, the above contracted sectors shrink more, due to higher tariff removal since the first period. Consequently, the overall economy activity decreases in the perfect competition model. The GNP sharply decreases due to the simultaneous effect of higher terms of trade deterioration and lower GDP. Interestingly, GDP grows in the imperfect competition model since the first period because greater competition encourages firms to further reduce their price and sell more. Besides, the pro-competitive effect of trade liberalisation compensates the negative demand effect in some previously contracting sectors such as metal processing and medical instruments.

In the perfect competition model, unskilled labour demand decreases now due the greater contraction of highly protected sectors, because the economy is not able to meet immediately foreign competition without factor productivity improvement. However, after some periods of migration and given that other things are equal, urban skilled and unskilled labour become scarce, and unemployment decreases. The wage curve insures that the real wage increases. Over the last two periods of the model, skilled unemployment goes up again. Indeed, there is a negative demand effect affecting some skilled-intensive sectors such as financial and rental services as well as editing. This demand effect stems from decreasing rural household consumption, besides lower intermediate demand of the contracting sectors. By contrast, in the imperfect competition model, unemployment and wages evolve as before but with greater change at the first period. In addition, in the last case, the real exchange rate appreciation dampens migration incentives since the fifth period. Rural and urban households' welfare evolves in the same direction as before but with smaller magnitude.

To summarise, a gradual liberalisation, like a gradual FTA, cushions the exposition of the economy to foreign competition. The results of a gradual liberalisation shock are better in terms of economic growth and welfare because the economy gets gradually used to foreign competition. A gradual multilateral liberalisation is also better than a gradual FTA establishment in terms of welfare and economic growth, as well as in terms of reduction of migration incentives.

4 Conclusion

The multiplicity of free trade agreements signed by Morocco as well as trade policy adjustments according to WTO rules raise the interest about the potential impact of trade liberalisation on the economy. In a country with a long history of migration, one of the crucial effects of tariff removal relates to labour market: trade liberalisation is able to affect migration incentives by its impact on unemployment and wages. The nature of the relation between tariff removal and emigration sounds of primary importance at a time developed countries closed their doors in face of South migration. The latter is only able to decrease if trade liberalisation improves living conditions in sending countries. Another concern is the skill composition of migrant flows. In the standard HO model, trade liberalisation is seen as a substitute for unskilled migration. By contrast, skilled migration and trade liberalisation are seen as complements. In an unskilled-labour abundant country, loosing unskilled labour is accepted as soon as it decreases the pressure on unskilled labour market. However, skilled migration is less accepted. This was at the origin of the “brain drain” literature.

This chapter looks at the effects of trade liberalisation on the skill composition of migrant flows, giving a new answer to the question with respect to previous works on Morocco. Bouzahzah et al. (2007), and Cogneau and Tapinos (1995) show that trade liberalisation and migration are complements. Migration is motivated by push factors such as a lower wage or a higher unemployment rate, resulting from trade liberalisation. This chapter deals with a new dimension of the question by distinguishing between skilled and unskilled migration. The results of the perfect competition model confirm the complementarity relationship between trade liberalisation and migration. Gradual liberalisation deteriorates rural wage and thus motivates rural migration. However, it improves the situation of skilled and unskilled workers in urban areas, at least in the short run. Despite the absence of any push factor, skilled and unskilled emigration from urban areas is motivated by the exchange rate depreciation that raises the value of international wage in foreign currency. Furthermore, when an imperfect market structure is adopted, migration incentives in rural and urban areas are reduced, like in Faini and de Melo (1995), for both skilled and unskilled workers. This is explained by the pro-competitive effect of trade liberalisation that makes the economy grow more. The results of this chapter are a step forward with respect to the literature, made possible by only some complications that better draw the reality of migration flows and their impact on the economy.

Different liberalisation scenarios are investigated. The multilateral liberalisation shock replicates most of the FTA results, but with greater changes in the variables, due to higher tariff removal. It sounds better in terms of welfare and economic growth. Besides, international migration flows are further reduced. Instantaneous liberalisation increases the exposition of the Moroccan economy to foreign competition since the first period and thus deteriorates the situation of rural and urban unskilled workers, in the perfect competition model. In other words, gradual liberalisation sounds better because it cushions the exposition of the economy to external competition by allowing an improvement of total factor productivity over periods. The overall conclusion from the model simulations is that efforts should be pursued for additional liberalisation. With multilateral liberalisation, the economy grows more and the results show that the more the economy grows, the more migration flows are able to decrease.

IV.A Appendix A: Data

The model data is based on a disaggregated SAM for 2003, to which the model parameters are calibrated. The SAM was constructed on the basis of various data sources, most importantly: the input-output table of the Moroccan economy for 2003, the National Survey on Household Living Standards, documents from the Ministry of the Economy and Finance, from External Trade department, from the Ministry of Agriculture, from Foreign Exchange department, and from Bank Al-Maghrib. The SAM gathers two production factors (labour and capital), five types of agents (households, non-financial institutions, financial institutions, the government and the RoW), 39 production sectors. I further decompose the SAM in order to distinguish between rural and urban areas and take into account two categories of household: a rural household offering his working hours to rural sectors and an urban household offering his working hours to urban sectors[16].

The SAM describes the Moroccan economy in 2003. At this period, GDP amounted to MAD 477 billion. On the output side, the primary and secondary sector are relatively small accounting for respectively 18% and 28% of real GDP. By contrast, the tertiary sector accounts for 54% of real GDP. On the demand side, households consumption accounts for 58% of GDP, while government current expenditures account for 18% of GDP. At the same time, total investment expenditures represent 26% of GDP, implying that Morocco is running a trade deficit equivalent to 2% of GDP. Indeed, exports and imports represent respectively 29% and 31% of GDP. Industrial imports constitute 86% of total imports whereas agricultural products and services only account for 7% of total imports each. Industrial exports are also the most important, about 60% of total exports, followed by agricultural products that represent 25% of total exports whereas services only account for 15% of total exports.

Migration data are taken from several sources:

[16] For further details, see Appendix A in Chapter 2.

1- To quantify Moroccan emigration, I resort to the data published by the OECD in 2006 on immigrant inflows by nationality in some OECD countries. I approximate Moroccan emigration by the flows of Moroccan migrants to their traditional destinations, such as Belgium, France, Italy, the Netherlands and Spain. The sum of these flows (102,000 migrants in 2003) is reported to the Moroccan working population of 2003 in order to calculate the annual percentage of emigrants (0.9%). I also use the stocks of Moroccan migrants in the previous selected countries in order to approximate the stock of migrants necessary to the adjustment of the model in the dynamic framework.

2- According to a report of the International Organisation of Migration (Erf and Heering, 2002), Moroccan emigration towards European countries is more originated from rural areas. I suppose that 60% of the national emigration flow/stock take place from rural areas and 40% from urban areas.

3- Agénor and El Aynaoui (2003) point out that each year, around 200,000 workers migrate from rural to urban areas. This corresponds approximately to 4% of the 2003 rural working population.

4- Finally, for lack of data on skilled and unskilled migration, I resort to OECD data on migrant stock by educational level in 2005 in order to calculate the stock of skilled migrants (26% of total migrant stock). The percentage of skilled flows (31% of total migrant flows) is calculated from Hamdouch (2005). Skilled wage premium for migrants is calculated on the basis of a weighted average of skilled wage premium in the main OECD countries receiving Moroccans. This results in a wage of 1.5 times higher for skilled migrants with respect to unskilled ones. Skilled wage premium in Morocco is calculated from the Investment Climate Assessment study by the World Bank and the Moroccan Ministry of Industry and Trade (Royaume du Maroc, 2005). Moroccan skilled wage premium is also evaluated at 1.5.

Trade data come from various sources: aggregate exports and imports by product are taken from the SAM. Export and import percentages to and from the EU are calculated using data from the Moroccan Ministry of External Trade, Rabat.

Average applied tariff rates are taken from national accounts. Tariff rates applied on EU products come from Caupin (2005) and from author's calculations based on CEPII's[17] "Trade and Production" database, available on CEPII's website. This database is based on the data of Nicita and Olarreaga (2001) coming from the United Nations sources: COMTRADE and UNIDO. Despite a wide covering, the World Bank files contain a lot of missing values for production figures in recent years. This is the reason why the Trade and Production database was largely extended using more recent versions of the UNIDO CD-ROM together with OECD STAN data for OECD members. Regarding trade data, the mirror inflows, available in Nicita and Olarreaga (2001), were used with the CEPII database on international trade (BACI)[18], which is also based on COMTRADE data. The data used is a cross section in 2001.

The calibration procedure is more difficult in an imperfect competition market structure. Baseline values are needed for fixed costs, the number of firms, and the perceived price elasticity of demand. None of these are given in the original SAM. Furthermore, those variables are linked within sectors by the zero-profit constraint. It is also easy to show that the price elasticity of domestic demand depends on Armington elasticities (Cockburn et al., 1998). Consequently, two of them are taken from external sources and the third one is calibrated. In the Moroccan case, no information is available on the number of firms by sector. Therefore, it is calibrated from Armington elasticities and the scale parameter. The scale parameter is set to 1.05, which is equivalent to say that fixed costs account for 5% of total costs by firm.

Finally, the following parameters are imported from external sources: the absolute value of the wage elasticity with respect to unemployment is fixed to 0.1 (See Chapter 2), transfer costs represent 9% of the amount of the transaction (Barendse, Hiddink, Janszen and Stavast, 2006) and the capital depreciation rate is set to 8% (Agénor and El Aynaoui, 2003). CES Armington function elasticities for aggregation of imports from different regions and of imports and domestic output

[17] Centre d'Etudes Prospectives et d'Informations Internationales.
[18] BACI is the new CEPII world database for international trade analysis at the product-level.

are respectively set to 5 and 2. CET function elasticities for transformation of domestic output to aggregate exports and domestic sales, and of aggregate exports to exports disaggregated by region are set to -5 and -8 respectively. These elasticities are borrowed from the literature on Morocco (Löfgren et al., 1999; Rutherford et al., 1997). The annual growth rate for public expenditures (3.5%) is calculated using data from national accounts. The rural population natural growth rate (2.6%) is taken from Agénor and El Aynaoui (2003). The urban population natural growth rate (0.8%) is based on author's calculations. For lack of data, exogenous transfers to and from households as well as minimum consumption by product are supposed to grow at the population growth rate.

IV.B Appendix B: Sectoral Aggregation

AGR	Agriculture
FIS	Fishing
MIN1	Mining of coal, lignite and peat
MIN2	Metal ore mining
MIN3	Other ores
FOO	Food industry
TOB	Tobacco industry
TEX	Textile industry
CLO	Clothing industry
LEA	Leather and shoes industry
WOO	Fabrication of wood and wood-based products
PAP	Paper industry
EDI	Editing, printing and reproduction
OIL	Oil refining
CHE	Chemical industry
RUB	Rubber and plastic industry
MIN	Manufacture of other non-metallic mineral products
MET	Metallurgy
MEP	Metal processing
MAC	Machines and equipment manufacturing
OFF	Office machinery
MAE	Electric machines
RAD	Radio and TV equipments
MED	Medical instrument manufacturing
CAR	Car industry
MTR	Manufacture of other transport means
FUR	Furniture manufacturing, other industries
REC	Recuperation
ELE	Electricity and water - production and distribution
CON	Construction
TRR	Trade and repair
HOT	Hotels and restaurants
TRA	Transport and telecommunication
TELE	Post and telecommunications
FIN	Financial activities and insurance
REN	Rental services
ADM	Public administration and social security
EDU	Education ad health
SER	Other non financial services

IV.C Appendix C: Mathematical Statement of the Model

Set indices are given by lower-case Latin letters as subscripts to variables and parameters. Parameters are represented with lower-case Latin letters or lower-case Greek letters, endogenous variables with upper-case Latin letters without a bar, exogenous variables with upper-case Latin letters with a bar.

Sets

$j \in J$	Sectors
$i \in I$	Products (=J)
$tr \in TR \subset J$	Tradable sectors
$ntr \in NTR \subset J$	Non-tradable sectors
$ps \in PS \subset J$	Private sectors
$pub \in PUB \subset J$	Public sectors
$ru \in RU \subset PS$	Rural private sectors
$up \in UP \subset PS$	Urban private sectors
$imc \in IMC \subset UP$	Imperfect competition products
$ag \in AG$	Agents
$da \in DA \subset AG$	Domestic agents
$h \in H \subset AG$	Households
$re \in RE$	Regions (EU, RoW)
$qu \in QU$	Worker qualifications
$t \in T$	Time period

Parameters

α_{ru}	Share parameter of the CES value added of rural sector ru
σ_{ru}	Elasticity of substitution between labour and capital (positive)
α_{1up}	Share parameter of the CES value added of urban private sector up

σ_{1up}	Elasticity of substitution between unskilled labour and the composite factor (positive)
α_{2up}	Share parameter of the CES composite factor in urban private sector up
σ_{2up}	Elasticity of substitution between skilled labour and capital (positive)
ske	Skilled labour externality parameter (positive)
l_{pub}	Labour share in public value added (Leontief)
k_{pub}	Capital share in public value added (Leontief)
io_j	Share of intermediary consumption in the production (Leontief) of sector j
v_j	Share of value added in the production (Leontief) of sector j
$aij_{i,j}$	Intermediary consumption of good i by unit of production of sector j
B_1	Scale parameter of the CET function of the rural population
ϖ_1	Share parameter of this function
ε_1	Elasticity of transformation between international rural migrants and national workers (negative)
B_2	Scale parameter of the CET function of the rural population that decides to stay in Morocco
ϖ_2	Share parameter of this function
ε_2	Elasticity of of transformation between internal migrants and rural workers (negative)
B_{3qu}	Scale parameter of the CET function of the urban population by qualification
ϖ_{3qu}	Share parameter of this function
ε_{3qu}	Elasticity of of transformation between international urban migrants and urban workers (negative)
imc	Internal migration costs
η_{ag}	Share of capital remuneration received by agent ag
ϕ_{ag}	Share of labour remuneration received by agent ag
tc	Transfer costs
$V_{1qu,h}$	Parameter in the international remittance rate function of household h
$\gamma_{1qu,h}$	Elasticity of international remittance rate with respect to household h's real income
$\gamma_{2qu,h}$	Elasticity of international remittance rate to household h with respect to the international wage
V_2	Parameter in the remittance rate function from urban to rural household
γ_3	Elasticity of internal remittance rate with respect to rural household real income
ψ_h	Household's h propensity to save
ty_h	Direct tax rate on household h's income
tye	Direct tax rate on firms' income
tx_j	Sales tax rate on sector j's product
tp_j	Production tax rate on sector j
$tm_{tr,re}$	Import tariff rate on product tr from region re
$te_{tr,re}$	Export tariff rate on product tr to region re
C_{1tr}	Scale parameter of the CET production function
δ_{1tr}	Share parameter of this function

κ_{1tr}	Transformation elasticity of the CET production function (negative)
$\varphi_{tr,re}$	Price elasticity of export demand by region re
C_{2tr}	Scale parameter of the Armington CES function
δ_{2tr}	Share parameter of this function
κ_{2tr}	Substitution elasticity of the Armington function (positive)
C_{3tr}	Scale parameter of the CET export function by region of destination
δ_{3tr}	Share parameter of this function
κ_{3tr}	Transformation elasticity of the CET export function (negative)
C_{4tr}	Scale parameter of the CES import function by region of origin
δ_{4tr}	Share parameter of this function
κ_{4tr}	Substitution elasticity of the CES import function (positive)
$\beta_{i,h}$	Budgetary share of good i in the supernumerary income of household h
μ_i	Share of product i in total investment value
ctm_{tr}	Quantity of trade input by import unit of good tr
$ctrm_{tr}$	Quantity of transport input by import unit of good tr
cte_{tr}	Quantity of trade input by export unit of good tr
$ctre_{tr}$	Quantity of transport input by export unit of good tr
ctd_i	Quantity of trade input by unit of domestic sales of good i
$ctrd_i$	Quantity of transport input by unit of domestic sales of good i
D	Scale parameter of the wage curve
ζ	The absolute value of the wage elasticity with respect to unemployment
θ_{1i}	Weight of commodity i in the consumer price index
$\theta_{2i,\text{“}hr\text{”}}$	Weight of commodity i in rural consumer price index
$\theta_{2i,\text{“}hu\text{”}}$	Weight of commodity i in urban consumer price index
θ_j	Share of sector j value added in GDP at factor cost
χ_{1qu}	Erosion rate of the first generation of migrants
χ_{2qu}	Erosion rate of the second generation of migrants
dep_{ps}	Capital depreciation rate of sector ps
D_{1ps}	Parameter in the investment equation
D_{2ps}	Parameter in the investment equation
V_3	Parameter in the international migration cost function
ν	Elasticity of international migration costs to the stock of international migrants (negative)
g_G	Growth rate of government expenditures
g_{A1}	Total factor productivity growth rate
g_{LSR}	Natural growth rate of rural population
g_{LSU}	Natural growth rate of urban population
ska	Skill acquisition rate

