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International Public Capital Flows

Ly Dai Hung*

December 30, 2020

Abstract

We analyze the international public capital flows by exploring the sovereign debt rating, a proxy for the safety of safe assets, on a cross-section sample of 132 advanced and developing economies. A higher sovereign debt rating is associated with less net public capital inflows, which are attributed to the decrease of grants inflows, net official debts inflows and IMF credit flows. Moreover, a higher productivity growth rate is associated with more foreign reserves for low sovereign debt rating but with less foreign reserves for high sovereign debt rating. Therefore, the net public capital inflows, especially the foreign reserves, builds up a buffer stock for the economy with low sovereign debt rating to insure against future uncertainty. The result is robust for instrument variable (IV) regression.

Keywords: Public Capital Flows, Sovereign Debt Rating, Productivity Growth, Allocation Puzzle, Instrument Variable Regression.

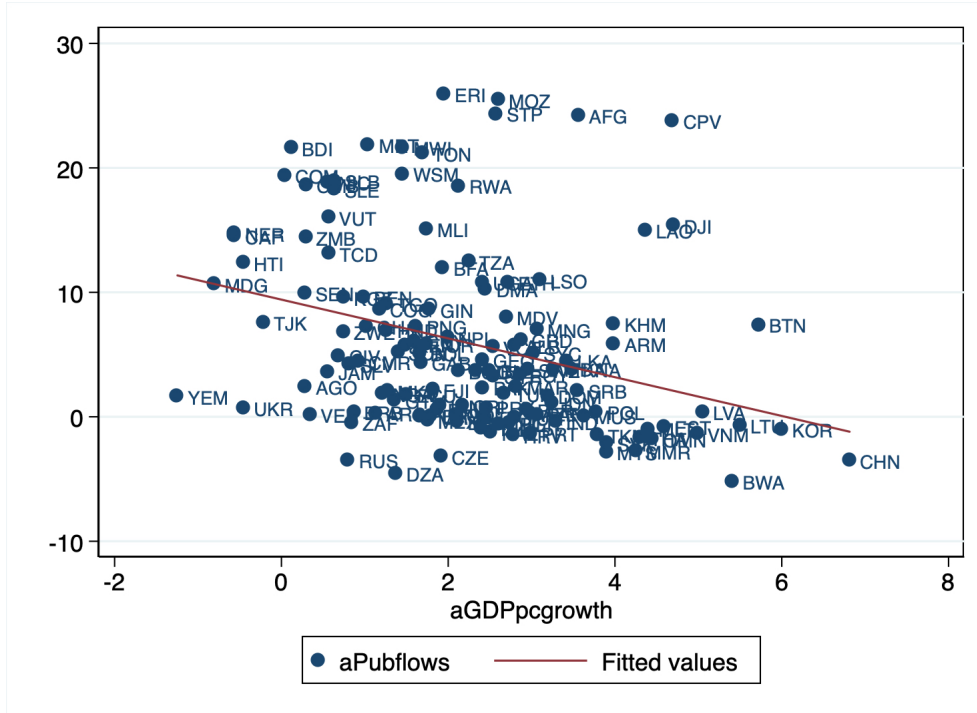
JEL classification: F21, F36, F41.

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1 Introduction.

The recent financial globalization on last decades is featured by the intensity of cross-border public capital flows. This type of capital flows consists the official public debts, foreign reserves, grants and credit by International Monetary Fund (IMF). By definition, the public flows are purely based on the net exchange of assets from sovereign to sovereign. Over the period 1980-2013, the net public capital inflows form about 6% of GDP on average over time for an economy. This faction is much greater than 0.33% of GDP constituted by net private capital inflows, which accounts for the participation of private sector.

Figure 1: International Public Capital Flows



The pattern of public capital flows opens a research gap on the cross-border capital flows. On a sample of developing economies, Gourinchas and Jeanne (2013) establish that there exists an allocation puzzle: an economy which grows faster tends to accumulate less public capi-

tal inflows. This result is also confirmed by Alfaro, Kalemli-Ozcan and Volosovych (2014) for a larger sample of both advanced and developing economies. Figure (1) illustrates the allocation puzzle: a higher productivity growth rate is associated with less net public capital inflows.

