HAL
open science

Responses of African economies to the international economic shocks: an empirical study.

Giscard Assoumou Ella

To cite this version:

Giscard Assoumou Ella. Responses of African economies to the international economic shocks: an empirical study.. 2012. hal-00721633v1

HAL Id: hal-00721633

https://hal.science/hal-00721633v1

Preprint submitted on 29 Jul 2012 (v1), last revised 9 Nov 2012 (v2)

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

Responses of African economies to the international economic shocks: an empirical study.

G. ASSOUMOU ELLA

giscard-assoumou-ella@etud.univ-tln.fr, LEAD, Université du Sud Toulon-Var

Abstract:

The aim of this study is first, to verify the assumption of decoupling or no decoupling of African economic conjunctures and international economic shocks. We test this assumption in 15 African countries using a SVAR model for the period 1970-2007. The results suggest that there is no decoupling. 12 countries are exposed to OEDC GDP per capita shocks, six to Federal funds effective rate shocks and five to World price of oil shocks. Furthermore, we investigate the viability of an economic and monetary union creation for the African countries and a new unified currency. The impulse response functions of the African economies after an international income, monetary or price shocks tend to be in general more or less similar. According to this indicator, we are optimistic for the possibility and the viability of this project.

Keywords: African economies; international economic shocks; SVAR model

JEL classification: C32; E32; E52; F44

I. INTRODUCTION

African countries are developing countries. They produce and export essentially raw materials toward advanced and emerging economies (Madeley, 2003). Contrary to the assumption of decoupling for the economic cycles, these countries are exposed to international economic shocks. Berman and Matin (2009) argue that an international industrial crisis would have a big impact on African economies because the growth and development of these economies depend upon the export of raw materials.

For example, during the 2009 Global Financial Crisis, the "average economic growth in Africa slowed to 1%, from an annual average of over 6% to 1% over the previous five years, before rebounding to 4% in 2010", (IMF, 2010). An international economic crisis leads to a contraction in global trade. In African economies this is associated with a related collapse in primary commodity exports and a decrease in foreign direct investment, migrant worker remittances and foreign aid (CRS, 2010). We can also enumerate the import and tourism transmission channels.

Africa is composed of several regional economic communities and monetary zones. The continental politic organization, the African Union, projects to create an economic and monetary union for the African countries and a new unified currency, similar to the euro.

This paper investigates the assumption of decoupling or no decoupling of African economic conjunctures and international economic shocks. If the assumption of no decoupling is valid, we analyze the impulse response functions of any country to the three types of crises that have affected advanced economies in recent years: international monetary shocks, international price shocks and international income shocks. After these international shocks, the responses of African economies are similar, more or less similar, or not similar? This second approach investigates the viability for an economic and monetary union creation for the African countries and a new unified currency, similar to the euro.

The international economic shock impacts in Africa had been analyzed by many recent studies. Kose and Riezman (2001) studied the impact of international trade shocks in African economies modeled by the relationship between the fluctuations in the prices of exported primary commodities, of imported capital goods, of intermediate inputs, the world real interest rate and macroeconomic fluctuations in Africa. Their results suggest that "while trade shocks account for roughly 45 percent of economic fluctuations in aggregate output, financial shocks play only a minor role. Adverse trade shocks induce also prolonged recessions."

Nkomo (2006) studied the relationship between world oil price movements, energy and development on Southern African countries. His result suggests that "oil price shocks increase the total import bill for a country. Low-income countries and poorer households tend to suffer the largest impact from oil price rise".

Abuka and al. (2011) aim to show whether a monetary union between economies of the Common Market for Eastern and Southern Africa (COMESA) is viable using the responses of the countries that compose this area to the internal and external shocks. They conclude that there is a possibility of creating a monetary union in this area.

The paper is organized as followed: the section 1 presents the methodology (definition of the variables and the model specification). The sections 2 and 3 present respectively the data used in this study and the results.