Endogenous Variables

a) **Prices**

wr_t	Rural wage rate
$wu_{qu,t}$	The wage rate by qualification paid by urban private sectors
$wg_{qu,t}$	The wage rate by qualification paid by urban public sectors
$wi_{qu,t}$	International wage rate by qualification, in foreign currency
wn_t	National wage rate of unskilled workers
$wug_{qu,t}$	Average urban wage rate by qualification
$wa_{qu,t}$	Expected urban wage rate by qualification
$r_{j,t}$	Capital return in sector j
i_t	Domestic interest rate
$PV_{j,t}$	Value added price of sector j
$PCOM_{up,t}$	Composite factor price in private urban sector up
$PL_{j,t}$	Producer price of local product j
$PD_{j,t}$	Market price of local product j sold on the domestic market (sales tax exclusive)
$P_{i,t}$	Producer price of product i
$PXS_{j,t}$	Gross price for production activity j
$PC_{j,t}$	Market price of the composite good belonging to sector j
$Pwm_{tr,re,t}$	International import price of product tr from region re, in foreign currency
$Pwe_{tr,re,t}$	International export price of product tr to region re, in foreign currency
$PMC_{tr,t}$	Domestic price of the aggregate imported good tr
$PM_{tr,re,t}$	Domestic price of the imported good tr originated from region re
$PEC_{tr,t}$	Producer price of the aggregate exported good tr
$PE_{tr,re,t}$	Producer price of the exported good tr by destination of region re
$Pfob_{tr,re,t}$	Fob price of the exported good tr to region re
$PINV_t$	Aggregate price of investment
e_t	Nominal exchange rate (the price of a unit of foreign currency in domestic currency)
CPI_t	Consumer price index
$CPIR_t$	Consumer price index in rural areas
$CPIU_t$	Consumer price index in urban areas
$Pindex_t$	GDP deflator, numéraire

b) **Production**

$XS_{j,t}$	Production of sector j (volume)
$XXS_{j,t}$	Production of sector j at base price
$DS_{j,i,t}$	Production of product i by sector j (volume)
$DD_{i,t}$	Total production of product i (volume)
$VA_{j,t}$	Value added of sector j (volume)
$A_{1ps,t}$	Total factor productivity in sector ps
$DI_{i,j,t}$	Intermediary demand of product i by sector j (volume)
$CI_{j,t}$	Total intermediary consumption of sector j (volume)

c) **Factors of production**

$KD_{j,t}$	Capital demand by sector j (volume)
$LDR_{ru,t}$	Labour demand by rural sector ru (volume)
$LDU_{qu,up,t}$	Labour demand by urban private sector up (volume)
$COM_{up,t}$	Composite factor in urban private sector up (volume)
$A_{2up,t}$	Skilled labour shift parameter in the CES function of the composite factor in sector up
$LDG_{qu,pub,t}$	Labour demand by public sector pub (volume)
LSR_t	Rural population
$LSU_{qu,t}$	Urban population by qualification
$u_{qu,t}$	Urban unemployment rate by qualification

d) **Migration**

NAT_t	Rural workers who decide to stay in Morocco
EMR_t	Rural emigrant flow
$NATR_t$	Rural workers who decide to stay in rural areas
MIG_t	Rural migrant flow towards urban areas
$NATU_{qu,t}$	Urban workers by qualification who decide to stay in urban areas
$EMU_{qu,t}$	Urban emigrant flow by qualification
$STKR_{1,t}$	The first generation of rural migrants
$STKU_{1qu,,t}$	The first generation of urban migrants by qualification
$STKR_{2,t}$	The second generation of rural migrants
$STKU_{2qu,,t}$	The second generation of urban migrants by qualification
$STKR_{3,t}$	The third generation of rural migrants
$STKU_{3qu,,t}$	The third generation of urban migrants by qualification
$TSTK_t$	Total stock of international migrants
$ISTK_t$	Stock of internal migrants from rural to urban areas
MC_t	International migration costs

e) **Income/Savings**

$Y_{ag,t}$	Agent ag's income
$YD_{h,t}$	Disposable income of household h
$S_{ag,t}$	Agent ag's savings
$T_{ag,ag,t}$	Transfers between agents
$RR_{qu,h,t}$	Remittance rate by qualification to household h
IR_t	Internal remittance rate from urban to rural household
$REM_{qu,h,t}$	Migrant remittances by qualification

f) **Tax revenues**

$TI_{j,t}$	Sales taxes on product j
$TIM_{tr,re,t}$	Import tariffs on product tr from region re
$TIE_{tr,re,t}$	Export tariffs on product tr to region re
$TIP_{j,t}$	Production taxes on sector j
adj_t	Compensatory tax

g) **External trade**

$EXS_{tr,t}$	Export supply of product tr (volume)
$EX_{tr,re,t}$	Export supply of product tr to region re (volume)
$EXD_{tr,re,t}$	Export demand of product tr by region re (volume)
$DOM_{j,t}$	Domestic production of sector j sold on the domestic market (volume)
$Q_{j,t}$	Supply of composite product belonging to sector j (volume)
$M_{tr,t}$	Import demand of product tr (volume)
$MR_{tr,re,t}$	Import demand of product tr from region re (volume)

h) **Final demand**

$CT_{i,h,t}$	Consumption of good i by household h (volume)
$CMIN_{i,h,t}$	Minimum consumption of good i by household h (volume)
$BC_{h,t}$	Consumption budget of household h
$G_{i,t}$	Public consumption of product i (volume)
$DIT_{i,t}$	Total intermediary consumption of product i (volume)
$INV_{i,t}$	Investment demand of product i (volume)
$STK_{i,t}$	Stock variation of product i (volume)
$TMA_{i,t}$	Total trade inputs for product i
$TRM_{i,t}$	Total transport inputs for product i
$NGDP_t$	Nominal GDP

i) **Imperfect Competition**

$AC_{imc,t}$	Average cost by firm
$RD_{imc,t}$	Scale parameter
$VC_{imc,t}$	Marginal cost by firm
$FC_{imc,t}$	Total fixed cost in sector imc
$KDV_{imc,t}$	Variable capital by sector
$KDF_{imc,t}$	Fixed capital by firm
$NBR_{imc,t}$	Number of firms by sector
$PROF_{imc,t}$	Total profits by sector
$PELAS_{imc,t}$	Price elasticity of domestic demand

j) **Investment**

$ITVOL_t$	Gross fixed capital formation (volume)
IT_t	Gross fixed capital formation (value)
SI_t	Savings-investment adjustment variable
$INVD_{ps,t}$	Investment in sector ps (volume)
$VARKD_t$	Capital demand variation in the public sector (volume)

$CLOSE_t$	Closure

Exogenous Variables

$wg_{qu,t}$	Wage rate by qualification in the urban public sector
$wi_{qu,t}$	International wage rate by qualification, in foreign currency
$r_{pub,t}$	Capital return in public sector *pub*
i_t	Domestic interest rate
$Pwm_{tr,re,t}$	International import price of product *tr* from region *re*, in foreign currency
$Pwe_{tr,re,t}$	International export price of product *tr* to region *re*, in foreign currency
$KD_{ps,t}$	Capital demand by sector *ps* (volume)
$CMIN_{i,h,\text{“1”}}$	Minimum consumption of product *i* by household *h* (volume)
$G_{i,\text{“1”}}$	Public consumption of product *i*, at the first period (volume)
$STK_{i,t}$	Stock variation of product *i* (volume)
$S_{row,t}$	External savings
$A_{1ps,\text{“1”}}$	Total factor productivity in sector *ps*, at the first period
$LSR_{\text{“1”}}$	Rural population, at the first period
$LSU_{qu,\text{“1”}}$	Urban population, at the first period
$STKR_{1,\text{“1”}}$	The first generation of rural migrants, at the first period
$STKU_{1qu,\text{“1”}}$	The first generation of urban migrants, at the first period
$STKR_{2,\text{“1”}}$	The second generation of rural migrants, at the first period
$STKU_{2qu,\text{“1”}}$	The second generation of urban migrants, at the first period
$STKR_{3,\text{“1”}}$	The third generation of rural migrants, at the first period
$STKU_{3qu,\text{“1”}}$	The third generation of urban migrants, at the first period
$TSTK_{\text{“1”}}$	Total stock of international migrants, at the first period
$ISTK_{\text{“1”}}$	Stock of internal migrants, at the first period
$KDF_{imc,t}$	Fixed capital by sector
$NBR_{imc,t}$	Number of firms by sector (short run)
$PROF_{imc,t}$	Total profits by sector (long run)
$CLOSE_t$	Closure
$Pindex_t$	GDP deflator, numéraire

All transfers between agents except direct taxes paid by households and firms. Transfers to and from households as well as minimum consumption by product are fixed at the first period and updated exogenously between periods with the population growth rate.

Equations

Supply Block

$$XS_{j,t} = VA_{j,t}/v_j \tag{A1}$$

$$XXS_{j,t} = XS_{j,t}(1 + tp_j) \tag{A2}$$

$$DS_{j,i,t} = x_{j,i} XXS_{j,t} \tag{A3}$$

$$DD_{i,t} = \sum_j DS_{j,i,t} \tag{A4}$$

$$CI_{j,t} = io_j XS_{j,t} \tag{A5}$$

$$DI_{i,j,t} = aij_{i,j} CI_{j,t} \tag{A6}$$

Rural Value-Added

$$VA_{ru,t} = \overline{A}_{1ru,t}[\alpha_{ru} LDR_{ru,t}^{(\sigma_{ru}-1)/\sigma_{ru}} + (1-\alpha_{ru})\overline{KD}_{ru,t}^{(\sigma_{ru}-1)/\sigma_{ru}}]^{\sigma_{ru}/(\sigma_{ru}-1)} \tag{A7}$$

$$LDR_{ru,t}/\overline{KD}_{ru,t} = (\frac{\alpha_{ru}}{1-\alpha_{ru}} \frac{r_{ru,t}}{wr_t})^{\sigma_{ru}} \tag{A8}$$

Urban Value-Added

$$VA_{up,t} = \overline{A}_{1up,t}[\alpha_{1up} LDU_{“un”,up,t}^{(\sigma_{1up}-1)/\sigma_{1up}} + (1-\alpha_{1up}) COM_{up,t}^{(\sigma_{1up}-1)/\sigma_{1up}}]^{\sigma_{1up}/(\sigma_{1up}-1)} \tag{A9}$$

$$LDU_{“un”,up,t}/COM_{up,t} = (\frac{\alpha_{1up}}{1-\alpha_{1up}} \frac{PCOM_{up,t}}{wu_{“un”,t}})^{\sigma_{1up}} \tag{A10}$$

$$COM_{up,t} = A_{2up,t}[\alpha_{2up} LDU_{“sk”,up,t}^{(\sigma_{2up}-1)/\sigma_{2up}} + (1-\alpha_{2up})\overline{KD}_{up,t}^{(\sigma_{2up}-1)/\sigma_{2up}}]^{\sigma_{2up}/(\sigma_{2up}-1)} \tag{A11}$$

$$LDU_{“sk”,up,t}/COM_{up,t} = (\frac{\alpha_{2up}}{1-\alpha_{2up}} \frac{r_{up,t}}{wu_{“sk”,t}})^{\sigma_{2up}} \tag{A12}$$

$$A_{2up,t} = A_{2up,t-1} \frac{NATU_{“sk”,t}}{NATU_{“sk”,t-1}}^{ske} \tag{A13}$$

Public Value-Added

$$VA_{pub,t} = KD_{pub,t}/k_{pub} \tag{A14}$$

$$LDG_{qu,pub,t} = l_{qu,pub} VA_{pub,t} \tag{A15}$$

$$KD_{pub,t} = \frac{PV_{pub,t} VA_{pub,t} - \sum_{qu} \overline{wg_{qu,t}} LDG_{qu,pub,t}}{\overline{r}_{pub,t}} \tag{A16}$$

Migration Block

$$\overline{LSR}_t = B_1[\varpi_1 NAT_t^{(\varepsilon_1-1)/\varepsilon_1} + (1-\varpi_1)EMR_t^{(\varepsilon_1-1)/\varepsilon_1}]^{\varepsilon_1/(\varepsilon_1-1)} \quad \text{(A17)}$$

$$\frac{EMR_t}{NAT_t} = (\frac{\varpi_1}{1-\varpi_1}\frac{\overline{wi_{\text{“}un\text{”},t-1}}e_{t-1}(1-MC_{t-1})}{wn_{t-1}/CPI_{t-1}})^{-\varepsilon_1} \quad \text{(A18)}$$

$$NAT_t = B_2[\varpi_2 NATR_t^{(\varepsilon_2-1)/\varepsilon_2} + (1-\varpi_2)MIG_t^{(\varepsilon_2-1)/\varepsilon_2}]^{\varepsilon_2/(\varepsilon_2-1)} \quad \text{(A19)}$$

$$\frac{MIG_t}{NATR_t} = (\frac{\varpi_2}{1-\varpi_2}\frac{wa_{\text{“}un\text{”},t-1}(1-imc)/CPIU_{t-1}}{wr_{t-1}/CPIR_{t-1}})^{-\varepsilon_2} \quad \text{(A20)}$$

$$\overline{LSU}_{qu,t} = B_{3qu}[\varpi_{3qu} NATU_{qu,t}^{(\varepsilon_{3qu}-1)/\varepsilon_{3qu}} + (1-\varpi_{3qu})EMU_{qu,t}^{(\varepsilon_{3qu}-1)/\varepsilon_{3qu}}]^{\varepsilon_{3qu}/(\varepsilon_{3qu}-1)} \quad \text{(A21)}$$

$$\frac{EMU_{qu,t}}{NATU_{qu,t}} = (\frac{\varpi_3}{1-\varpi_3}\frac{\overline{wi_{qu,t-1}}e_{t-1}(1-MC_{t-1})}{wa_{qu,t-1}/CPIU_{t-1}})^{-\varepsilon_3} \quad \text{(A22)}$$