We fill in the research gap by an explanation for the pattern of international public capital flows. First, we approach the public capital flows as a collection of mostly safe assets. Each component of public capital flows has constant rate of return: the official public debts have interest rate at time of being issued, the foreign reserves together with grants and IMF credit have zero interest rate. According to Caballero, Farhi and Gourinchas (2017), these components are safe assets, since their interest rate are insensitive to uncertainty. This feature suggests that the characteristic of safe assets can be crucial to account for the pattern of cross-border public capital flows.

We employ the sovereign debts rating to be proxy for the safety of safe assets. The empirical evidence on a cross-section data sample of 132 economies shows that a higher sovereign debts rating is associated with a reduction of net public capital inflows, which is attributed to the decrease of grants inflows, net official debts inflows and IMF credit flows. A higher productivity growth rate is associated with more foreign reserves for economy with low sovereign debts rating but with less foreign reserves for economy with high sovereign debts rating. Therefore, the net public capital inflows, especially the foreign reserves, constitutes a buffer stock for the economy with low sovereign debts rating to insure against future uncertainty.

The paper belongs to the literature on the cross-border capital flows (a recent survey on Gourinchas and Rey (2014)). On a seminal paper,

Lucas raises a paradox that the capital does not flow from rich to compensate for the scarcity of capital stock on the poor economy (Lucas (1990)). Recent empirical evidence also records that the capital even does not flows as the prediction of neoclassical growth model. Prasad, Rajan and Subramanian (2007) show that the capital flows from developing economies with high economic growth rate to advanced economies with low growth rate. They label this phenomenon as up-hill capital flows. There are various answers for this phenomenon. The capital flows to advance economies since these economies have a higher long-run capital accumulation level, then a huger investment (Matsuyama (2004)), a higher financial development level with less tight credit constraint (Coeurdacier, Guibaud and Jin (2015)), higher marginal product of capital (Hung (2020b)) or more supply of financial assets (Caballero, Farhi and Gourinchas (2008)).

These aforementioned papers account for the net total capital inflows, leaving aside their components: public and private capital flows. Our paper, however, focus on the net public capital flows. First, we consider the flows of public capital to be similar to the flows of safe assets across countries. Then, we emphasize the safety of safe assets as a key determinant of the pattern of public capital flows. Second, we compare the pattern of public capital flows with that of private capital flows, and investigate their components such as the official public debts and the foreign reserves.

The current paper is also relevant to the literature on safe assets. The safety of safe assets is attributed to the debt capacity and macroeconomic fundamental (He, Krishnamurthy and Milbradt (2019)). It is also based on the supply of assets: an asset is safe only if its issued

quantity is appropriate (Farhi and Maggiori (2018)). And the optimal quantity of safe assets is determined by the income per capita (Hung (2020a)). Moreover, the safe assets can constitute on the financial crisis by building up the global liquidity of assets (Geithner (2007)). And the scarcity of safe assets can result on a safety trap on which the monetary policy is ineffective (Caballero and Farhi (2018)). At the financial integration, the safety trap in the world supplier of safe assets can spread a stagnation to the rest of world by causing an endogenous reduction of world aggregate demand (Caballero, Farhi and Gourinchas (2017)).

Our paper focuses on the role of safety of assets on shaping the pattern of international capital flows, while they focus on the role of supply of safe assets. We show that the safety of public debts, a type of safe assets, underlines the building up of buffer stock, then, underlines the pattern of cross-border capital flows.

Finally, our paper sheds a new light on the literature on the foreign reserves flows. According to theory developed by Jeanne and Ranciere (2011), the foreign reserves are used to insure against sudden stop of capital flows. For the emerging market in Asia, the buildup of reserves can be explained by a large anticipated output cost of sudden stops and a high level of risk aversion. And the sudden stop risk together with the financial globalization can account for the surge in the foreign reserves, as established by Durdu, Mendoza and Terrones (2009). Recently, Hur and Kondo (2016) prove that the accumulation of large foreign reserves in the emerging economies is an optimal response to the increase in foreign debt rollover risk. Gourinchas and Jeanne (2013) even show that there exists an allocation puzzle of foreign reserves: a higher productivity growth rate goes along with a huger foreign reserves accumulation.

Our paper provides an explanation for the allocation puzzle of foreign reserves. A greater foreign reserves accumulation is associated with a higher productivity growth only for the economy with low sovereign debt rating. On other words, for the economy with high sovereign debt rating, or low sovereign risk, there does not exit the allocation puzzle.