II. IMPACT OF INTERNATIONAL ECONOMIC SHOCKS IN AFRICA: A SVAR MODEL

2.1. Methodology

2.1.1. The variables

Any national's VAR is a model with nine variables: three externs and six domestics. External variables represent three types of crises that have affected advanced economies in recent years:

- International monetary shocks: world interest rate is approximated by the Federal funds effective rate (Gossé and Guillumin, 2010);

- International price shocks: we use the world price of oil to characterize this type of shock (Allegret and Sand-Zantman, 2010), because African's countries product essentially raw materials (Madley, 2003);
- International income shocks: we approximate international income shock by GDP per capita in OECD countries because this indicator takes into account the population and because he "is a generic measure of economic performance and gives a fairly good indication of the magnitude of the impact of external shocks on the domestic economy" (BAD, 2009).

Domestic GDP per capita represents the endogenous variable. We use the usual determinants of economic growth in a country to characterize the control variables: education (adult literacy rate), investment, life expectancy, public spending and domestic consumer prices.

2.1.2. Model specification

Our formalization uses a SVAR model to study the impact of external shocks in domestic economy, Gossé and Guilliaumin (2010).

First, we assume that any African's economy is described by this reduced-form VAR model:

$$A(L)X_t = u_t \qquad (1)$$

Where $A(L)$ is a matrix polynomial in lag operator L, $E(u_t) = 0$, $Var(u_t) = \sigma^2$ and $X_t = (\Delta r, \Delta baril, \Delta ddgdpocde1, \Delta gdp, \Delta alph, \Delta inv, \Delta life, \Delta g, \Delta p)'$, with Δ, the first derivative, and r, baril, ddgdpocde1, gdp, inv, life, g, p represent respectively, Federal funds effective rate, world price of oil, GDP per capita in OECD, domestic GDP per capita, adult literacy rate, investment, life expectancy, public spending and domestic consumer prices.

We can rewrite the equation (1) in VMA form:

$$X_t = B(L)u_t \qquad (2)$$

With $u_t = S\varepsilon_t$, where $\varepsilon_t = (\varepsilon_t^{ext}, \varepsilon_t^{gdp}, \varepsilon_t^{alph}, \varepsilon_t^{inv}, \varepsilon_t^{life}, \varepsilon_t^{g}, \varepsilon_t^{p})'$; an orthogonal normalized innovations vector and represents the structural shocks. $\varepsilon_t^{ext}, \varepsilon_t^{alph}, \varepsilon_t^{inv}, \varepsilon_t^{life}, \varepsilon_t^{g}, \varepsilon_t^{p}$ represent respectively the external shocks, the domestic GDP per capita shock, the education shock, the investment shock, the sanitary shock, the public spending shock and the domestic consumer prices shock, satisfying $u_t = S\varepsilon_t$ and $E(\varepsilon\varepsilon') = I$, with I the identity matrix.

The consequence is that $SS' = \sum$. Using the orthogonal matrix S, we can write the VMA model with structural shocks:

$$X_t = C(L)\varepsilon_t \qquad (3)$$

Were $C(L) = B(L)S$.

If we compare the number of parameters that we must determine to identify the VAR structural model and the numbers of parameters effectively estimated in the VAR model, we

conclude that the identification of the VAR structural form conduces to impose $\frac{n(n-1)}{2}$ constraints.

We assume that the external variables are exogenous, relatively to domestic variables (Allégret and Sand-Zantman, 2007; Gimet, 2007 and McAleer and al. 2009).

2.1.3. Impact of external shocks on endogenous variable

We study the contribution of international shocks to the variance of endogenous variable using a SVAR model with an exogenous hypothesis, Mackowiak (2007). This specification improves the quality of the estimations (Sosa, 2008). We rewrite de SVAR model in this form:

$$\sum_{s=0}^{p} \begin{bmatrix} A_{11}(S) & A_{12}(S) \\ A_{21}(S) & A_{22}(S) \end{bmatrix} \begin{bmatrix} y_{1(t-s)} \\ y_{2(t-s)} \end{bmatrix} = \begin{matrix} \varepsilon_1(t) \\ \varepsilon_2(t) \end{matrix}$$

Where $A_{12} = 0$ for any $S = 0,1, \dots, \infty$, with $E[\varepsilon(t)/y_{t-s}, s > 0] = 0$ and $E[\varepsilon(t)\varepsilon(t)'/y_{t-s}, s > 0] = I$, with I the identity matrix. $y_{1(t-s)}, y_{2(t-s)}$, $\varepsilon_1(t)$ and $\varepsilon_2(t)$ represent respectively, the vector of external variables, the vector of domestic variables, the vector of structural external shocks and the vector of structural domestic shocks. We assume with Gossé and Guilliaumin (2010) that $A_{12}(S) = 0$ for any $S = 0,1, \dots, \infty$. That is to say that the domestic structural shocks do not affect $y_{1(t-s)}$ in t or in $t - s$. We also suppose that a short-term shock of any external variable do not affects any others external variables (McAleer and al. 2009).