Households and Firms

$$\begin{aligned} Y_{\text{“}hr\text{”},t} \quad = \quad & \sum_{ru} wr_t LDR_{ru,t} + \eta_{\text{“}hr\text{”}} \sum_j r_j KD_{j,t} + \sum_{da} T_{\text{“}hr\text{”},da,t} + \\ & e_t \overline{T}_{\text{“}hr\text{”},\text{“}row\text{”},t} + IR_t ISTK_t + (1-tc)REM_{\text{“}un\text{”},\text{“}hr\text{”},t} \end{aligned} \quad \text{(A23)}$$

$$\begin{aligned} Y_{\text{“}hu\text{”},t} \quad = \quad & (1-\phi_{row})[\sum_{qu,up} wu_{qu,t} LDU_{qu,up,t} + \sum_{qu,pub} \overline{wg_{qu,t}} LDG_{qu,pub,t}] + \\ & \eta_{\text{“}hu\text{”}} \sum_j r_{j,t} KD_{j,t} + \sum_{da} T_{\text{“}hu\text{”},da,t} + e_t \overline{T}_{\text{“}hu\text{”},\text{“}row\text{”},t} + \\ & (1-tc)\sum_{qu} REM_{qu,\text{“}hu\text{”},t} \end{aligned} \quad \text{(A24)}$$

$$\begin{aligned} YD_{\text{“}hr\text{”},t} \quad = \quad & Y_{\text{“}hr\text{”},t}(1-ty_{\text{“}hr\text{”}}) - \overline{T}_{\text{“}hr\text{”},\text{“}hr\text{”},t} - \overline{T}_{\text{“}hu\text{”},\text{“}hr\text{”},t} - \\ & \overline{T}_{\text{“}fm\text{”},\text{“}hr\text{”},t} - e_t \overline{T}_{\text{“}row\text{”},\text{“}hr\text{”},t} \end{aligned} \quad \text{(A25)}$$

$$\begin{aligned} YD_{\text{“}hu\text{”},t} \quad = \quad & Y_{\text{“}hu\text{”},t}(1-ty_{\text{“}hu\text{”}}) - \overline{T}_{\text{“}hr\text{”},\text{“}hu\text{”},t} - \overline{T}_{\text{“}hu\text{”},\text{“}hu\text{”},t} - \\ & \overline{T}_{\text{“}fm\text{”},\text{“}hu\text{”},t} - e_t \overline{T}_{\text{“}row\text{”},\text{“}hu\text{”},t} - IR_t ISTK_t \end{aligned} \quad \text{(A26)}$$

$$S_{h,t} = \psi_h YD_{h,t} \quad \text{(A27)}$$

$$BC_{h,t} = YD_{h,t} - S_{h,t} \tag{A28}$$

$$REM_{``un",``hr",t} = RR_{``un",``hr",t}\overline{STKR}_{1t} + 1/2RR_{``un",``hr",t}\overline{STKR}_{2t} \tag{A29}$$

$$REM_{qu,``hu",t} = RR_{qu,``hu",t}\overline{STKU}_{1qu,t} + 1/2RR_{qu,``hu",t}\overline{STKU}_{2qu,t} \tag{A30}$$

$$RR_{``un",``hr",t} = V_{1``un",``hr"}(\frac{YD_{``hr",t}}{CPIR_t})^{\gamma_{1``un",``hr"}}\overline{wi}_{``un",t}^{\gamma_{2``un",``hr"}} \tag{A31}$$

$$RR_{qu,``hu",t} = V_{1qu,``hu"}(\frac{YD_{``hu",t}}{CPIU_t})^{\gamma_{1qu,``hu"}}\overline{wi}_{qu,t}^{\gamma_{2qu,``hu"}} \tag{A32}$$

$$IR_t = V_2(\frac{YD_{``hr",t}}{CPIR_t})^{\gamma_3} \tag{A33}$$

$$\begin{aligned} Y_{``fm",t} &= (1 - \eta_{``hr"} - \eta_{``hu"} - \eta_{``gv"} - \eta_{``row"})\sum_j r_{j,t}KD_{j,t} + \\ &\sum_{da} T_{``fm",da,t} + e_t\overline{T_{``fm",``row",t}} \end{aligned} \tag{A34}$$

$$S_{``fm",t} = Y_{``fm",t} - \sum_{da} T_{da,``fm",t} - e_t\overline{T_{``row",``fm",t}} \tag{A35}$$

The Government

$$TI_{tr,t} = adj_t tx_{tr} PD_{tr,t} DOM_{tr,t} + adj_t tx_{tr} PMC_{tr,t} M_{tr,t} \tag{A36}$$

$$TI_{ntr,t} = adj_t tx_{ntr} PD_{ntr,t} DD_{ntr,t} \tag{A37}$$

$$TIM_{tr,re,t} = tm_{tr,re} e_t \overline{Pwm_{tr,re,t}} M_{tr,re,t} \tag{A38}$$

$$TIE_{tr,re,t} = te_{tr,re} e_t Pfob_{tr,re,t} EX_{tr,re,t} \tag{A39}$$

$$TIP_{j,t} = tp_j PXS_{j,t} XS_{j,t} \tag{A40}$$

$$T_{``gv",h,t} = ty_h Y_{h,t} \tag{A41}$$

$$T_{\text{“}gv\text{”},\text{“}fm\text{”},t} = tyeY_{\text{“}fm\text{”},t} \tag{A42}$$

$$\begin{aligned} Y_{\text{“}gv\text{”},t} &= \eta_{\text{“}gv\text{”}} \sum_j r_{j,t} KD_{j,t} + \sum_{tr,re} TIM_{tr,re,t} + \sum_{tr,re} TIE_{tr,re,t} + \\ &\quad \sum_j TI_{j,t} + \sum_j TIP_{j,t} + \sum_{da} T_{\text{“}gv\text{”},da,t} + e_t \overline{T_{\text{“}gv\text{”},\text{“}row\text{”},t}} \end{aligned} \tag{A43}$$

$$S_{\text{“}gv\text{”},t} = Y_{\text{“}gv\text{”},t} - \sum_i PC_{i,t}\overline{G}_{i,t} - \sum_{da} \overline{T}_{da,\text{“}gv\text{”},t} - e_t \overline{T_{\text{“}row\text{”},\text{“}gv\text{”},t}} \tag{A44}$$

Trade Block

$$DD_{tr,t} = C_{1tr}[\delta_{1tr} EXS_{tr,t}^{(\kappa_{1tr}-1)/\kappa_{1tr}} + (1-\delta_{1tr}) DOM_{tr,t}^{(\kappa_{1tr}-1)/\kappa_{1tr}}]^{\kappa_{1tr}/(\kappa_{1tr}-1)} \tag{A45}$$

$$DD_{ntr,t} = DOM_{ntr,t} \tag{A46}$$

$$\frac{EXS_{tr,t}}{DOM_{tr,t}} = (\frac{\delta_{1tr}}{1-\delta_{1tr}} \frac{PL_{tr,t}}{PEC_{tr,t}})^{\kappa_{1tr}} \tag{A47}$$

$$EXS_{tr,t} = C_{3tr}[\delta_{3tr} EX_{tr,\text{“}eu\text{”},t}^{(\kappa_{3tr}-1)/\kappa_{3tr}} + (1-\delta_{3tr}) EX_{tr,\text{“}rw\text{”},t}^{(\kappa_{3tr}-1)/\kappa_{3tr}}]^{\kappa_{3tr}/(\kappa_{3tr}-1)} \tag{A48}$$

$$\frac{EX_{tr,\text{“}eu\text{”},t}}{EX_{tr,\text{“}rw\text{”},t}} = (\frac{\delta_{3tr}}{1-\delta_{3tr}} \frac{PE_{tr,\text{“}rw\text{”},t}}{PE_{tr,\text{“}eu\text{”},t}})^{\kappa_{3tr}} \tag{A49}$$

$$EXD_{tr,re,t} = EXD_{tr,re,t-1}(\frac{\overline{Pwe_{tr,re,t}}}{Pfob_{tr,re,t}})^{\varphi_{tr,re}} \tag{A50}$$

$$Q_{tr,t} = C_{2tr}[\delta_{2tr} M_{tr,t}^{(\kappa_{2tr}-1)/\kappa_{2tr}} + (1-\delta_{2tr}) DOM_{tr,t}^{(\kappa_{2tr}-1)/\kappa_{2tr}}]^{\kappa_{2tr}/(\kappa_{2tr}-1)} \tag{A51}$$

$$Q_{ntr,t} = DOM_{ntr,t} \tag{A52}$$

$$\frac{M_{tr,t}}{DOM_{tr,t}} = (\frac{\delta_{2tr}}{1-\delta_{2tr}} \frac{PD_{tr,t}}{PMC_{tr,t}})^{\kappa_{2tr}} \tag{A53}$$

$$M_{tr,t} = C_{4tr}[\delta_{4tr} MR_{tr,\text{“}eu\text{”},t}^{(\kappa_{4tr}-1)/\kappa_{4tr}} + (1-\delta_{4tr}) MR_{tr,\text{“}rw\text{”},t}^{(\kappa_{4tr}-1)/\kappa_{4tr}}]^{\kappa_{4tr}/(\kappa_{4tr}-1)} \tag{A54}$$

$$\frac{MR_{tr,\text{“}eu\text{”},t}}{MR_{tr,\text{“}rw\text{”},t}} = \left(\frac{\delta_{4tr}}{1-\delta_{4tr}}\frac{PM_{tr,\text{“}rw\text{”},t}}{PM_{tr,\text{“}eu\text{”},t}}\right)^{\kappa_{4tr}} \tag{A55}$$

$$\begin{aligned}\overline{S_{\text{“}row\text{”},t}} \;=\;& \sum_{tr,re}\overline{Pwm_{tr,re,t}}MR_{tr,re,t} + \sum_{ag}\overline{T}_{\text{“}row\text{”},ag,t} - \sum_{ag}\overline{T}_{ag,\text{“}row\text{”},t} - \\ & \sum_{tr,re}Pfob_{tr,re,t}EXS_{tr,re,t} - \frac{\sum_h(1-tc)REM_{h,t}}{e_t}\end{aligned} \tag{A56}$$

Final Demand

$$CT_{i,\text{“}hr\text{”},t} = \overline{CMIN}_{i,\text{“}hr\text{”},t} + \frac{\beta_{i,\text{“}hr\text{”}}}{PC_{i,t}}(BC_{\text{“}hr\text{”},t} - \sum_i PC_{i,t}\overline{CMIN}_{i,\text{“}hr\text{”},t}) \tag{A57}$$

$$CT_{i,\text{“}hu\text{”},t} = \overline{CMIN}_{i,\text{“}hu\text{”},t} + \frac{\beta_{i,\text{“}hu\text{”}}}{PC_{i,t}}(BC_{\text{“}hu\text{”},t} - \sum_i PC_{i,t}\overline{CMIN}_{i,\text{“}hu\text{”},t}) \tag{A58}$$

$$INV_{i,t} = \mu_i IT_t / PC_{i,t} \tag{A59}$$

$$ITVOL_t = IT_t / PINV_t \tag{A60}$$

$$DIT_{i,t} = \sum_i aij_{i,j}CI_{j,t} \tag{A61}$$

$$TMA_{tr,t} = \sum_{re} ctm_{tr}MR_{tr,re,t} + \sum_{re} cte_{tr}EX_{tr,re,t} + ctd_{tr}DOM_{tr,t} \tag{A62}$$

$$TMA_{ntr,t} = ctd_{ntr}DOM_{ntr,t} \tag{A63}$$

$$TRM_{tr,t} = \sum_{re} ctrm_{tr}MR_{tr,re,t} + \sum_{re} ctre_{tr}EX_{tr,re,t} + ctrd_{tr}DOM_{tr,t} \tag{A64}$$

$$TRM_{ntr,t} = ctrd_{tr}DOM_{ntr,t} \tag{A65}$$

$$\begin{aligned}NGDP_t \;=\;& \sum_i PC_{i,t}\overline{G}_{i,t} + \sum_h\sum_i PC_{i,t}CT_{i,h,t} + \sum_i PC_{i,t}INV_{i,t} + \sum_i PC_{i,t}\overline{STK_{i,t}} + \\ & \sum_{tr,re} e_t Pfob_{tr,re,t}EXD_{tr,re,t} - \sum_{tr,re}\overline{Pwm_{tr,re,t}}e_t MR_{tr,re,t}\end{aligned} \tag{A66}$$

Price Block

$$\ln \frac{wu_{qu,t}}{CPIU_t} = D - \zeta \ln u_{qu,t} \tag{A67}$$

$$\overline{wg_{qu,t}} \succ wu_{qu,t} \tag{A68}$$

$$wn_t = \frac{wr_t \sum_{ru} LDR_{ru,t} + wu_{``un",t} \sum_{up} LDU_{``un",up,t} + \overline{wg_{``un",t}} \sum_{pub} LDG_{``un",pub,t}}{\sum_{ru} LDR_{ru,t} + \sum_{up} LDU_{``un",up,t} + \sum_{pub} LDG_{``un",pub,t}} \tag{A69}$$

$$wug_{qu,t} = \frac{wu_{qu,t} \sum_{up} LDU_{qu,up,t} + \overline{wg_{qu,t}} \sum_{pub} LDG_{qu,pub,t}}{\sum_{up} LDU_{qu,up,t} + \sum_{pub} LDG_{qu,pub,t}} \tag{A70}$$

$$wa_{qu,t} = wug_{qu,t}(1 - u_{qu,t}) \tag{A71}$$

$$r_{ru,t} = \frac{PV_{ru,t}VA_{ru,t} - wr_{ru,t}LDR_{ru,t}}{\overline{KD}_{ru,t}} \tag{A72}$$

$$r_{up,t} = \frac{PV_{up,t}VA_{up,t} - \sum_{qu} wu_{qu,t}LDU_{qu,up,t}}{\overline{KD}_{up,t}} \tag{A73}$$

$$PV_{j,t} = \frac{PXS_{j,t}XS_{j,t} - \sum_i PC_{i,t}DI_{i,j,t}}{VA_{j,t}} \tag{A74}$$

$$PCOM_{up,t} = \frac{wu_{``sk",t}LDU_{``sk",up,t} + r_{up,t}\overline{KD}_{up,t}}{COM_{up,t}} \tag{A75}$$

$$PM_{tr,re,t} = e_t\overline{Pwm_{tr,re,t}}(1 + tm_{tr,re}) + ctm_{tr}PC_{``trr",t} + ctrm_{tr}PC_{``tra",t} \tag{A76}$$

$$PMC_{tr,t} = \sum_{re} \frac{PM_{tr,re,t}MR_{tr,re,t}}{M_{tr,t}} \tag{A77}$$

$$PE_{tr,re,t} = \frac{e_tPfob_{tr,re,t}}{(1 + te_{tr,re})} - cte_{tr}PC_{``trr",t} - ctre_{tr}PC_{``tra",t} \tag{A78}$$

$$PEC_{tr,t} = \sum_{re} \frac{PE_{tr,re,t}EX_{tr,re,t}}{EXS_{tr,t}} \tag{A79}$$

$$PC_{tr,t} = (1 + tx_{tr}adj_t)\frac{DOM_{tr,t}PD_{tr,t} + \sum_{re} MR_{tr,re,t}PM_{tr,re,t}}{Q_{tr,t}} \tag{A80}$$

$$PC_{ntr,t} = PD_{ntr,t} \tag{A81}$$

$$PD_{j,t} = PL_{j,t} + ctd_j PC_{\text{“}trr\text{”},t} + ctrd_j PC_{\text{“}tra\text{”},t} \tag{A82}$$

$$P_{tr,t} = \frac{PL_{tr,t}DOM_{tr,t} + PEC_{tr,t}EXS_{tr,t}}{DD_{tr,t}} \tag{A83}$$

$$P_{ntr,t} = PL_{ntr,t} \tag{A84}$$

$$PXS_{j,t} = \sum_i \frac{P_{i,t}DS_{j,i,t}}{XXS_{j,t}} \tag{A85}$$

$$PINV_t = \prod_i (\frac{PC_{i,t}}{\mu_i})^{\mu_i} \tag{A86}$$

$$CPI_t = \sum_i \theta_{1i} PC_{i,t} \tag{A87}$$

$$CPIR_t = \sum_i \theta_{2i,\text{“}hr\text{”}} PC_{i,t} \tag{A88}$$

$$CPIU_t = \sum_i \theta_{2i,\text{“}hu\text{”}} PC_{i,t} \tag{A89}$$

$$\overline{Pindex_t} = \sum_j \theta_j PV_{j,t} \tag{A90}$$

Dynamics

$$STKR_{1t+1} = STKR_{1t}(1 - \chi_{1\text{“}un\text{”}}) + EMR_t \tag{A91}$$

$$STKU_{1qu,t+1} = STKU_{1qu,t}(1 - \chi_{1qu}) + EMU_{qu,t} \tag{A92}$$

$$STKR_{2t+1} = STKR_{2t}(1 - \chi_{2\text{“}un\text{”}}) + \chi_{1\text{“}un\text{”}} STKR_{1t} \tag{A93}$$

$$STKU_{2qu,t+1} = STKU_{2qu,t}(1 - \chi_{2qu}) + \chi_{1qu} STKU_{1qu,t} \tag{A94}$$

$$STKR_{3t+1} = STKR_{3t} + \chi_{2\text{``}un\text{''}} STKR_{2t} \tag{A95}$$

$$STKU_{3qu,t+1} = STKU_{3qu,t} + \chi_{2qu} STKU_{2qu,t} \tag{A96}$$

$$\begin{aligned} TSTK_t &= STKR_{1t} + STKR_{2t} + STKR_{3t} + \\ &\sum_{qu} (STKU_{1qu,t} + STKU_{2qu,t} + STKU_{3qu,t}) \end{aligned} \tag{A97}$$

$$ISTK_{t+1} = ISTK_t + MIG_t \tag{A98}$$

$$KD_{ps,t+1} = (1 - dep_{ps}) KD_{ps,t} + INVD_{ps,t} \tag{A99}$$

$$\begin{aligned} \frac{INVD_{ps,t}}{KD_{ps,t}} &= D1_{ps} \left(\frac{r_{ps,t}}{PINV_t(dep_{ps} + \overline{i_t})}\right)^2 + \\ &D2_{ps} \frac{r_{ps,t}}{PINV_t(dep_{ps} + \overline{i_t})} \end{aligned} \tag{A100}$$

$$VARKD_{pub,t} = KD_{pub,t} - KD_{pub,t-1} \tag{A101}$$

$$MC_t = V_3 (TSTK_t)^{\nu} \tag{A102}$$

$$G_{i,t+1} = G_{i,t}(1 + g_G) \tag{A103}$$

$$A_{1ps,t+1} = A_{1ps,t}(1 + g_{A1}) \tag{A104}$$

$$LSR_{t+1} = LSR_t(1 + g_{LSR}) - MIG_t - EMR_t \tag{A105}$$

$$\begin{aligned} LSU_{\text{``}un\text{''},t+1} &= LSU_{\text{``}un\text{''},t}(1 + g_{LSU}) - ska LSU_{\text{``}sk\text{''},t} + \\ &MIG_t - EMU_{\text{``}un\text{''},t} \end{aligned} \tag{A106}$$

$$LSU_{\text{``}sk\text{''},t+1} = LSU_{\text{``}sk\text{''},t}(1 + ska) - EMU_{\text{``}sk\text{''},t} \tag{A107}$$