The paper processes as follows. Section (2) lays the analysis framework. Next, section (3) presents the empirical evidence on the fundamentals of public safe assets. Finally, section (4) concludes and is followed by Appendix.

2 Estimation.

We first present the theoretical motivation underlining the choice of variables. Then, we describe the data and empirical model to investigate the pattern of public capital flows.

2.1 Theoretical Motivation.

The literature on international capital flows records that the net total capital inflows are determined by the productivity growth rate (Solow (1956)), since a high growth rate raises the marginal product of capital, then attracts more net capital inflows. Another determinant of capital flows is the institutional quality (Alfaro, Kalemli-Ozcan, and Volosovych (2008)) and the macroeconomic fundamentals, which also underline the marginal product of capital (Fratzscher (2012)). As a type of capital flows, the pattern of public capital flows are also affected by these factors. Moreover, according to Eaton (1989), each components of public capital flows can be driven by different factor: the official public debts

are shaped by the sovereign risk and the grants are determined by the aid for development.

The literature on safe assets states that the safe assets determines the pattern of international capital flows (Bernanke, Bertaut, Demarco and Kamin (2011)). The capital flows from the economy with scarcity of safe assets to the economy with abundance of safe assets (Caballero, Farhi and Gourinchas (2008)) in seeking a store of wealth. Recently, Caballero, Farhi and Gourinchas (2017) shows that the scarcity of safe assets can result in a safety trap in which the monetary policy is ineffective. Then, if the world main supplier of safe asset is on safety trap, the world economy can fall into the secular stagnation. Furthermore, the supply of safe assets also constitutes the liquidity of global financial market. Then, a higher supply, such as creation of an European Safe Bonds (ESBies) in the euro-area context can solve the issue of cross-border flight-to-safety capital flows (Brunnermeier et al (2016)).

For the analysis strategy, we focus on the role of safe assets on shaping the pattern of international capital flows. In particular, Caballero, Farhi and Gourinchas (2017) define the safe assets as the assets with rate of return which is insensitive to uncertainty. By this definition, the public debts belongs to the safe assets since they have a constant interest rate known at time of being issued by the government. For the data, we use the sovereign debts rating to proxy for the safety of public debts. Then, we employ the interaction of sovereign debts rating with the productivity growth rate to account for the cross-border capital flows.

For the choice of variable, the theory suggests a list of potential independent variables. In details, the sovereign debts rating can affect the pattern of public capital flows through various channels: the market ac-

cess (such as grants flows), the sovereign solvency (such as IMF credit), the repayment commitment (such as official debts), the insurance motive by buffer stock (such as foreign reserves), and the profit seeking motivation as the net total capital inflows. Moreover, other variables also have potential impact on the public capital flows. The productivity growth rate determines the sovereign solvency of official public debts and also the insurance motivation underlining the foreign reserves accumulation. The macroeconomic fundamentals also exert an impact on the solvency of sovereign debts, then the IMF credits, and also on the market access, then, affects the grants flows. The institutional quality affects the public capital flows through the market access and the sovereign solvency. In brief, our approach builds up a bridge to connect the literature on the safe assets with that on the cross-border capital flows.

2.2 Data Description.

The data set is a cross-section sample of about 132 economies. The value of each variable is averaged over 1980-2013.

The net public capital inflows ($aPubflows$) are on percentage of gross domestic products (GDP), which comes from a panel dataset on net private and public capital flows constructed by Alfaro, Kalemli-Ozcan and Volosovych (2014). The panel includes a number of countries, both developing and advanced, and spans the period from 1980 to 2013.

The net public capital inflows can be decomposed into different components, including grants flows ($aGraflows$), officially public debts ($aOfftflows$), IMF credit ($aImffflows$), subtracting by foreign reserves accumulation ($aResflows$). We have following formulas for each

time period (t):

$$Pubflows = Graflows + Offtflows + Imfflows - Resflows$$

The sovereign debts rating, denoted by ($asovrate$), is from World Bank Cross-Country Database of Fiscal Space. The data, which is constructed by Kose, Kurlat, Ohnsorge and Sugawara (2017), covers up to 200 countries over period 1960-2016. The sovereign debt rating index is ranged from 1 to 21, and a greater index means safer. It illustrates the market perception on a country's ability to roll over debt, or to issue new debt, and on its market cost of borrowing. The index is an annual average of sovereign debt ratings by Moody's, Standard & Poor's and Fitch Ratings on a daily frequency.