2.2. Data characteristics

The data for this study come from the website of the World Bank. We use ADF and Fhillips-Perron tests to study the stationarity of the series, before using the short-run SVAR (there is no long-term relationship between the variables). In applying this model, the Akaike Information Criterion (AIC) is used to determine the optimal lag length. After the estimations, we perform the residual autocorrelation test (LM test), collinearity test (Wald test), and we also check the stability of the model. The model was estimated using Stata 10.0 during 1970-2007.

2.3. Results

2.3.1. International income shocks

OEDC GDP per capita shocks impact 12 African countries: Benin, South Africa, Botswana, Chad, Ghana, Kenya, Mali, Niger, Centrafrique, Senegal, Togo and Tunisia. A 1% decrease in OEDC GDP per capita affects each country from -0.23 to -0.09 %. Inversely a 1% increase affects each country from 0.1 to 0.16%.

Let us analyze the impulse response functions. Appendix 2.1 presents the summary of impulse response functions of the endogenous variable to positive OEDC GDP per capita shocks. The graphs indicate in general that the responses seem to be more or less similar except for the Chad and Ghana. Positive OEDC GDP per capita shock has initially a positive effect on GDP per capita in each country but after one period it becomes negative and dies out after 4 or 5 years.

2.3.2. International monetary shocks

Federal funds effective rate shocks impact six African countries: South Africa, Chad, Centrafrique, Kenya, Mali and Senegal. A 1% decrease in federal funds effective rate affects each country from 4.2 to 8.04%. Inversely a 1% increase affects their GDP per capita from -0.66 to -0.46 %, except for South Africa and Kenya for which, a decrease in federal funds effective rate has a negative impact on their GDP per capita, and inversely.

Appendix 2.2 presents the summary of impulse response functions. A positive Federal funds effective rate shock has initially a positive effect on GDP per capita in South Africa and Kenya. This impact becomes negative after 3 years in South Africa and after 4 years in Kenya and dies out. In Mali, a positive Federal funds effective rate shock has initially a negative effect on GDP per capita during the first year, and a positive effect in the second year, a negative in the third year, and dies out after 4 years. The impulse response functions of Chad, Centrafrique and Senegal are more or less similar with the Kenya and South Africa's impulse response functions.

2.3.3. International price shocks

World price of oil shocks impact five African countries: South Africa, Algeria, Congo, Nigeria and Tunisia. Excepting South Africa, all the others countries are oil producers. A 1% decrease in world price of oil affects each country from -0.99% to -0.7. Inversely a 1% increase affects each country from 0.01 to 0.12%, excepting Tunisia for which, a 1% decrease in world price of oil impacts its GDP per capita of 9.94% and a 1% increase of -0.004%.

Appendix 2.3 presents the summary of impulse response functions. Positive world price of oil shock has initially a positive effect on GDP per capita but after one year it becomes negative

and dies in general after 2 years, excepting Tunisia for which a positive word price of oil shock has a negative impact and dies after 5 years.

III. CONCLUSION

The contribution of this study is first to verify the decoupling or no decoupling of African economic conjunctures and international economic shocks. The response is that: there is no decoupling. We have estimated our SVAR model in 15 African countries.12 countries are exposed to OEDC GDP per capita shocks, six to Federal funds effective rate shocks and five to World price of oil shocks. Second, the impulse responses functions of the African economies to OEDC GDP per capita shocks seem to be more or less similar. In general, the effect is first positive, becomes negative after one year, and dies out. Concerning the Federal funds effective rate shocks, five countries are approximately the same response, and four in the case of the World price of oil shocks. According to the response of any African economy to International income, monetary and price shocks, we conclude that: there is a possibility for African Union to create an economic and monetary union for the African countries and a new unified currency, similar to the euro.

References:

Abuka, C., Apaa-Okello J., Njoroge, L. K. and Opolot, J. (2011): "Nature and Extent of Shocks in COMESA: Implications for a Monetary Union", Interdisciplinary Journal of Research in Business, vol.1, pp. 23-46.