Equilibrium Conditions and Closure

$$NATR_t = \sum_{ru} LDR_{ru,t} \tag{A108}$$

$$\begin{aligned}(NATU_{``un",t} + (1 - imc)MIG_t)(1 - u_{``un",t}) = \\ \sum_{up} LDU_{``un",up,t} + \sum_{pub} LDG_{``un",pub,t}\end{aligned} \tag{A109}$$

$$NATU_{``sk",t}(1 - u_{``sk",t}) = \sum_{up} LDU_{``sk",up,t} + \sum_{pub} LDG_{``sk",pub,t} \tag{A110}$$

$$Q_{i,t} = \overline{G}_{i,t} + DIT_{i,t} + \sum_{h} CT_{i,h,t} + INV_{i,t} + \overline{STK_{i,t}} \tag{A111}$$

$$\begin{aligned}Q_{``trr",t} &= \overline{G}_{``trr",t} + DIT_{``trr",t} + \sum_{h} CT_{``trr",h,t} + INV_{``trr",t} + \\ &\quad \overline{STK_{``trr",t}} + \sum_{i} TMA_{i,t}\end{aligned} \tag{A112}$$

$$\begin{aligned}Q_{``tra",t} &= \overline{G}_{``tra",t} + DIT_{``tra",t} + \sum_{h} CT_{``tra",h,t} + INV_{``tra",t} + \\ &\quad \overline{STK_{``tra",t}} + \sum_{i} TRM_{i,t}\end{aligned} \tag{A113}$$

$$EXS_{tr,t} = EXD_{tr,t} \tag{A114}$$

$$IT_t + \sum_{i} \overline{STK_{i,t} PC_{i,t}} \;=\; e_t \overline{S_{"row",t}} + \sum_{da} S_{da,t} \tag{A115}$$

$$\overline{CLOSE_t} = S_{``gv",t}/NGDP_t \tag{A116}$$

$$ITVOL_t = SI_t(\sum_{ps} INVD_{ps,t} + VARKD_t) \tag{A117}$$

The Imperfect Competition Module

$$\frac{PD_{imc,t} - VC_{imc,t}}{PD_{imc,t}} = \frac{1}{NBR_{imc,t} PELAS_{imc,t}} \tag{A118}$$

$$\frac{e_t Pfob_{imc,re,t} - VC_{imc,t}}{e_t Pfob_{imc,re,t}} = \frac{1}{NBR_{imc,t}\varphi_{tr,re}} \tag{A119}$$

$$AC_{imc,t} = \frac{FC_{imc,t}}{XS_{imc,t}} + VC_{imc,t} \tag{A120}$$

$$RD_{imc,t} = \frac{AC_{imc,t}}{VC_{imc,t}} \tag{A121}$$

$$FC_{imc,t} = NBR_{imc,t}(r_{imc,t}KDF_{imc,t}) \tag{A122}$$

$$KD_{imc,t} = NBR_{imc,t}KDF_{imc,t} + KDV_{imc,t} \tag{A123}$$

$$\begin{aligned} PROF_{imc,t} = PXS_{imc,t}XS_{imc,t} - FC_{imc,t} - \sum_i PC_{i,t}DI_{i,imc,t} - \\ (wu_{\text{“}un\text{”},t}LDU_{\text{“}un\text{”},imc,t} + wu_{\text{“}sk\text{”},t}LDU_{\text{“}sk\text{”},imc,t} + r_{imc,t}KDV_{imc,t}) \end{aligned} \tag{A124}$$

$$\begin{aligned} PELAS_{imc,t} = (1 - \frac{(1+tx_{imc}adj_t)PD_{imc,t}DOM_{imc,t}}{PC_{imc,t}Q_{imc,t}})\kappa_{2imc} + \\ \frac{(1+tx_{imc}adj_t)PD_{imc,t}DOM_{imc,t}}{PC_{imc,t}Q_{imc,t}}((1 - \frac{CMIN_{imc,\text{“}hr\text{”},t}(1-\beta_{imc,\text{“}hr\text{”}})}{CT_{imc,\text{“}hr\text{”},t}})\frac{CT_{imc,\text{“}hr\text{”},t}}{Q_{imc,t}} + \\ (1 - \frac{CMIN_{imc,\text{“}hu\text{”},t}(1-\beta_{imc,\text{“}hu\text{”}})}{CT_{imc,\text{“}hu\text{”},t}})\frac{CT_{imc,\text{“}hu\text{”},t}}{Q_{imc,t}} + \frac{INV_{imc,t}}{Q_{imc,t}}) \end{aligned} \tag{A125}$$

$$\begin{aligned} EV_h &= (BC_{h,t} - \sum_i PC_{i,t}CMIN_{i,h,t})(\frac{\prod_i PCO_i}{\prod_i PC_{i,t}})^{\beta_{i,h}} - \\ &\quad (BCO_h - \sum_i PCO_i CMINO_{i,h}) \end{aligned} \tag{A126}$$

IV.D Appendix D: Tables

Table IV.2: **The BAU Growth Path - Perfect Competition**

Percentage Change with Respect to the Base Year

	t	**t+5**	**t+10**	**t+15**
Economic growth				
Real GDP at factor cost	0.00	11.48	31.51	59.15
Real GNP	0.00	11.00	30.45	56.85
Real wage				
Rural	0.00	11.29	24.19	38.81
Urban unskilled	0.00	0.99	6.00	16.97
Urban skilled	0.00	2.93	10.35	43.23
Unemployment				
Unskilled	0.00	-9.34	-44.17	-79.14
Skilled	0.00	-25.05	-62.65	-97.25
Migration flows				
Rural	0.00	1.79	-2.64	-13.18
Urban unskilled	0.00	21.06	19.86	2.91
Urban skilled	0.00	3.08	-10.53	-30.91
Internal	0.00	-18.10	-21.38	-17.05
Household real disposable income				
Rural	0.00	6.39	13.79	22.00
Urban	0.00	9.41	26.84	52.80
Remittances				
To rural household	0.00	1.47	-6.83	-23.77
To urban household:				
From unskilled migrants	0.00	45.30	22.89	-31.52
From skilled migrants	0.00	-34.99	-62.20	-79.59
External trade				
Total export volume	0.00	12.31	38.61	77.43
To the EU	0.00	11.61	36.03	71.54
To the RoW	0.00	14.18	45.53	93.18
Total import volume	0.00	8.60	26.90	54.96
From the EU	0.00	8.39	26.51	54.47
From the RoW	0.00	8.92	27.50	55.69
Real exchange rate	0.00	4.24	6.41	6.77

Source: Author's calculations.

Table IV.3: **The BAU Growth Path - Imperfect Competition (LR)**
Percentage Change with Respect to the Base Year

	t	**t+5**	**t+10**	**t+15**
Economic growth				
Real GDP at factor cost	0.00	12.26	34.70	65.98
Real GNP	0.00	10.73	29.28	55.60
Real wage				
Rural	0.00	9.96	22.17	37.48
Urban unskilled	0.00	2.09	10.67	29.44
Urban skilled	0.00	3.06	11.22	53.61
Unemployment				
Unskilled	0.00	-18.71	-63.71	-92.43
Skilled	0.00	-26.01	-65.46	-98.63
Migration flows				
Rural	0.00	-1.08	-11.27	-28.71
Urban unskilled	0.00	12.43	-1.03	-23.77
Urban skilled	0.00	-2.13	-21.53	-44.66
Internal	0.00	-11.60	-5.90	-6.28
Household real disposable income				
Rural	0.00	6.11	13.13	20.72
Urban	0.00	11.27	33.23	66.78
Remittances				
To rural household	0.00	2.16	-6.78	-25.10
To urban household:				
From unskilled migrants	0.00	32.81	-7.10	-58.81
From skilled migrants	0.00	-37.76	-67.31	-84.62
External trade				
Total export volume	0.00	14.73	48.93	99.20
To the EU	0.00	13.53	44.01	87.56
To the RoW	0.00	17.93	62.08	130.30
Total import volume	0.00	11.58	37.14	76.61
From the EU	0.00	11.55	37.33	77.33
From the RoW	0.00	11.61	36.86	75.51
Real exchange rate	0.00	2.06	1.59	-0.28

Source: Author's calculations.

Table IV.4: **The BAU Growth Path - Imperfect Competition (SR)**
Percentage Change with Respect to the Base Year

	t	**t+5**	**t+10**	**t+15**
Economic growth				
Real GDP at factor cost	0.00	12.13	33.88	64.41
Real GNP	0.00	10.65	28.67	54.19
Real wage				
Rural	0.00	9.77	21.95	37.32
Urban unskilled	0.00	1.77	9.07	22.92
Urban skilled	0.00	3.04	10.99	47.53
Unemployment				
Unskilled	0.00	-16.09	-58.02	-91.12
Skilled	0.00	-25.86	-64.75	-97.69
Migration flows				
Rural	0.00	-0.36	-8.86	-23.81
Urban unskilled	0.00	14.31	4.51	-15.58
Urban skilled	0.00	-1.15	-18.76	-40.54
Internal	0.00	-12.52	-9.72	-1.20
Household real disposable income				
Rural	0.00	6.03	13.06	21.06
Urban	0.00	10.99	31.76	63.35
Remittances				
To rural household	0.00	2.60	-5.95	-24.63
To urban household:				
From unskilled migrants	0.00	34.75	-0.89	-53.22
From skilled migrants	0.00	-37.35	-66.23	-83.51
External trade				
Total export volume	0.00	14.80	47.87	97.01
To the EU	0.00	13.66	43.53	87.15
To the RoW	0.00	17.85	59.46	123.38
Total import volume	0.00	11.72	36.40	74.39
From the EU	0.00	11.73	36.63	75.10
From the RoW	0.00	11.72	36.07	73.30
Real exchange rate	0.00	2.41	2.72	1.77

Source: Author's calculations.

Table IV.5: **Economic growth**

Percentage Change with Respect to the BAU Growth Path

	t	t+5	t+10	t+15
Gradual FTA - Perfect Competition				
Real GDP at factor cost	0.01	-0.05	-0.31	-0.66
Real GNP	-7.57	-7.04	-5.41	-3.27
Gradual FTA - Imperfect Competition (LR)				
Real GDP at factor cost	0.05	0.09	-0.09	-0.43
Real GNP	-0.10	-0.03	-0.17	-0.42
Gradual FTA - Imperfect Competition (SR)				
Real GDP at factor cost	0.04	0.13	0.06	-0.24
Real GNP	-0.10	-0.03	-0.10	-0.32
Gradual MULTI - Perfect Competition				
Real GDP at factor cost	0.01	0.03	-0.04	-0.20
Real GNP	-7.70	-7.05	-5.26	-3.23
Gradual MULTI - Imperfect Competition (LR)				
Real GDP at factor cost	0.09	0.35	0.52	0.44
Real GNP	-0.17	0.10	0.26	0.33
Gradual MULTI - Imperfect Competition (SR)				
Real GDP at factor cost	0.08	0.45	0.87	1.01
Real GNP	-0.17	0.11	0.45	0.72
Instantaneous FTA - Perfect Competition				
Real GDP at factor cost	-0.02	-0.33	-0.73	-1.13
Real GNP	-8.37	-7.15	-5.62	-3.91
Instantaneous FTA - Imperfect Competition (LR)				
Real GDP at factor cost	0.18	-0.14	-0.52	-0.81
Real GNP	-0.55	-0.08	-0.43	-0.75
Instantaneous FTA - Imperfect Competition (SR)				
Real GDP at factor cost	0.16	-0.03	-0.27	-0.47
Real GNP	-0.55	-0.07	-0.30	-0.53
Instantaneous MULTI - Perfect Competition				
Real GDP at factor cost	-0.08	-0.19	-0.36	-0.55
Real GNP	-8.91	-7.08	-5.38	-3.50
Instantaneous MULTI - Imperfect Competition (LR)				
Real GDP at factor cost	0.28	0.28	0.26	0.19
Real GNP	-0.82	0.19	0.16	0.09
Instantaneous MULTI - Imperfect Competition (SR)				
Real GDP at factor cost	0.25	0.52	0.83	0.61
Real GNP	-0.81	0.26	0.49	0.40

Source: Author's calculations.

Table IV.6: **Real Wage**

Percentage Change with Respect to the BAU Growth Path

	t	**t+5**	**t+10**	**t+15**
Gradual FTA - Perfect Competition				
Rural	-0.77	-0.94	-1.28	1.00
Urban unskilled	0.02	0.06	-0.09	-4.86
Urban skilled	0.01	0.05	0.01	-0.20
Gradual FTA - Imperfect Competition (LR)				
Rural	-0.80	-0.88	-1.03	-0.16
Urban unskilled	0.07	0.20	0.09	-0.46
Urban skilled	0.02	0.06	0.02	-0.95
Gradual FTA - Imperfect Competition (SR)				
Rural	-0.76	-0.51	-0.39	0.24
Urban unskilled	0.10	0.31	0.39	1.29
Urban skilled	0.02	0.07	0.06	-0.56
Gradual MULTI - Perfect Competition				
Rural	-1.18	-1.03	-1.24	-0.73
Urban unskilled	0.01	0.16	0.23	0.34
Urban skilled	0.01	0.10	0.17	0.54
Gradual MULTI - Imperfect Competition (LR)				
Rural	-1.33	-1.20	-1.19	0.07
Urban unskilled	0.12	0.50	0.88	0.77
Urban skilled	0.03	0.13	0.26	0.81
Gradual MULTI - Imperfect Competition (SR)				
Rural	-1.24	-0.58	-0.11	1.16
Urban unskilled	0.18	0.75	1.55	3.19
Urban skilled	0.03	0.15	0.35	3.07
Instantaneous FTA - Perfect Competition				
Rural	-5.24	-0.65	-0.87	-1.08
Urban unskilled	-0.04	-0.16	-0.41	-0.87
Urban skilled	0.01	0.02	-0.13	-1.37
Instantaneous FTA - Imperfect Competition (LR)				
Rural	-5.46	-0.43	-0.23	-0.10
Urban unskilled	0.23	-0.05	-0.52	-1.13
Urban skilled	0.05	0.02	-0.20	-2.06
Instantaneous FTA - Imperfect Competition (SR)				
Rural	-5.23	0.15	0.53	0.41
Urban unskilled	0.37	0.12	-0.13	-0.47
Urban skilled	0.05	0.03	-0.14	-1.07
Instantaneous MULTI - Perfect Competition				
Rural	-6.39	-0.57	-0.72	-0.93
Urban unskilled	-0.20	-0.01	0.00	0.01
Urban skilled	0.00	0.08	0.06	-0.05
Instantaneous MULTI - Imperfect Competition (LR)				
Rural	-7.36	-0.59	-0.11	0.28
Urban unskilled	0.34	0.35	0.36	0.21
Urban skilled	0.07	0.10	0.07	-0.07
Instantaneous MULTI - Imperfect Competition (SR)				
Rural	-6.97	0.36	1.25	1.64
Urban unskilled	0.65	0.74	1.18	2.82
Urban skilled	0.07	0.14	0.21	2.34

Source: Author's calculations.