Moreover, the supply of public debts is measured by the general government gross debt stock per GDP, denoted by ($aggdy$). The variable is from World Bank Cross-Country Database of Fiscal Space database. This measure of debt rules out the country-size effect by scaling the value of debt by national income.

For the macroeconomic fundamentals and institutional quality, the net productivity growth rate ($aGDPpcgrowth$) is measured by net growth of output per capita. The data is from the World Development Indicators. In the neoclassical growth model (Solow (1956)), the long-run growth rate of per capita output is equal to the total factor productivity growth rate. Moreover, the institutional quality, denoted by ($aLaw$), is the rule of law index. The data is from the institutional quality dataset constructed by Kunčič (2014). And the inflation rate, denoted by ($acpi$), is the annual Consumer Price Index (CPI). The variable is from World Development Indicators database.

Table 1: Descriptive Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Net public capital inflows (<i>aPubflows</i>)	132	6.201351	7.999069	-5.21225	38.65173
Net private capital inflows (<i>aPrivflows</i>)	132	-.3376523	6.348411	-15.76761	14.11783
Sovereign debts rating (<i>aSovrate</i>)	98	9.511576	3.065138	5.173059	16.36776
Productivity growth (<i>aGDPpcgrowth</i>)	132	2.211025	1.516071	-1.246613	6.813113
Inflation rate (<i>aCpi</i>)	127	28.78075	60.35748	1.073233	394.6283
Law quality (<i>aLaw</i>)	132	-.3735781	.710221	-1.713173	1.37063
Supply of public debts (<i>aGgdyS</i>)	131	9.76e-07	30.2061	-48.5572	144.1504

Table (1) illustrates the descriptive statistics for the data sample. Each variable is on ratio of two nominal values, then, are on real values. The net public capital inflows have mean at (6.2%) and a standard deviation at (7.9%). The net private capital inflows have a lower mean (-0.33%) and lower standard deviation (6.3%). In comparison with the public flows, the sovereign debt rating has a higher mean (9.5) but a lower deviation (3.96) while the productivity growth rate has a much lower mean (2.21) and a less deviation (1.51). Other variables also exhibit a quite large standard deviation. In short, the data sample offers a rich variation to investigate the international public capital flows.

2.3 Empirical Model.

We employ the cross section regression to analyze the cross-border public capital flows. The method focuses on the long-run equilibrium, since a long-period (nearly 40 years on the data sample) can absorb the macroeconomic fluctuation over time. The strategy is also employed by Gourinchas and Jeanne (2013) and Alfaro, Kalemli-Ozcan and Volosovych (2014) to study the international capital flows.

The empirical specification captures the determinants of public capital flows. Our main model is based on the ordinary-least-square (OLS) regression. The key feature of the empirical model is the interaction term between the sovereign debts rating and the productivity growth. This term measures how the safety of safe assets can shape the dependence pattern of net public capital inflows on the productivity growth rate. Other unobserved factors are included into the error term (u^j).

$$aPubflows^j = \alpha + \beta^{sovrte} aSovrate^j + \beta^{growth} aGDPpcgrowth^j + \beta^{inter} aSovrate^j * aGDPpcgrowth^j + \beta^{cpi} aCpi^j + \beta^{law} aLaw^j + u^j$$

The expected sign of coefficient is determined by the literature on the capital flows. (β^{growth}) measures the impact of productivity growth rate on the public capital inflows. The neoclassical growth model (Solow (1956)), a higher growth rate raises the net capital inflows, including both public and private flows. Thus, the coefficient is expected to be positive: ($\beta^{growth} > 0$). And (β^{sovrte}) measures the impact of sovereign debt rating on the net public capital inflows. Moreover, (β^{inter}) measures the jointed impact of sovereign debts and productivity growth on the public capital flows. The sign of these two coefficients are undermined.

Furthermore, we also employ the instrument variable (IV) method on analyzing the public capital inflows. This method solves a potential reverse causality on the regression of net public capital inflows on the sovereign debts ratings. The net total capital inflows, including both public and private one, is a component of balance of payment. Then, it contributes on the stability of macroeconomic environment of an economy, which, in turn, can affect the market perception on the sovereign

debt rating. Thus, the potential reverse causality can exist, and then, raise the endogeneity on the OLS analysis of public capital flows.