African Development Bank (2009): "Impact of High Oil Prices on African Economics", working paper.

Allegret, J-P and Sand-Zantman, A. (2010): "Processus d'intégration et coordination des politiques macroéconomiques dans le MERCOSUR: une approche en termes de cycles", L'actualité économique, Revue d'analyse économique, vol.86, n°2.

Berman N. and Martin, P. (2009): "The vulnerability of sub-Sahara Africa to the financial crisis: the case of trade", Conference on financial markets, adverse shocks and policy responses in fragile countries, Accra, Ghana, May.

Congressional Research Service (2010): "The Global Economic Crisis: Impact on Sub-Saharan Africa and Global Policy Responses", working paper prepared for members and Committees of Congress, April.

Gimet, C. (2007): "L'impact des chocs externes dans les économies du Mercosur: un modèle VAR structurel", Economie Internationale, 110, pp.107-136.

Gossé, J-B and Guillaumin, C. (2010): “L’impact des chocs externes sur et dans la zone euro: un modèle VAR structurel”, Document de travail du Centre d’économie de l’Université Paris Nord N°08.

International Monetary Fund (2010): “The implications of the global financial crisis for low-income countries”, Washington, March.

Kose, M., A. and Riezman, R. (2001): “Trade shocks and Macroeconomic Fluctuations in Africa”, Journal of Development Economics, vol.65, pages: 55-80.

Madley, J. (2003): “Transnational Corporations and Developing Countries: big Business, Poor peoples”, the ACP-EU Courier, (196): 36-38.

Mackowiak, B. (2007): “External shocks, U.S. monetary policy and macroeconomic fluctuation in emerging markets”, Jounal of Monetary Economics, vol.54, pp.2512-2520.

Nkomo, J-C (2006): “The Impact of higher oil prices on Southern African countries”, Journal of Energy in Southern Africa, Vol. 17 N°1.

McAleer, M., Sato, K. and Zhang, Z. (2011): “Identifying Shocks in Regionally Integrated East Asian Economics with Structural VAR and Block Exogeneity”, Journal Mathematics and Computers in Simulation, Volume 81 Issue 7, March, pages 1353-1364.

Sosa, S. (2008): “External Shocks and Business Cycle Fluctuations in Mexico: How Impact are U.S. Factors?, IMF working paper 08/100.

Appendix:

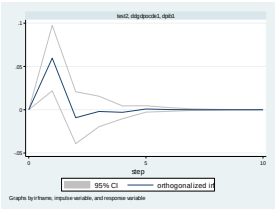
Appendix 1: Model estimations (Benin, Congo, South Africa, Algeria, Botswana, Chad, Ghana, Kenya, Mali, Niger, Nigeria, Centrafrique, Senegal, Togo and Tunisia)

ddgdpocde1	dbaril	dfed	alph	life	inv	g	p
-0.14^{***}	0.14	1.39	0.01	0.02^{*}	-9.28^{*}	0.06	3.11^{***}
-0.05	-0.99^{***}	-2.64	-0.00	-0.003	0.37	0.41^{**}	-1.23
-0.13^{***}	-0.7^{***}	-3.81^{*}	0.001	-0.002	-0.1	1.76^{***}	0.02
-0.1	-0.76^{***}	-2.59	-0.03^{***}	0.11	0.03^{***}	-0.17	0.48
-0.21^{***}	-0.2	-3.1	-0.03	0.15	0.05	-0.002	-0.48
-0.08^{*}	0.19	4.5^{***}	0.09	-0.66^{*}	0.008	-0.05^{***}	-2.43^{**}
-0.19^{***}	0.4	-3.29	-0.03	-0.04	-0.03^{***}	-0.28^{**}	-0.5
-0.15^{**}	-0.33	-5.43^{***}	-0.01	0.13^{**}	-0.07	1.51	-0.001
-0.13^{***}	-0.18	4.38^{**}	-0.13^{***}	-0.02^{*}	0.12	0.13	2.21^{***}
-0.23^{***}	0.53	1.56	-0.05	-0.004	-0.98	0.46^{***}	-1.5
-0.4	-0.84^{***}	0.66	-0.006	-0.14	-0.013	0.68^{***}	0.87
-0.14^{***}	0.04	5.55^{***}	-0.005	-0.13	0.02	0.17	-0.66
-0.18^{***}	8.03^{***}	-0.024	0.012	0.16	-0.002	0.13	5.04^{***}
-0.23^{***}	-0.03	1.25	-0.003	0.17	-0.01	0.77^{***}	-1.66
-0.41^{***}	-0.85	9.95^{**}	0.004	0.32^{***}	-0.13	0.021	0.003