Table IV.7: **Unemployment**

Percentage Change with Respect to the BAU Growth Path

	t	**t+5**	**t+10**	**t+15**
Gradual FTA - Perfect Competition				
Unskilled	-0.19	-0.61	0.89	3.87
Skilled	-0.08	-0.51	-0.15	3.50
Gradual FTA - Imperfect Competition (LR)				
Unskilled	-0.74	-1.98	-0.91	3.95
Skilled	-0.16	-0.64	-0.20	5.66
Gradual FTA - Imperfect Competition (SR)				
Unskilled	-1.00	-3.05	-3.84	-0.84
Skilled	-0.16	-0.68	-0.56	3.71
Gradual MULTI - Perfect Competition				
Unskilled	-0.07	-1.58	-2.28	-3.34
Skilled	-0.10	-0.95	-1.69	-5.20
Gradual MULTI - Imperfect Competition (LR)				
Unskilled	-1.23	-4.89	-8.40	-7.35
Skilled	-0.26	-1.31	-2.54	-7.76
Gradual MULTI - Imperfect Competition (SR)				
Unskilled	-1.83	-7.20	-14.26	-16.83
Skilled	-0.26	-1.44	-3.40	-9.52
Instantaneous FTA - Perfect Competition				
Unskilled	0.45	1.58	4.19	9.08
Skilled	-0.09	-0.16	1.33	14.77
Instantaneous FTA - Imperfect Competition (LR)				
Unskilled	-2.26	0.53	5.38	12.04
Skilled	-0.48	-0.17	2.05	23.20
Instantaneous FTA - Imperfect Competition (SR)				
Unskilled	-3.67	-1.22	1.26	4.86
Skilled	-0.46	-0.32	1.45	11.36
Instantaneous MULTI - Perfect Competition				
Unskilled	2.01	0.10	-0.03	-0.08
Skilled	0.03	-0.78	-0.62	0.46
Instantaneous MULTI - Imperfect Competition (LR)				
Unskilled	-3.34	-3.47	-3.52	-2.04
Skilled	-0.71	-1.04	-0.74	0.66
Instantaneous MULTI - Imperfect Competition (SR)				
Unskilled	-6.23	-7.10	-11.05	-13.73
Skilled	-0.69	-1.40	-2.07	-4.81

Source: Author's calculations.

Table IV.8: **Migration Flows**

Percentage Change with Respect to the BAU Growth Path

	t	**t+5**	**t+10**	**t+15**
Gradual FTA - Perfect Competition				
Rural	0.00	1.88	1.31	1.27
Urban unskilled	0.00	1.63	2.01	2.74
Urban skilled	0.00	1.65	1.50	1.95
Internal	0.00	2.65	1.07	-0.10
Gradual FTA - Imperfect Competition (LR)				
Rural	0.00	1.16	0.09	-0.05
Urban unskilled	0.00	0.38	0.55	1.43
Urban skilled	0.00	0.71	0.29	0.78
Internal	0.00	3.29	1.01	-1.24
Gradual FTA - Imperfect Competition (SR)				
Rural	0.00	0.74	-0.69	-1.24
Urban unskilled	0.00	-0.32	-0.77	-0.32
Urban skilled	0.00	0.24	-0.65	-0.55
Internal	0.00	3.19	0.85	-1.74
Gradual MULTI - Perfect Competition				
Rural	0.00	2.61	1.34	0.56
Urban unskilled	0.00	2.26	1.61	1.39
Urban skilled	0.00	2.39	1.53	1.18
Internal	0.00	3.44	1.99	1.45
Gradual MULTI - Imperfect Competition (LR)				
Rural	0.00	1.12	-1.37	-2.70
Urban unskilled	0.00	-0.61	-1.97	-1.57
Urban skilled	0.00	0.23	-1.42	-1.82
Internal	0.00	5.62	3.46	0.47
Gradual MULTI - Imperfect Competition (SR)				
Rural	0.00	0.28	-2.99	-5.14
Urban unskilled	0.00	-2.10	-4.76	-5.25
Urban skilled	0.00	-0.76	-3.39	-4.56
Internal	0.00	5.74	3.72	0.18
Instantaneous FTA - Perfect Competition				
Rural	0.00	1.38	1.27	1.74
Urban unskilled	0.00	2.71	3.03	3.79
Urban skilled	0.00	1.65	1.87	2.77
Internal	0.00	0.15	-0.47	-0.80
Instantaneous FTA - Imperfect Competition (LR)				
Rural	0.00	0.28	0.03	0.70
Urban unskilled	0.00	1.04	1.75	2.55
Urban skilled	0.00	0.36	0.66	1.73
Internal	0.00	0.59	-1.65	-2.82
Instantaneous FTA - Imperfect Competition (SR)				
Rural	0.00	-0.40	-1.11	-0.78
Urban unskilled	0.00	-0.06	-0.06	0.46
Urban skilled	0.00	-0.40	-0.62	0.13
Internal	0.00	0.29	-1.78	-3.35
Instantaneous MULTI - Perfect Competition				
Rural	0.00	1.79	1.07	0.83
Urban unskilled	0.00	2.99	2.21	2.15
Urban skilled	0.00	2.08	1.64	1.77
Internal	0.00	0.59	0.57	0.82

Instantaneous MULTI - Imperfect Competition (LR)				
Rural	0.00	-0.52	-2.09	-2.41
Urban unskilled	0.00	-0.89	-1.42	-0.85
Urban skilled	0.00	-0.90	-1.59	-1.32
Internal	0.00	2.93	0.66	-1.31
Instantaneous MULTI - Imperfect Competition (SR)				
Rural	0.00	-1.88	-4.26	-5.33
Urban unskilled	0.00	-3.25	-5.05	-5.08
Urban skilled	0.00	-2.52	-4.18	-4.49
Internal	0.00	3.02	0.91	-1.76

Source: Author's calculations.

Table IV.9: **Household Real Disposable Income**

Percentage Change with Respect to the BAU Growth Path

	t	**t+5**	**t+10**	**t+15**
Gradual FTA - Perfect Competition				
Rural	-0.20	-0.17	-0.37	-0.38
Urban	0.12	0.18	-0.01	-0.17
Gradual FTA - Imperfect Competition (LR)				
Rural	-0.20	-0.04	-0.29	-0.11
Urban	0.14	0.40	0.14	-0.27
Gradual FTA - Imperfect Competition (SR)				
Rural	-0.18	-0.00	-0.03	-0.04
Urban	0.10	0.41	0.31	-0.40
Gradual MULTI - Perfect Competition				
Rural	-0.32	-0.11	-0.24	-0.26
Urban	0.19	0.36	0.31	0.40
Gradual MULTI - Imperfect Competition (LR)				
Rural	-0.32	-0.14	-0.29	0.05
Urban	0.24	0.86	1.07	1.06
Gradual MULTI - Imperfect Competition (SR)				
Rural	-0.29	-0.09	-0.15	0.40
Urban	0.16	0.99	1.52	1.34
Instantaneous FTA - Perfect Competition				
Rural	-1.50	-0.07	-0.31	-0.59
Urban	-0.81	-0.82	-0.50	-0.96
Instantaneous FTA - Imperfect Competition (LR)				
Rural	-1.48	-0.02	-0.11	-0.10
Urban	0.00	-0.08	-0.50	-1.00
Instantaneous FTA - Imperfect Competition (SR)				
Rural	-1.39	0.20	0.20	0.10
Urban	0.08	0.19	-0.22	-1.03
Instantaneous MULTI - Perfect Competition				
Rural	-1.85	-0.10	-0.14	-0.45
Urban	0.96	0.20	0.05	-0.06
Instantaneous MULTI - Imperfect Competition (LR)				
Rural	-1.96	-0.04	-0.05	-0.09
Urban	1.23	0.77	0.64	0.52
Instantaneous MULTI - Imperfect Competition (SR)				
Rural	-1.81	0.39	0.48	0.56
Urban	0.82	1.06	1.29	0.99

Source: Author's calculations.

Table IV.10: **Remittances**

Percentage Change with Respect to the BAU Growth Path

	t	**t+5**	**t+10**	**t+15**
Gradual FTA - Perfect Competition To rural household	0.86	1.37	2.64	2.65
To urban household:				
From unskilled migrants	0.22	0.11	1.79	2.58
From skilled migrants	0.12	0.06	1.11	1.67
Gradual FTA - Imperfect Competition (LR)				
To rural household	0.82	1.09	1.79	0.88
To urban household:				
From unskilled migrants	-0.21	-1.16	-0.21	1.79
From skilled migrants	-0.11	-0.54	0.03	1.04
Gradual FTA - Imperfect Competition (SR)				
To rural household	0.75	0.42	0.39	-0.28
To urban household:				
From unskilled migrants	-0.24	-1.56	-1.53	-0.50
From skilled migrants	-0.13	-0.70	-0.64	-0.22
Gradual MULTI - Perfect Competition				
To rural household	1.35	1.48	2.50	2.49
To urban household:				
From unskilled migrants	0.64	0.55	0.40	0.04
From skilled migrants	0.33	0.60	0.54	0.50
Gradual MULTI - Imperfect Competition (LR)				
To rural household	1.37	1.31	1.65	-0.12
To urban household:				
From unskilled migrants	-0.30	-3.16	-4.86	-5.26
From skilled migrants	-0.16	-1.52	-2.33	-2.84
Gradual MULTI - Imperfect Competition (SR)				
To rural household	1.22	0.16	-0.78	-3.07
To urban household:				
From unskilled migrants	-0.40	-4.18	-7.88	-8.38
From skilled migrants	-0.21	-1.96	-3.92	-4.75
Instantaneous FTA - Perfect Competition				
To rural household	6.56	1.93	2.81	4.04
To urban household:				
From unskilled migrants	3.49	2.71	4.77	7.20
From skilled migrants	1.82	1.26	2.45	3.89
Instantaneous FTA - Imperfect Competition (LR)				
To rural household	6.46	1.35	1.24	1.01
To urban household:				
From unskilled migrants	1.30	1.03	3.41	6.02
From skilled migrants	0.68	0.54	1.69	3.03
Instantaneous FTA - Imperfect Competition (SR)				
To rural household	6.05	0.19	-0.55	-0.58
To urban household:				
From unskilled migrants	1.09	-0.06	1.18	4.70
From skilled migrants	0.57	0.11	0.57	2.22
Instantaneous MULTI - Perfect Competition				
To rural household	8.18	1.96	2.56	3.56
To urban household:				
From unskilled migrants	6.15	2.68	2.76	2.89
From skilled migrants	3.18	1.20	1.60	1.83

Instantaneous MULTI - Imperfect Competition (LR)				
To rural household	8.69	1.46	0.66	-0.44
To urban household:				
From unskilled migrants	1.72	-1.91	-2.70	-2.64
From skilled migrants	0.89	-0.86	-1.39	-1.71
Instantaneous MULTI - Imperfect Competition (SR)				
To rural household	7.96	-0.47	-2.56	-4.28
To urban household:				
From unskilled migrants	1.13	-4.34	-7.38	-7.30
From skilled migrants	0.59	-1.87	-3.82	-4.45

Source: Author's calculations.

Table IV.11: **External Trade**

Percentage Change with Respect to the BAU Growth Path

	t	**t+5**	**t+10**	**t+15**
Gradual FTA - Perfect Competition				
Total export volume	0.88	3.19	4.07	4.68
To the EU	0.92	3.50	4.66	5.31
To the RoW	0.76	2.39	2.61	3.20
Total import volume	0.17	2.66	3.84	3.69
From the EU	2.03	9.03	12.43	12.01
From the RoW	-2.64	-6.94	-9.08	-8.82
Real exchange rate	0.94	0.87	1.18	0.71
Gradual FTA - Imperfect Competition (LR)				
Total export volume	1.01	3.82	4.91	3.95
To the EU	1.04	4.15	5.70	4.88
To the RoW	0.95	2.98	3.04	1.93
Total import volume	0.37	3.15	4.51	4.01
From the EU	2.25	9.47	12.87	11.97
From the RoW	-2.46	-6.41	-8.19	-8.16
Real exchange rate	0.72	0.48	0.55	0.16
Gradual FTA - Imperfect Competition (SR)				
Total export volume	0.97	3.75	5.06	3.61
To the EU	1.00	4.07	5.89	4.73
To the RoW	0.91	2.93	3.06	1.11
Total import volume	0.36	3.00	4.49	3.74
From the EU	2.23	9.29	12.84	11.72
From the RoW	-2.48	-6.53	-8.21	-8.47
Real exchange rate	0.67	0.38	0.31	-0.14
Gradual MULTI - Perfect Competition				
Total export volume	1.55	5.52	7.52	7.01
To the EU	1.63	6.02	8.45	8.17
To the RoW	1.36	4.24	5.22	4.24
Total import volume	0.31	4.51	6.82	7.17
From the EU	-1.38	-1.21	-1.18	-0.86
From the RoW	2.88	13.14	18.84	19.23
Real exchange rate	1.63	1.29	1.55	0.81
Gradual MULTI - Imperfect Competition (LR)				
Total export volume	1.85	7.04	9.86	9.42
To the EU	1.91	7.72	11.61	12.05
To the RoW	1.69	5.30	5.70	3.69
Total import volume	0.76	5.84	9.01	9.38
From the EU	-0.91	0.09	0.89	1.15
From the RoW	3.29	14.54	21.37	21.98
Real exchange rate	1.17	0.39	0.17	-0.47
Gradual MULTI - Imperfect Competition (SR)				
Total export volume	1.75	6.94	10.29	9.58
To the EU	1.81	7.62	12.14	12.48
To the RoW	1.60	5.19	5.83	3.08
Total import volume	0.71	5.57	9.10	9.47
From the EU	-0.96	-0.17	0.96	1.19
From the RoW	3.24	14.25	21.48	22.15
Real exchange rate	1.05	0.15	-0.36	-1.14

Instantaneous FTA - Perfect Competition				
Total export volume	4.99	4.36	3.38	2.52
To the EU	5.27	4.94	4.09	3.28
To the RoW	4.25	2.84	1.59	0.72
Total import volume	1.31	4.37	3.78	2.97
From the EU	9.55	13.28	12.46	11.30
From the RoW	-11.17	-9.06	-9.26	-9.55
Real exchange rate	5.50	0.67	0.63	0.78
Instantaneous FTA - Imperfect Competition (LR)				
Total export volume	5.72	5.33	4.28	3.26
To the EU	5.94	6.17	5.55	4.52
To the RoW	5.13	3.16	1.27	0.53
Total import volume	2.35	5.05	4.35	3.38
From the EU	10.70	13.93	12.81	11.32
From the RoW	-10.30	-8.40	-8.52	-8.78
Real exchange rate	4.38	0.13	0.01	0.16
Instantaneous FTA - Imperfect Competition (SR)				
Total export volume	5.48	5.39	4.67	3.11
To the EU	5.70	6.24	6.06	4.65
To the RoW	4.91	3.20	1.34	-0.34
Total import volume	2.24	4.88	4.49	3.27
From the EU	10.58	13.72	12.97	11.26
From the RoW	-10.38	-8.50	-8.41	-8.97
Real exchange rate	4.07	-0.02	-0.30	-0.22
Instantaneous MULTI - Perfect Competition				
Total export volume	7.62	7.65	7.13	6.54
To the EU	8.02	8.52	8.25	7.82
To the RoW	6.57	5.36	4.34	3.51
Total import volume	1.85	7.22	7.17	6.83
From the EU	-5.91	-0.72	-0.81	-1.15
From the RoW	13.61	19.21	19.16	18.84
Real exchange rate	8.32	0.98	0.79	0.82
Instantaneous MULTI - Imperfect Competition (LR)				
Total export volume	9.01	10.09	9.91	9.24
To the EU	9.37	11.59	12.47	12.52
To the RoW	8.05	6.26	3.82	2.09
Total import volume	3.96	9.22	9.54	9.22
From the EU	-3.82	1.16	1.38	0.98
From the RoW	15.74	21.42	21.95	21.83
Real exchange rate	6.01	-0.24	-0.61	-0.57
Instantaneous MULTI - Imperfect Competition (SR)				
Total export volume	8.52	10.29	10.88	9.78
To the EU	8.88	11.83	13.67	13.45
To the RoW	7.55	6.33	4.14	1.55
Total import volume	3.71	8.99	10.00	9.64
From the EU	-4.03	0.97	1.80	1.32
From the RoW	15.42	21.15	22.48	22.37
Real exchange rate	5.42	-0.60	-1.26	-1.35

Source: Author's calculations.