In order to carry out the IV regression, we use the supply of public debts as an instrument variable for the sovereign debts rating. On the theory, He, Krishnamurthy and Milbradt (2019) prove that the safety of public debt improves for a huger debt capacity. Thus, the variable satisfies the strong first stage. Moreover, on the data, the public debt safety does not affect the pattern of public capital flows. Thus, the variable also satisfies the exclusion requirement.

3 Evidence.

3.1 International Public Capital Flows.

Table (2) shows the regression results of net public and private capital inflows on the sovereign debts rating and productivity growth rate.

The first two columns focus on the sovereign debts rating. The negative coefficient of ($\beta^{Sovrate} = -1.26$) on Column (1) proves that an economy with a lower sovereign debt rating also tends to accumulate more public capital inflows. Thus, the net public capital inflows are important for economy with a low sovereign debt rating. The result indicates that the net inflows of public capital can be used to compensate for lower sovereign debt rating. An explanation for this result can rely on the fact that an economy with a low debt rating also has a high sovereign risk. Then, its ability to access the international capital market is also limited. On that case, it can accumulate public capital inflows to insure against the future uncertainty. Overall, since the public capital flows comprise mostly the flows of safe assets, which can be used as a store of

wealth, the accumulation of public capital flows can builds up a buffer stock for an economy with low sovereign debt rating to insure against the future uncertainty. Thus, the insurance motivation can underline the net public capital inflows. Moreover, the positive coefficient ($\beta^{Sovrate} = 0.53$) on Column (2) proves that the economy with a higher debts rating tends to receive more net private capital inflows. Thus, the private capital flows are important for economy with high sovereign debt rating. In sum, an improvement of sovereign debts rating is associated with a reduction of net public capital inflows but an increase of net private capital inflows.

Table 2: Regression Results of Net Public and Private Capital Inflows on Sovereign Debts Rating and Productivity Growth Rate

VARIABLES	(1) aPubflows	(2) aPrivflows	(3) aPubflows	(4) aPrivflows	(5) aPubflows	(6) aPrivflows
Sovereign Debts Rating (<i>aSovrate</i>)	-1.260*** (0.157)	0.538*** (0.169)			-1.308*** (0.188)	0.367* (0.200)
Productivity Growth Rate (<i>aGDPpcgrowth</i>)			-1.707*** (0.438)	1.452*** (0.344)	0.186 (0.399)	0.665 (0.424)
Constant	15.89*** (1.568)	-4.432*** (1.685)	9.976*** (1.172)	-3.547*** (0.922)	15.90*** (1.575)	-4.387** (1.673)
Observations	98	98	132	132	98	98
R-squared	0.401	0.096	0.105	0.120	0.403	0.119

Notes: Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. The net public capital inflows (*aPubflows*) are measured by the sum of grants flows (*aGrflows*), officially public debts (*aOffflows*), IMF credit (*aImflows*), subtracting by foreign reserves flows (*aResflows*). Then, the net private capital inflows (*aPrivflows*) are the net total capital inflows subtracting by the net public capital inflows. The variables is from panel dataset by Alfaro, Kalemli-Ozcan and Volosovych (2014) The sovereign debts rating (*aSovrate*) is ranged from 1 to 21, and a greater index means safer. The supply of public debts (*aggdy*) is measured by the general government gross debt stock per GDP. These two variables are from World Bank Cross-Country Database of Fiscal Space database. The net productivity growth rate (*aGDPpcgrowth*) is measured by net growth of output per capita. The variable is from the World Bank Development Indicators.

The next two columns of Table (2) present the dependence pattern of net capital inflows on the productivity growth rate. A higher productivity growth rate is associated with less net public capital inflows,

as recorded on Column (3), but with more private capital inflows, as shown on Column (4). The findings show that the allocation puzzle holds for the public capital flows while the prediction of neoclassical growth model applies for the private capital flows.

The last two columns of Table (2) compare the relative role of sovereign debts rating with that of productivity growth rate on shaping the pattern of capital flows. On comparison with results on Column (3) and (4), the addition of sovereign debt rating turns the coefficients of productivity growth rate to be insignificant. This result proves that the sovereign debts rating is more important than the productivity growth rate on affecting both the public and private capital flows. Alfaro, Kalemli-Ozcan, and Volosovych (2008) applies the same strategy to prove that the institutional quality is more crucial than the income per capita to solve the Lucas paradox that the capital does not flow from rich to poor economy (Lucas (1990)).