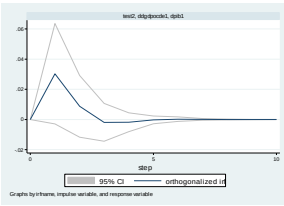
Appendix 2: Impulse response functions

Appendix 2.1: International income shocks

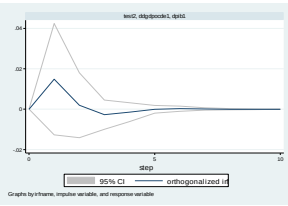
Benin



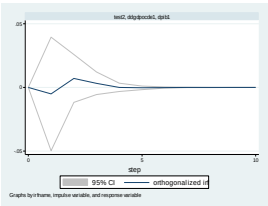
South Africa



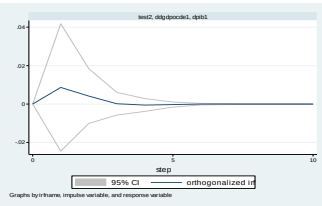
Botswana



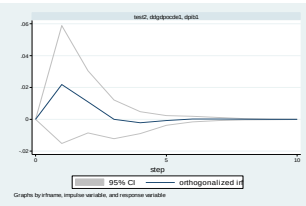
Ghana



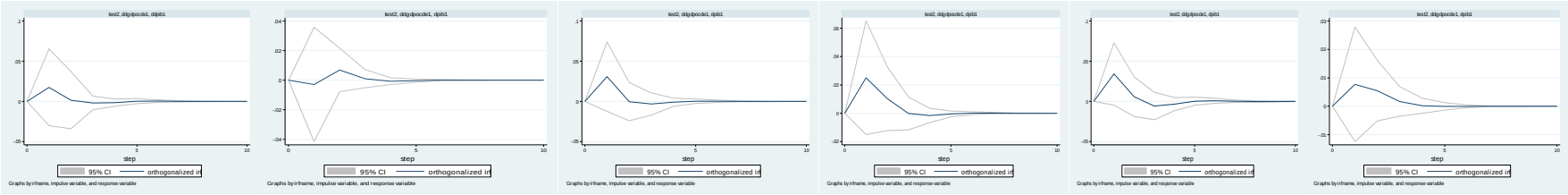
Niger



Togo

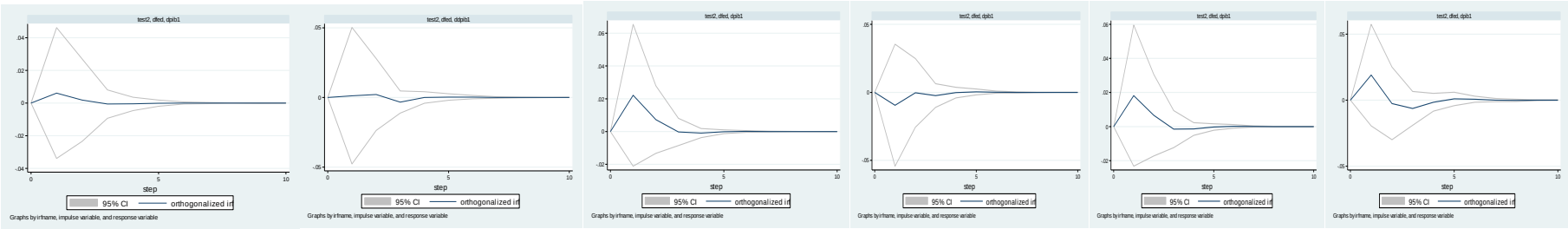


Chad Kenya Mali Centrafrique Senegal Tunisia



Appendix 2.2: International monetary shocks

South Africa Chad Kenya Mali Centrafrique Senegal



Appendix 2.3: International price shocks

Congo South Africa Algeria Nigeria Tunisia