Table IV.12: **GDP at Factor Cost**
For Selected Values of Skilled Externality Parameter *ske*
Percentage Change with Respect to the BAU Growth Path

ske	**Model**	Scenario	**t**	**t+5**	**t+10**	**t+15**
0.20	Imperfect Competition (LR)	FTA	0.05	0.09	-0.09	-0.43
		MULTI	0.09	0.35	0.51	0.48
	Imperfect Competition (SR)	FTA	0.04	0.13	0.06	-0.19
		MULTI	0.08	0.45	0.87	1.03
0.05	Imperfect Competition (LR)	FTA	0.05	0.09	-0.09	-0.43
		MULTI	0.09	0.35	0.52	0.44
	Imperfect Competition (SR)	FTA	0.04	0.13	0.06	-0.19
		MULTI	0.08	0.44	0.87	1.03

Notes: FTA and MULTI stand here for gradual free trade agreement and gradual multilateral liberalisation.
Source: Author's calculations.

Table IV.13: **GDP at Factor Cost**
For Selected Values of Base Year Profits
Percentage Change with Respect to the BAU Growth Path

Profits	**Model**	Scenario	**t**	**t+5**	**t+10**	**t+15**
0	Imperfect Competition (LR)*	FTA	0.06	0.10	-0.08	-0.43
		MULTI	0.10	0.37	0.53	0.44
	Imperfect Competition (SR)	FTA	0.05	0.13	0.06	-0.19
		MULTI	0.09	0.45	0.85	1.00
20% of capital remuneration	Imperfect Competition (LR)*	FTA	0.05	0.09	-0.08	-0.42
		MULTI	0.08	0.34	0.52	0.46
	Imperfect Competition (SR)	FTA	0.04	0.13	0.06	-0.55
		MULTI	0.07	0.45	0.90	0.69
10% of capital remuneration	Imperfect Competition (LR)**	FTA	0.05	0.10	-0.08	-0.36
		MULTI	0.09	0.36	0.53	0.47

Notes: (1) FTA and MULTI stand here for gradual free trade agreement and gradual multilateral liberalisation.
(2) *: In the LR simulation, profits are brought back to their benchmark value.
(3) **: Profits are brought back to zero.
Source: Author's calculations.

Table IV.14: **GDP at Factor Cost - Imperfect Competition For Selected Combinations of Remittance Elasticities**

Percentage Change with Respect to the BAU Growth Path

$\gamma_{1"un",h}$	$\gamma_{1"sk",h}$	Model	Scenario	**t**	**t+5**	**t+10**	**t+15**
-8.4	-2.2	LR	FTA	0.05	0.10	-0.08	-0.44
			MULTI	0.09	0.36	0.52	0.43
		SR	FTA	0.05	0.13	0.06	-0.59
			MULTI	0.08	0.45	0.88	0.64
-8.4	-1.1	LR	FTA	0.05	0.10	-0.08	-0.44
			MULTI	0.09	0.36	0.52	0.44
		SR	FTA	0.05	0.13	0.06	-0.59
			MULTI	0.08	0.45	0.88	0.65
-8.4	-4.2	LR	FTA	0.05	0.10	-0.09	-0.45
			MULTI	0.09	0.35	0.52	0.43
		SR	FTA	0.05	0.13	0.06	-0.60
			MULTI	0.08	0.44	0.88	0.63
-4.2	-1.1	LR	FTA	0.05	0.09	-0.09	-0.43
			MULTI	0.09	0.35	0.52	0.44
		SR	FTA	0.05	0.13	0.06	-0.54
			MULTI	0.08	0.45	0.87	0.67

Notes: (1) $\gamma_{1"un",h}$: Elasticity of international remittance rate by unskilled workers with respect to household h's real income.
(2) $\gamma_{1"sk",h}$: Elasticity of international remittance rate by skilled workers with respect to household h's real income.
Source: Author's calculations.

Table IV.15: **Remittances - Imperfect Competition For Selected Combinations of Remittance Elasticities**

Percentage Change with Respect to the BAU Growth Path

$\gamma_{1\text{"}un\text{"},h}$	$\gamma_{1\text{"}sk\text{"},h}$	Model	Scenario	Household	**t**	**t+5**	**t+10**	**t+15**
-8.4	-2.2	LR	FTA	Rural	1.17	1.39	2.59	1.32
				Urban				
				From unskilled migrants	-0.49	-2.53	-0.61	3.79
				From skilled migrants	-0.13	-0.50	0.07	1.25
			MULTI	Rural	1.95	1.67	2.51	-0.04
				Urban				
				From unskilled migrants	-0.73	-6.25	-9.12	-8.91
				From skilled migrants	-0.19	-1.43	-2.39	-2.74
		SR	FTA	Rural	1.06	0.43	0.42	-0.36
				Urban				
				From unskilled migrants	-0.54	-3.04	-2.76	-4.08
				From skilled migrants	-0.14	-0.65	-0.65	-0.93
			MULTI	Rural	1.73	0.01	-1.19	-4.61
				Urban				
				From unskilled migrants	-0.88	-7.64	-14.01	-13.19
				From skilled migrants	-0.23	-1.83	-4.09	-4.77
-8.4	-1.1	LR	FTA	Rural	1.17	1.39	2.60	1.34
				Urban				
				From unskilled migrants	-0.51	-2.60	-0.66	3.69
				From skilled migrants	-0.07	-0.13	0.19	0.83
			MULTI	Rural	1.95	1.67	2.51	-0.05
				Urban				
				From unskilled migrants	-0.75	-6.38	-9.23	-9.02
				From skilled migrants	-0.10	-0.57	-1.25	-1.69
		SR	FTA	Rural	1.06	0.43	0.44	-0.36
				Urban				
				From unskilled migrants	-0.56	-3.11	-2.82	-3.96
				From skilled migrants	-0.07	-0.24	-0.33	-0.33
			MULTI	Rural	1.73	0.01	-1.19	-4.62
				Urban				
				From unskilled migrants	-0.91	-7.79	-14.13	-13.29
				From skilled migrants	-0.12	-0.85	-2.45	-3.42
-8.4	-4.2	LR	FTA	Rural	1.17	1.39	2.58	1.32
				Urban				
				From unskilled migrants	-0.46	-2.45	-0.55	3.92
				From skilled migrants	-0.23	-1.15	-0.13	2.06
			MULTI	Rural	1.95	1.67	2.51	-0.05
				Urban				
				From unskilled migrants	-0.68	-6.07	-9.02	-8.81
				From skilled migrants	-0.34	-2.92	-4.39	-4.59
		SR	FTA	Rural	1.06	0.42	0.41	-0.34
				Urban				
				From unskilled migrants	-0.50	-2.95	-2.71	-4.24
				From skilled migrants	-0.25	-1.36	-1.21	-2.07
			MULTI	Rural	1.73	0.01	-1.20	-4.60
				Urban				
				From unskilled migrants	-0.82	-7.43	-13.91	-13.11
				From skilled migrants	-0.41	-3.53	-6.98	-7.16

Notes: (1) $\gamma_{1\text{"}un\text{"},h}$: Elasticity of international remittance rate by unskilled workers with respect to household h's real income.
(2) $\gamma_{1\text{"}sk\text{"},h}$: Elasticity of international remittance rate by skilled workers with respect to household h's real income.
(3) FTA and MULTI stand here for gradual free trade agreement and gradual multilateral liberalisation.
Source: Author's calculations.

-4.2	-1.1	LR	FTA	Rural	0.82	1.09	1.79	0.88
				Urban				
				From unskilled migrants	-0.22	-1.19	-0.23	1.74
				From skilled migrants	-0.06	-0.15	0.18	0.72
			MULTI	Rural	1.38	1.31	1.65	-0.12
				Urban				
				From unskilled migrants	-0.31	-3.23	-4.92	-5.32
				From skilled migrants	-0.08	-0.62	-1.20	-1.73
		SR	FTA	Rural	0.75	0.42	0.40	-0.29
				Urban				
				From unskilled migrants	-0.26	-1.60	-1.55	-1.25
				From skilled migrants	-0.07	-0.26	-0.31	-0.22
			MULTI	Rural	1.22	0.16	-0.77	-3.08
				Urban				
				From unskilled migrants	-0.42	-4.26	-7.94	-8.45
				From skilled migrants	-0.11	-0.91	-2.33	-3.37

Table IV.16: **Household Real Disposable Income - Imperfect Competition For Selected Combinations of Remittance Elasticities**

Percentage Change with Respect to the BAU Growth Path

$\gamma_{1"un",h}$	$\gamma_{1"sk",h}$	Model	Scenario	Household	**t**	**t+5**	**t+10**	**t+15**
-8.4	-2.2	LR	FTA	Rural	-0.14	-0.11	-0.24	-0.11
				Urban	0.06	0.35	0.11	-0.37
			MULTI	Rural	-0.23	-0.11	-0.25	0.05
				Urban	0.09	0.81	1.07	1.00
		SR	FTA	Rural	-0.13	0.00	-0.02	-0.03
				Urban	0.06	0.39	0.30	-0.52
			MULTI	Rural	-0.20	-0.06	-0.12	0.38
				Urban	0.10	0.93	1.57	1.30
-8.4	-1.1	LR	FTA	Rural	-0.14	-0.11	-0.24	-0.11
				Urban	0.06	0.36	0.12	-0.36
			MULTI	Rural	-0.23	-0.11	-0.25	0.05
				Urban	0.09	0.83	1.09	1.01
		SR	FTA	Rural	-0.13	0.00	-0.02	-0.03
				Urban	0.07	0.39	0.31	-0.51
			MULTI	Rural	-0.20	-0.06	-0.12	0.39
				Urban	0.11	0.95	1.59	1.31
-8.4	-4.2	LR	FTA	Rural	-0.14	-0.11	-0.24	-0.11
				Urban	0.05	0.34	0.11	-0.38
			MULTI	Rural	-0.23	-0.11	-0.25	0.05
				Urban	0.08	0.79	1.06	0.98
		SR	FTA	Rural	-0.13	0.00	-0.02	-0.02
				Urban	0.06	0.38	0.29	-0.54
			MULTI	Rural	-0.20	-0.06	-0.12	0.38
				Urban	0.10	0.91	1.56	1.29
-4.2	-1.1	LR	FTA	Rural	-0.20	-0.14	-0.29	-0.11
				Urban	0.05	0.38	0.14	-0.26
			MULTI	Rural	-0.32	-0.14	-0.29	0.05
				Urban	0.07	0.87	1.08	1.07
		SR	FTA	Rural	-0.18	0.00	-0.03	-0.04
				Urban	0.06	0.42	0.31	-0.38
			MULTI	Rural	-0.29	-0.09	-0.15	0.41
				Urban	0.10	1.01	1.53	1.36

Notes: (1) $\gamma_{1"un",h}$: Elasticity of international remittance rate by unskilled workers with respect to household h's real income.

(2) $\gamma_{1"sk",h}$: Elasticity of international remittance rate by skilled workers with respect to household h's real income.

(3) FTA and MULTI stand here for gradual free trade agreement and gradual multilateral liberalisation.

Source: Author's calculations.

General Conclusion

After the large interest in the impact of South-North migration on developed countries, economists were particularly busy for years in looking at its effects on developing countries. Undoubtedly, South-North migration is quantitatively important. But as much tremendous as South-North migration is South-South migration, accounting for 47% of total emigration from the South. In the real world, the common case is a developing country having both the status of emigration and immigration countries. This is for example the case of North African countries such as Mauritania, Algeria, Libya, Morocco and Tunisia. They send migrants to the EU and receive, in turn, immigrants from Sub-Saharan Africa (Senegal, Gambia, Sierra Leone, Liberia, Mali and others) for transit or for stay. This is also true for many other developing countries. The coexistence of inflows and outflows of workers raises doubts about the effects of South-North migration on developing countries, especially when they concern its impact on labour market. Indeed, if emigration helps raise wages or diminish unemployment in the sending country, immigration acts in the opposite direction. Besides, an interesting interdependency arises between inflows and outflows of workers. On the one hand, if the labour market is taken into account in the emigration decision, the pressure exerted by South-South migration on wages and unemployment in the developing country may motivate people to leave. On the other hand, the alleviating effect of South-North emigration on the labour market in the sending country is able to attract immigration from another developing country. What would be the overall impact of inflows and outflows of workers on the labour market of the developing country?

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With respect to the literature on "Migration and Development", this thesis proposes to look over the scope of South-North migration. It gives a particular attention to inflows and outflows of workers affecting a developing country. If South-North migration helps raise wages or diminish unemployment in the sending region, the conditions of the labour market make this region attractive for immigrants or for internal migrants inside the country. Indeed, internal migration from disadvantaged regions has been largely documented in the literature. Furthermore, immigration and internal migration increase the pressure on the labour market of the receiving region, stimulating outflows of workers from this region. This interdependency between inflows and outflows of workers has been omitted in the literature on the impact of emigration on labour market in the sending country. That is why the literature argues that emigration reduces unemployment and/or increases the wage rate. However, when inflows and outflows of workers coexist, the overall impact of all migratory flows on domestic labour market is ambiguous. It depends on the magnitude of inflows and outflows: if outflows are higher, unemployment decreases, as it is found in the migration literature. By contrast, if inflows are greater, unemployment increases.

The answer to this question is brought in the second chapter of this thesis. Morocco is the country of application. It is the typical example of a developing country undergoing the combination of inflows and outflows of workers. Chapter 2 proposes a modelling of all migration flows affecting the Moroccan urban labour market: rural and urban emigration, internal migration from rural to urban areas, and Sub-Saharan immigration to Moroccan urban areas. Migration flows depend on the wage differential between the sending and receiving regions net of migration costs. Therefore, this is a general equilibrium problem and to deal with, the analysis is done with a static CGE model. Only African immigration does not depend on wage differentials because it mainly occurs for security and personal reasons. Thus, the stock of African immigrants is exogenised and is subject to a shock reflecting higher African immigration. The increase of international and internal migration is simulated by a drop of internal and international migration costs. The results show that the pressure of immigration and internal migration on Moroccan urban labour market outweighs the alleviating effect of urban emigration, so that unemployment rates by professional category increase. This result is contradictory to the literature and suggests that the impact of migration on labour market should be apprehended cautiously, by taking into consideration the characteristics of migratory flows in the corresponding country.