Figure 2: Pattern of International Public Capital Flows

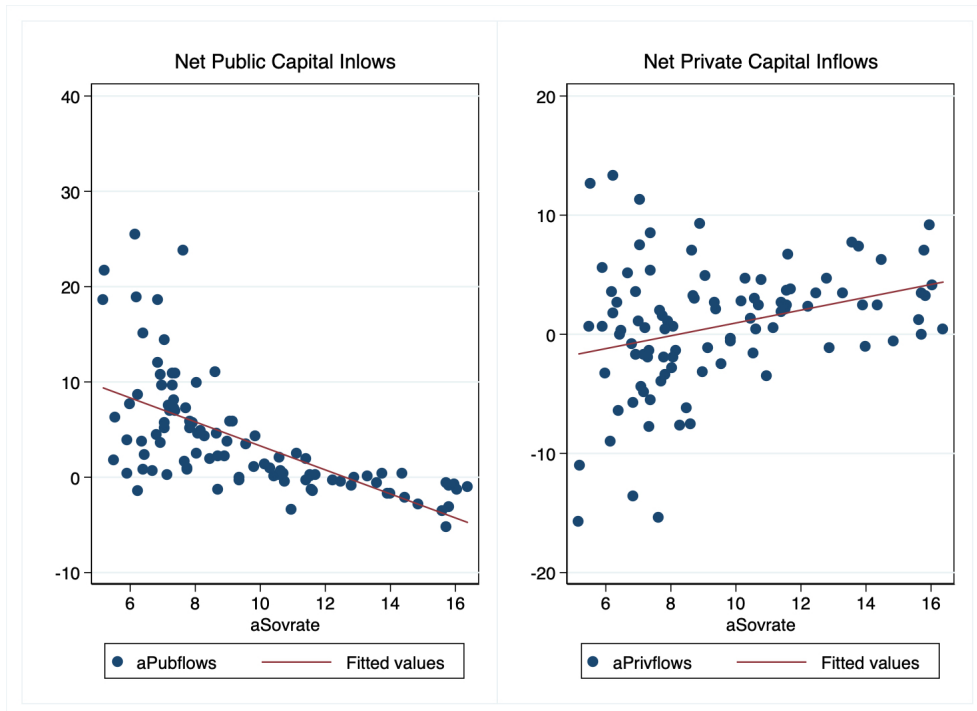


Figure (2) presents the pattern of cross-border public capital flows. On Panel A, a higher sovereign debts rating is associated with less net public capital inflows. And on Panel B, it is associated with more net private capital inflows. Thus, the data confirms the empirical evidence.

Table 3: Regression Results of Net Public Capital Inflows on Sovereign Debts Rating, Productivity Growth Rate, Inflation Rate and Rule of Law.

VARIABLES	(1) aPubflows	(2) aPubflows	(3) aPubflows
Sovereign Debts Rating (<i>aSovrate</i>)	-1.308*** (0.188)	-1.663*** (0.197)	-1.829*** (0.207)
Productivity Growth Rate (<i>aGDPpcgrowth</i>)	0.186 (0.399)	-0.0558 (0.347)	-0.183 (0.344)
Inflation Rate (<i>aCpi</i>)		-0.0145** (0.00618)	-0.0140** (0.00606)
Rule of Law (<i>aLaw</i>)		2.513*** (0.855)	2.712*** (0.841)
Interaction between (<i>aSovrate</i>) and (<i>aGDPpcgrowth</i>)			0.182** (0.0823)
Constant	3.872*** (0.486)	5.136*** (0.500)	4.747*** (0.520)
Observations	98	94	94
R-squared	0.403	0.551	0.574

Notes: Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. The net public capital inflows (*aPubflows*) are measured by the sum of grants flows (*aGrflows*), officially public debts (*aOfftflows*), IMF credit (*aImffflows*), subtracting by foreign reserves flows (*aResflows*). The variables is from panel dataset by Alfaro, Kalemli-Ozcan and Volosovych (2014) The sovereign debts rating (*aSovrate*) is ranged from 1 to 21, and a greater index means safer. The variable is from World Bank Cross-Country Database of Fiscal Space database. The net productivity growth rate (*aGDPpcgrowth*) is measured by net growth of output per capita. The variable is from the World Bank Development Indicators. Moreover, the institutional quality, denoted by (*aLaw*), is the rule of law index. The data is from the institutional quality dataset constructed by Kunčič (2014). And the inflation rate, denoted by (*acpi*), is the annual Consumer Price Index (CPI). The variable is from World Development Indicators database.