The second question is related to the investment of remittances in developing countries. Case studies argue that they are mainly invested in real estate, that is called a "refugee sector". The problem of the real estate activity is that construction services are offered domestically and do not compete with exports. Therefore, they do not profit from total factor productivity improvement, for example through technology transfer in order to meet the world market quality standards. A sketchy analysis suggests that the investment of remittances in productive exportable sectors should create the conditions of a sustainable growth. This problem is dealt with in a dynamic CGE model that shows the transmission channels by which remittances affect households and sectors as well as the interactions between economic agents. In contrast to the literature that is interested in the household impact of remittances, this thesis proposes a overall view of the economy. To begin with, remittances affect household income. But since a fraction of remittances is invested, they also affect production and the demand for factors. In turn, wage variation modifies household income. Besides, remittances affect the BoP and induce an appreciation or a depreciation of the real exchange rate. Since the evolution of the exchange rate enters in migration decision by changing the value of foreign wage in domestic currency, it affects migration flows and thus the amount remitted. In order to investigate the specific investment of remittances in real estate, a segmentation of the savings markets is necessary where different savings sources finance investment in different sectors.

The answer to this question is given in Chapter 3. This chapter proposes a dynamic CGE model applied to Morocco, with each source of savings being devoted to investment in specific sectors. The application to Morocco is interesting especially since it is the fourth developing country and the first MENA country in terms of remittances received. Besides, 80% of remittances invested finance the real estate sector. A 50% drop of the amount of remittances invested in the real estate sector is then simulated. The results show that the investment of remittances in productive sectors unexpectedly reduces the overall economic activity. This is due to the fact that the real estate sector is highly integrated in the economy. It consumes an important volume of intermediary inputs from the other sectors. Therefore, when the real estate sector contracts after receiving less investment, the other sectors also shrink because of a negative demand effect. Positive effects in terms of welfare and economic growth only stem from government ability to attract investors through an improvement in the country risk premium, and private efforts to reduce international transfer costs. Indeed, with a better investment climate, foreign and domestic investors have greater confidence in investment. Given that other things are equal, the capital used in the production of all sectors rises and the production follows, *ceteris paribus*, the evolution of the capital volume. This is translated in a higher economic growth. Similarly, when transfer costs decrease, households receive a larger value of remittances that increases their income, consumption budget and welfare. Furthermore, as long as a fraction of remittances is invested, the drop in transfer costs should, *ceteris paribus*, boost domestic investment in all sectors, and mostly in real estate, enhancing economic growth.

The third question in which this thesis is interested concerns the labour market effects of trade liberalisation for unskilled and skilled workers, and their indirect effects on migration incentives. The relation between tariff removal and unskilled and skilled migration is largely investigated on the theoretical ground, beginning by the HO model. In an unskilled-labour abundant country that is advantaged in unskilled-labour intensive sectors, trade liberalisation should raise unskilled-labour intensive exports as well as unskilled labour demand. Unskilled wage then increases, reducing migration incentives. The opposite is true for skilled labour. But some complications of this model are sufficient to reverse the results. Therefore, empirical country-specific works must be done. The analysis is conducted with a dynamic CGE model because trade agreements involve substantial changes in prices, resource allocation and income, and affect capital stock through savings as well as human capital and technology. Based on a robust and widely accepted modelling of agents' behaviour, CGE models are able to provide a detailed description of the impact of such shocks on the economy.

The CGE model is calibrated on the newest Moroccan SAM for the year 2003. The country is in the bulk of the trade liberalisation process. It is about to achieve a free trade area with the EU and has signed FTAs with the US, Turkey and other Arab countries. The application to Morocco also allows to compare the results with previous works on migration and trade liberalisation in Morocco, and to show how some complications of the model are likely to reverse the results. Morocco is unskilled-labour abundant and is advantaged in unskilled-labour intensive sectors. Therefore, trade liberalisation should be a substitute for unskilled migration, and a complement for skilled migration. However, the results show that the final effect on labour demand also depends on the initial protection structure. Indeed, some unskilled-intensive sectors, initially highly protected, shrink after tariff removal. This is for example the case of agriculture. Rural unskilled labour demand then decreases and the rural wage falls in order to balance the market. Unskilled rural migration is thus stimulated. In urban areas, both skilled and unskilled labour demand increase in the short run as well as wages. Skilled labour demand increases in the short run because skilled-intensive sectors expand, selling more on foreign markets thanks to the real exchange rate depreciation and to cheaper intermediary inputs. Skilled and unskilled demand however decrease in the long run with increased foreign competition, and so do wages. Despite falling unemployment in the short run, unskilled and skilled urban people choose to migrate, motivated by the exchange rate depreciation that increases the value of the foreign wage in domestic currency. In other words, there is a pull factor for urban emigration. When the FTA shock is run with an imperfect competition framework, migration flows of skilled and unskilled workers decrease, even in rural areas in the long run. Indeed, with imperfect competition, the pro-competitive effect of trade liberalisation allows a greater expansion of the economic activity, and thus a greater labour demand that reduces unemployment and increases wages. Gradual multilateral liberalisation strengthens the previous effects. The economic growth is even higher than the FTA case because of cheaper inputs and greater real exchange rate depreciation that improves export competitiveness on foreign markets. In the imperfect competition model, all emigration flows decrease, more than the FTA shock, meaning that trade liberalisation and migration are substitutes. In other words, the more the economy grows, the lower are migration flows. The results of this chapter are contradictory with the works of Bouzahzah et al. (2007) and Cogneau and Tapinos (1995) on Morocco where migration is motivated by push factors due to tariff removal. In this model, migration is mostly due to pull factors and may even decrease. This does not mean that the previous works are wrong, but it puts forward the importance of the conceptualised model, especially when some complications are likely to reverse the results.

It is worth mentioning that the three above-mentioned CGE models are built on the basis of Chapter 1 that presents a useful exercise to examine the functioning of such models. The first chapter is an attempt to determine the appropriate CGE framework adapted to use. It investigates how the results of a trade liberalisation shock change under different structures of CGE models. It discusses how trade liberalisation outcomes are affected by the change of the functional forms corresponding to production (CES vs. Leontief), value added (CES vs. Cobb Douglas), intermediary consumption (CES vs. Leontief), investment (CES vs. Cobb-Douglas) and utility (Stone-Geary vs. Cobb-Douglas), as well as the choice of the *numéraire*, the macroeconomic closure (investment-driven vs. savings-driven), the structure of the commodity market (imperfect vs. perfect competition) and the time dimension (dynamic vs. static). The results are not considerably affected when the functional forms are modified: only the classification of winners and losers is altered as well as the magnitude of variable changes. They are, however, more sensitive to changes of the intermediate consumption Leontief function, the macroeconomic closure, the commodity market structure and the time horizon adopted. Many changes are detected in signs. The importance of the imperfect vs. perfect commodity market structure is felt in the last chapter of this thesis, with imperfect competition leading to somewhat opposite results when compared to those of perfect competition.

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In economics as well as other model-based sciences, a modeller has to do a sensitivity analysis to show the validity of the results generated from his numerical model simulations. Indeed, results from simulation models are dependent on values chosen for critical parameters such as elasticities or time preference parameters. A sensitivity analysis is the study of how the output of a model varies, qualitatively or quantitatively, following different sources of variation in input parameters. In this thesis, a sensitivity analysis followed each chapter. The results come out to be sufficiently robust to reasonable variation or combined variation of key parameters. Some selected results of the sensitivity analysis are summarised in tables at the end of each chapter and pointed out to in the analysis.

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What is behind the scope of this thesis? The present work tackles some interesting issues on “Migration and Development”. However, other aspects merit to be apprehended as well. For example, Chapter 2 does not consider the possibility of changing the professional category when migrating from rural to urban areas. Nevertheless, it is often true that rural workers occupy unskilled job in industry or services after moving to the cities, especially when agricultural jobs are scare in urban areas. Accurate estimations of cross-elasticities of labour supply by professional category help capture this issue. Then, internal migrants would shift to professions whose expected real wage increases the most and consequently, raise the pressure on this segment of labour market and not the others. The pressure on some segments of labour markets may be further exacerbated by return migration that is not taken into consideration in this thesis. Unskilled migrants may return with newly acquired skills and occupy a job belonging to another professional category. They are then able to affect the unemployment rate of a more skilled profession. These are very few examples of what could also be done about "Migration and Development". As the General Secretary of the United Nations Kofi Annan said, on the occasion of the High-level Dialogue on International Migration and Development held in 14-15 of September 2006, in a report prepared in anticipation of the meeting: "We are only beginning to learn how to make migration work more consistently for development. Each of us holds a piece of the migration puzzle, but none has the whole picture. It is time to start putting it together."

Bibliography

[1] Abdelkhalek T. and N. Zaoujal (2004), Une Matrice de Comptabilité Sociale de l'Economie Marocaine Base 1998 : Cadre Comptable d'un MCEG Micro Simulé, *Cahier de recherche de l'équipe MIMAP-Maroc*, INSEA, Rabat.

[2] Abdelkhalek T. (2003), Construction d'Une Matrice de Comptabilité Sociale de l'Economie Marocaine : Base Comptable du Modèle IMMPA, *mimeo*.

[3] Adams, R.Jr. (1991), The Effects of International Remittances on Poverty, Inequality and Development in Rural Egypt, *Research Report No. 96*, International Food Policy Research Institute, Washington D.C.

[4] Adams, R.Jr. (1998), Remittances, Investment, and Rural Asset Accumulation in Pakistan, *Economic Development and Cultural Change*, **47(1)**, 155-173.

[5] Adams, R.Jr. (2006), Remittances, Poverty, and Investment in Guatemala, *in International Migration, Remittances and the Brain Drain*, The World Bank, Washington D.C.

[6] Agénor, P.R. and K. El Aynaoui (2003), Labour Market Policies and Unemployment in Morocco: A Quantitative Analysis, *Policy Research Working Paper Series 3091*, The World Bank, Washington D.C.

[7] Abdelkhalek T. (2005), Libéralisation Commerciale et Pauvreté au Maroc: Une Analyse en Equilibre Général Micro Simulé, *Cahier de recherche de l'équipe MIMAP-Maroc*, INSEA, Rabat.

[8] Ahlburg, D.A. (1996), Remittances and the Income Distribution in Tonga, *Population Research and Policy Review*, **15(4)**, 391-400.

[9] Annabi, N. and T. Rajhi (2001), Dynamics of Trade Liberalization: An Inter-Temporal Computable General Equilibrium Model Applied to Tunisia, *mimeo*.

[10] Armington, P.S. (1969), A Theory of Demand for Products Distinguished by Place of Production, *IMF Staff Papers*, **16**, 159-178.

[11] Barendse, J., C. Hiddink, A. Janzsen and A. Stavast (2006), The Remittance Corridor the Netherlands-Morocco: Review of Obstacles and Recommendations on How to Increase the Use of the Bank Channel, *mimeo*.

[12] Bchir, M.H., Y. Decreux, J.L. Guérin and S. Jean (2002), MIRAGE, A CGE Model for Trade Policy Analysis, *CEPII Working Paper 2002-17*, Paris.

[13] Beine, M., F. Docquier and H. Rapoport (2001), Brain Drain and Economic Growth: Theory and Evidence, *Journal of Development Economics*, **64(1)**, 275-289.

[14] Bernstein, J., A. Regmi and J. Seale (2003), International Evidence on Food Consumption Patterns, *Technical Bulletin number 1904*, United States Department of Agriculture.

[15] Berriane, M. (1996), Migration Internationale et Extension du Cadre Bâti: Le Cas des Villes du Maroc Nord, *mimeo*.

[16] Bijaad, H. (1987), Conséquences Socio-Economiques des Migrants Maghrébins de Retour: Enquête dans la région Sud du Maroc, Doctoral dissertation, Aix-Marseille University.

[17] Blanchflower D. and A. Oswald (1995), An Introduction to the Wage Curve, *The Journal of Economic Perspectives*, **9(3)**, 153-167.

[18] Borjas, G.J. (1999), The Economic Analysis of Immigration, *In Handbook of Labour Economics*, **3(1)**, 1697-1760, ed. O. Ashenfelter and D. Card, Amsterdam,New York, and Oxford: Elsevier Science North-Holland.

[19] Bouhga-Hagbe, J. (2004), A Theory of Workers' Remittances With an Application to Morocco, *IMF Working Paper WP/04/194*, IMF International Monetary Fund, Washington D.C.

[20] Bourchachen, J. (2000), Apports des Transferts des Résidents à l'Etranger à la Réduction de la Pauvreté: Cas du Maroc, Paper presented at the seminar "Statistique, développement et droits de l'homme", Montreux, 4-8 September.

[21] Bourguignon, F., W.H. Branson and J. de Melo (1989), Macroeconomic Adjustment and Income Distribution: A Macro-Micro Simulation Model, *Technical paper No. 1*, OECD, Paris.

[22] Bouzahzah, M., H. Esmaeili and A. Ihadiyan (2007), Ouverture Commerciale et Migration: Un Modèle d'Equilibre Général Calculable pour le Maroc, *L'Actualié Economique*, **83(1)**, 71-90.

[23] Brockmeier, M. (2001), A Graphical Exposition of the GTAP Model, *GTAP Technical Paper No.8*, Center for Global Trade Analysis, Purdue University.

[24] Brooke, A., D. Kendrick and A. Meeraus (1988), GAMS: A user's guide, Scientific Press, Redwood City, CA.

[25] Bruyn, T. de and U. Kuddus (2005), Dynamics of Remittance Utilization in Bangladesh, International Organisation of Migration, Geneva.

[26] Caupin, V. (2005), Libre-Echange Euro-Méditerranéen: Premier Bilan en Maroc et en Tunisie, Agence Française de Développement, Paris.

[27] Chami, R., C. Fullenkamp and S. Jahjah (2005), Are Immigrant Remittance Flows a Source of Capital for Development?, *IMF Staff Papers*, **52(1)**, International Monetary Fund, Washington D.C.

[28] Chan, N., T.K. Dung, M. Ghosh and J. Whalley (2005), Adjustment Costs in Labour Markets and the Distributional Effects of Trade Liberalization: Analytics and Calculation for Vietnam, *Journal of Policy Modeling*, **27**, 1009-1024.

[29] Chiappori, P-A. (1992), Collective Labour Supply and Welfare, *Journal of Political Economy*, **100**, 437-67.

[30] Cockburn, J., B. Decaluwé and B. Dostie (1998), Les Leçons du Mariage entre les Modéles d'Equilibre Général Calculable et la Nouvelle Théorie du Commerce International: Application à la Tunisie, *L'Actualité Economique*, **74(3)**, 381-413.

[31] Cockburn, J., B. Decaluwé, I. Fofana and V. Robichaud (2006), Un Modèle Standard d'Equilibre Général Calculable pour l'Analyse de l'Impact des Politiques Economiques, *mimeo*.

[32] Cogneau, D. and G. Tapinos (1995), Libre-Echange, Répartition du Revenu et Migration au Maroc, *Revue d'Economie du Développement*, **1**, 27-52.

[33] Dalen, H.P. van, G. Groenewold and T. Fokkema (2005), The Effect of Remittances on Emigration Intentions in Egypt, Morocco and Turkey, *Population Studies*, **59(3)**, 375-392.

[34] Decaluwé, B., A. Martens and L. Savard (2001), La Politique Economique du Développement et les Modèles d'Equilibre Général Calculable, Les Presses de l'Université de Montréal, Montréal.

[35] Decaluwé, B., A. Lemelin, D. Bahan and N. Annabi (2005), Offre de Travail Endogène et Mobilité du Capital dans un Modèle d'Equilibre Général Calculable Birégional, *Travaux de recherche 2005-001*, Ministère des Finances du Québec, Québec.

[36] Deaton, A. and J. Muellbauer (1980), Economics and Consumer Behavior, Cambridge University Press, Cambridge.

[37] Dixit, A.K. and J.E. Stiglitz (1977), Monopolistic Competition and Optimum Product Diversity, *American Economic Review*, **67(3)**, 297-308.

[38] Docquier, F. and A. Marfouk (2004), Measuring the International Mobility of Skilled Workers (1990-2000) - Release 1.0, *Policy Research Working Paper Series 3381*, The World Bank, Washington D.C.

[39] Drinkwater, S., P. Levine, E. Lotti and J. Pearlman (2003), The Economic Impact of Migration: A Survey, *Department of Economics Discussion Papers 103*, University of Surrey, United Kingdom.

[40] Erf, R. van der and L. Heering (2002), Moroccan Migration Dynamics: Prospects for the Future, *IOM Migration Research Series No.10*, International Organisation for Migration, Geneva.

[41] Escribano, G. and A. Lorca (2003), La Politique Commerciale du Maroc: Entre Libéralisation et Modernisation, *mimeo*.

[42] Faini, R. (2002), Migration, Remittances and Growth, paper presented at the Conference on Poverty, International Migration and Asylum, Helsinki, September 27-28.

[43] Faini, R. (2007), Remittances and the Brain Drain: Do More Skilled Migrants Remit More?, *The World Bank Economic Review*, **21(2)**, 177-191.

[44] Faini, R. and J. de Melo (1995), Trade Liberalization, Employment and Migration. Some Simulations for Morocco, *CEPR Discussion Paper Series No. 1198*, Centre for Economic Policy Research, London.

[45] Faini, R., J. de Melo and K. Zimmermann (1999) eds., Migration: The Controversies and the Evidence, Cambridge University Press, Cambridge.

[46] Femise Research Project (2004), A Favourable Macro-economic Environment, Innovative Financial Instruments and International Partnership to Channel Workers' Remittances Towards the Promotion of Local Development. Two Case Studies in Morocco and Tunisia, *Research N.FEM-21-08*, directed by Bruno Amoroso, Federico Caffè Center - Dept. of Social Sciences, Roskilde University, Denmark.

[47] Gasiorek, M., A. Smith and A. Venables (1992), Trade and Welfare, A General Equilibrium Model, *CEPR Discussion Paper 672*.

[48] Glytsos, N.P. (1993), Measuring the Income Effects of Migrant Remittances: A Methodological Approach Applied to Greece, *Economic Development and Cultural Change*, **42(1)**, 131-168.

[49] Glytsos, N.P. and L.T. Katseli (2006), Greek Migration: The Two Faces of Janus, in K. Zimmermann (ed.), European Migration: What Do We Know?, Oxford University Press, Oxford, pp.337-388.

[50] Haas, H. de (2003), Migration and Development in Southern Morocco. The Disparate Socio-Economic Impacts of Out-Migration on the Todgha Oasis Valley, Unpublished PhD Thesis, Radboud University, Nijmegen.

[51] Haas, H. de (2006), Migration, Remittances and Regional Development in Southern Morocco, *Geoforum*, **37(4)**, 565-580.

[52] Haas, H. de (2007), The Impact of International Migration on Social and Economic Development in Moroccan Sending Regions: a Review of the Empirical Literature, *Working paper 3*, International Migration Institute, University of Oxford.

[53] Hamdouch, B. (2000), Les Marocains Résidant à l'Etranger, une Enquête Socioéconomique, INSEA, Rabat.

[54] Hamdouch, B. (2005), Les Effets Economiques de la Migration Internationale au Maroc, Fondation Friedrich Ebert, Rabat.

[55] Hanoch (1965), The "Backward-Bending" Supply of Labour, *The Journal of Political Economy*, **73**, 635-642.

[56] Harris, R. (1984), Applied General Equilibrium Analysis of Small Open Economies with Scale Economies and Imperfect Competition, *American Economic Review*, **74(5)**, 1016-1032.

[57] Harrison, G.W., T.F. Rutherford, D.G. Tarr and A. Gurgel (2003), Trade policy and poverty reduction in Brazil, *mimeo*.

[58] Head, K. and J. Ries (1998), Immigration and Trade Creation: Econometric Evidence from Canada, *Canadian Journal of Economics*, **31(1)**, 47-62.

[59] Hildebrandt, N. and D. McKenzie (2004), The Effects of Migration on Child Health in Mexico, Economia, forthcoming.

[60] Hill, J. and J. Méndez (1984) The Effect of Commercial Policy on International Migration Flows: The Case of the US and Mexico, *Journal of International Economics*, **17**, 41-53.

[61] IOM, World Migration 2008, International Organisation for Migration, Geneva.

[62] Karam, F. (2008), When Migrant Remittances Are Not Everlasting, How Can Morocco Make Up?, *CES Working Papers 2008.81*, Paris School of Economics, University of Paris 1.

[63] Karam, F. and B. Decaluwé (2006), Une Analyse des Effets de la Libéralisation Commerciale sous des Hypothèses Alternatives d'un MEGC, *mimeo*.

[64] Karam, F. and B. Decaluwé (2008), Migration Impact on Moroccan Unemployment: a Static Computable General Equilibrium Analysis, *CES Working Papers 2008.52*, Paris School of Economics, University of Paris 1.

[65] Katseli, L.T., R.E.B. Lucas and T. Xenogiani (2006), Effects of Migration on Sending Countries: What Do We Know?, *OECD Development Center Working Paper No.250*, OECD, Paris.

[66] Lahlou, M. (2003), Le Maghreb et les Migrations des Africains du Sud du Sahara, présenté lors du colloque "Entre mondialisation et protection des droits - Dynamiques migratoires marocaines : histoire, économie, politique et culture", Casablanca, 13, 14 et 15 Juin.

[67] Lazaar, M. (1987), International Migration and its Consequences in the Central Rif (Morocco), *European Review of International Migration*, **3**, 3, 97-114.

[68] Lazaar, M. (1989), La Migration Internationale de Travail et Ses Effets sur les Campagnes du Rif, *mimeo*.

[69] Lluch, C. (1973), The Extended Linear Expenditure System, *European Economic Review*, **4**, 21-32.

[70] Lopez, R. and M. Schiff (1998), Migration and the Skill Composition of the Labor Force: The Impact of Trade Liberalization in LDCs, *Canadian Journal of Economics*, **31(2)**, 318-336.

[71] Löfgren, H., M. El-Said and S. Robinson (1999), Trade Liberalization and Complementary Domestic Policies: A Rural-Urban General Equilibrium Analysis of Morocco, *TMD Discussion Paper No.41*, International Food Policy Research Institute, Washington D.C.

[72] Löfgren, H., R.L. Harris, and S. Robinson (2002), A Standard Computable General Equilibrium (CGE) Model in GAMS, International Food Policy Research Institute, Washington D.C.

[73] Lucas, R.E.B. (1987), Emigration to South Africa's Mines, *American Economic Review*, **77**, 313-330.

[74] Lucas, R.E.B. (2005a), International Migration and Economic Development: Lessons from Low-Income Countries, Edward Elgar in association with the Expert Group on Development Issues, Swedish Ministry for Foreign Affairs, Cheltenham, UK and Northampton, MA, USA.

[75] Lucas, R.E.B. (2005b), International Migration: Lessons from Recent Data, Presentation in the Migration Seminar Series, the World Bank. Washington D.C., 8 March.

[76] McKenzie, D.J. (2005), Beyond Remittances: The Effects of Migration on Mexican Households, in Schiff, M. and Ç. Özden (eds.), International Migration, Remittances, and the Brain Drain, the World Bank, Washington, D.C.

[77] McKenzie, D. and H. Rapoport (2005), Migration Incentives, Migration Networks and the Dynamics of Education Inequality in Rural Mexico, presented at the "Economic Integration, Remittances, and Development" Conference, Inter-American Development Bank, Washington, DC.

[78] Melchor del Rio A. and S. Thorwarth (2006), Tomatoes or Tomato Pickers? - Free Trade and Migration in the NAFTA Case, *Discussion Paper Series No. 429*, University of Heidelberg, Department of Economics.

[79] Melo, J. de and S. Robinson (1990), Productivity and Externalities: Models of Export-Led Growth, *Working paper 387*, The World Bank, Washington D.C.

[80] Melo, J. de and D. Tarr (1992), A General Equilibrium Analysis of US Foreign Trade Policy, The MIT Press.

[81] Mercenier, J. (1992), Completing the European Market: A General Equilibrium Evaluation Under Alternative Market Structure Assumptions, *Cahiers du CRDE 0892*, Université de Montréal, Montréal.

[82] Mountford, A. (1997), Can a Brain Drain be Good for Growth in the Source Economy?, *Journal of Development Economics*, **53**, 287-303.

[83] Mundell, R.A. (1957), International Trade and Factor Mobility, *American Economic Review*, **47**, 321-335.

[84] Nicita, A. and M. Olarreaga (2001), Trade and production, 1976-99, *Policy Research Working Paper Series 2701*, The World Bank, Washington D.C.

[85] Nyberg-Sorensen, N. (2004), Migrant Remittances as a Development Tool: The Case of Morocco, *IOM Migration Research Series No.2*, International Organisation for Migration, Geneva.

[86] OECD, International Migration Outlook, Annual Report, 2006 Edition, Organisation for Economic Co-operation and Development, Paris.

[87] Pieke, F.N., N. van Hear and A. Lindley (2005), Synthesis Study. A Part of the Report on Informal Remittance Systems in Africa, Caribbean and Pacific (ACP) Countries, commissioned by DFID, EC-PREP, Deloitte and Touche, COMPAS, University of Oxford, Oxford.

[88] Ratha, D. (2005), Workers' Remittances: An Important and Stable Source of External Development Finance in S.M. Maimbo and D. Ratha (eds.), Remittances. Development Impact and Future Prospects, the World Bank, Washington DC, pp. 19-52.

[89] Ratha, D. and W. Shaw (2007), South-South Migration and Remittances, *World Bank Working Paper Series no. 102*, The World Bank, Washington D.C.

[90] Robinson, S., M.E. Burfisher, R. Hinojosa-Ojeda and K.E. Thierfelder (1993), Agricultural Policies and Migration in a U.S.-Mexico Free Trade Area: A Computable General Equilibrium Analysis, *Journal of Policy Modeling*, **15(5-6)**, 673-701.

[91] Rodrigo, G.C. and E. Thorbecke (1997), Sources of Growth: A Reconsideration and General Equilibrium Application to Indonesia, *World Development*, **25(10)**, 1609-1625.

[92] Rodriguez, E. (1998), International Migration and Income Distribution in the Philippines, *Economic Development and Cultural Change*, **46(2)**, 329-350.

[93] Royaume du Maroc, Activité, Emploi et Chômage en 1999, Rapport de synthèse, Direction de la Statistique, Rabat.

[94] Royaume du Maroc (2001), Nomenclature Analytique des Professions, Direction de la Statistique, Rabat.

[95] Royaume du Maroc, Enquête Nationale sur la Consommation et les Dépenses des Ménages 2000/2001 Rapport de synthèse, Direction de la Statistique, Rabat.

[96] Royaume du Maroc (2003), Activité, Emploi et Chômage, Premiers Résultats, Direction de la Statistique, Rabat.

[97] Royaume du Maroc (2005a), Activité, Emploi et Chômage, Premiers Résultats, Direction de la Statistique, Rabat.

[98] Royaume du Maroc (2005b), Evaluation du Climat de l'Investissement, Banque Mondiale et Ministère de l'Industrie et du Commerce, Rabat.

[99] Rutherford, T.F, E.E. Rutstrõm and D. Tarr (1997), Morocco's Free Trade Agreement with the EU: A Quantitative Assessment, *Economic Modelling*, **14**, 237-269.

[100] Saith, A. (1997), Emigration Pressures and Structural Change: Case on the Philippines, *International Migration Papers No. 19*, International Labour Office, Geneva.

[101] Saxenian, A.L. (1999), Silicon Valley's New Immigrant Entrepreneurs, Public Policy Institute of California, San Francisco, CA.

[102] Srinivasan, T.N. and J. Whalley (1986), General Equilibrium Trade Policy Modeling, Cambridge, Massachusetts, the MIT Press.

[103] Stark, O. and Y. Wang (2002), Inducing Human Capital Formation: Migration as a Substitute for Subsidies, *Journal of Public Economics*, **86(1)**, 29-46.

[104] Stone, J.R.N. (1954), Linear Expenditure Systems and Demand Analysis: An Application to the Pattern of British Demand, *Economic Journal*, **64**, 511-527.

[105] Taylor, J.E. and G. Dyer (2006), Migration and the Sending Economy: A Disaggregated Rural Economy Wide Analysis, *ARE Working Papers 06-002*, Department of Agricultural and Resource Economics, University of California, Davis.

[106] Taylor, J.E. and T.J. Wyatt (1996), The Shadow Value of Migrant Remittances, Income and Inequality in a Household-Farm Economy, *Journal of Development Studies*, **32(6)**, 899-912.

[107] United Nations, International Migration Report 2006: A Global Assessment.

[108] Wagner, D., K. Head and J. Ries (2002), Immigration and the Trade of Provinces, *Scottish Journal of Political Economy*, **49(5)**, 507-525.

[109] Winters, A. (2007), Introducing a Global Database on Migrant Stocks, *CEPR Discussion Paper Series No. 17*, Centre for Economic Policy Research, London.

[110] World Bank (2002), Kingdom of Morocco: Public Expenditure Review, draft, Social and Economic Development Group (MNSED), Middle East and North Africa, Washington, D.C.

[111] World Bank (2005), Global Development Finance 2005. Mobilizing Finance and Managing Vulnerability, the World Bank, Washington D.C.

[112] Yang, D. and C.A. Martinez (2006), Remittances and Poverty in Migrants' Home Areas: Evidence from the Philippines, *in International Migration, Remittances and the Brain Drain*, the World Bank, Washington D.C.

[113] Zachariah, K.C., E.T. Matthews and S. Irudaya Rajan (1999), Impact of Migration on Kerala's Economy and Society, *W*orking Paper No.297, Centre for Development Studies, Trivandrum.

[114] Zouhar, Y. (2005), Human Capital and Economic Growth in Morocco, *mimeo*.

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Résumé

L'intérêt croissant des économistes dans la migration Sud-Nord a donné au Sud le statut de pays d'émigration et au Nord le statut de pays d'immigration. Toutefois, lorsque l'on observe de près les données, on trouve que la migration Sud-Sud est aussi importante que la migration Sud-Nord. L'ampleur des migrations Sud-Sud a fait de certains pays en développement, des pays d'origine, de transit et de destination. Quant à l'impact sur le marché du travail, deux effets contradictoires peuvent être observés: d'une part, l'immigration ainsi que les migrations entre régions à l'intérieur du pays augmentent la pression sur le marché du travail local et par la suite, l'incitation à émigrer. D'autre part, l'émigration peut servir soit à augmenter les salaires, soit à réduire le chômage dans les régions d'origine, ce qui permet, de renforcer la migration interne ainsi que l'immigration. Alors que la plupart des économistes ont particulièrement négligé cet aspect, cette thèse cherche, en premier lieu, à illustrer l'interdépendance entre ces différents flux migratoires. Elle conclut que l'impact de la migration sur le marché du travail dans le pays d'origine devrait être analysé avec précaution en tenant compte des entrées et des sorties de travailleurs. Cette thèse met également l'accent sur l'investissement des transferts dans le secteur immobilier et conclut que la canalisation des transferts vers les secteurs productifs n'a pas de retombées positives sur l'économie lorsque le secteur immobilier est très intégré dans cette dernière. Elle conclut aussi que l'économie marocaine a intérêt à poursuivre ses efforts de libéralisation commerciale en vue de réduire les flux migratoires.

Mots-clés : Migration, Marché du travail, Envoi de fonds, Libre-échange, Modèle d'équilibre général calculable

Abstract

The growing interest of economists in South-North migration has given the South the status of emigration countries and the North the status of immigration countries. However, when we look closely at the data, we find that South-South migration is as important as South-North migration. The magnitude of South-South migration has made some developing countries, countries of origin, of transit and of destination. Concerning the impact on the labour market, two contradictory effects can be observed: first, immigration and migration between regions within countries increase the pressure on the local labour market and consequently, the incentive to emigrate. On the other hand, migration can increase wages or reduce unemployment in the regions of origin, that in turn, strengthens internal migration and immigration. While most economists have neglected this aspect, this thesis tries to shed the light on the interdependency between migration flows. It concludes that the impact of migration on the labour market in the country of origin should be carefully analysed by taking into account the entry and exit of workers. This thesis also focuses on the investment of remittances in real estate and concludes that channeling remittances to productive sectors has no positive impact on the economy when the real estate sector is highly integrated in the latter. It also concludes that the Moroccan economy must continue its efforts to liberalise trade in order to reduce migration flows.

Keywords : Migration, Labour market, Remittances, Free trade, Computable general equilibrium model