Table (3) shows the regression results of net public capital inflows on the sovereign debt rating and productivity growth rate, on controlling

for macroeconomic fundamental and institutional quality. Column (1) recorded the same result as Column (5) of Table (2): the coefficient of productivity growth is insignificant. The same pattern holds on controlling for the inflation rate and rule of law on Column (2), and for the interaction between sovereign debt rating and productivity growth on Column (3). An increase of 1 point of sovereign debt rating is associated with a reduction of 1.8% of net public capital inflows per GDP.

Moreover, the last two columns reveal that both the macroeconomic fundamental and institutional quality are important for net public capital flows. On Column (3), a higher inflation rate (an increase of 1%) is associated with less net public capital inflows per GDP (a reduction of 0.01% correspondingly) while a greater rule of law (an upgrade of 1 point) goes along with more public capital inflows (an increase of 2.7% correspondingly). In brief, on controlling for both macroeconomic and institutional variables, the sovereign debts rating is more important than productivity growth rate on shaping the net public capital inflows.

3.2 Decomposition of Public Capital Flows.

Table (4) investigates the dependence pattern of each component of net public capital inflows on the sovereign debt rating and productivity growth rate.

The first four columns focus on the sovereign debts rating. A higher sovereign debts rating is associated with more foreign reserves on Column (1), less net grants inflows on Column (2), less net officially public debts inflows on Column (3), and less IMF credit on Column (4). Specially, a decrease of net public debts inflows means that the borrowing is less than lending, since the net public debts inflows equals

to the borrowing subtracting to the lending. Then, the negative coefficient ($\beta^{Sovrate} = -0.26 < 0$) on Column (3) uncovers that the economy with safer sovereign debt tends to lend more than borrow in the world sovereign-to-sovereign capital market.

Table 4: Regression Results of Each Component of Net Public Capital Inflows on Sovereign Debts Rating and Productivity Growth Rate

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	aResflows	aGraflows	aOfftflows	aImfflows	aResflows	aGraflows	aOfftflows	aImfflows
Sovereign Debts Ratings (<i>aSovrate</i>)	0.479*** (0.108)	-0.792*** (0.132)	-0.258*** (0.0449)	-0.00947** (0.00431)	0.252** (0.123)	-0.888*** (0.158)	-0.332*** (0.0521)	-0.0109** (0.00517)
Productivity Growth Rate (<i>aGDPpcgrowth</i>)					0.878*** (0.260)	0.370 (0.334)	0.290*** (0.110)	0.00540 (0.0109)
Constant	-4.800*** (1.080)	11.11*** (1.321)	4.124*** (0.449)	0.159*** (0.0430)	-4.740*** (1.025)	11.14*** (1.319)	4.144*** (0.436)	0.159*** (0.0432)
Observations	98	98	98	98	98	98	98	98
R-squared	0.170	0.272	0.255	0.048	0.259	0.282	0.306	0.050

Notes: Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. The net public capital inflows (*aPubflows*) are measured by the sum of grants flows (*aGraflows*), officially public debts (*aOfftflows*), IMF credit (*aImfflows*), subtracting by foreign reserves flows (*aResflows*). The variables is from panel dataset by Alfaro, Kalemli-Ozcan and Volosovych (2014). The sovereign debts rating (*aSovrate*) is ranged from 1 to 21, and a greater index means safer. The variable is from World Bank Cross-Country Database of Fiscal Space database. The net productivity growth rate (*aGDPpcgrowth*) is measured by net growth of output per capita. The variable is from the World Bank Development Indicators.

The last four columns analyze the role of sovereign debt rating, on controlling for the productivity growth rate. The sovereign debt rating is more important than the productivity growth rate on determining the pattern of net grants inflows on Column (6) and IMF credits on Column (8). On other columns, the sovereign debt rating and productivity growth jointly determine the net officially public debt inflows on Column (7) and the foreign reserves on Column (5). In particular, on Column (7), a higher productivity growth rate is associated with more net of-

ficially public debts inflows. This result is consistent to the prediction by neoclassical growth model. And on Column (5), a higher productivity growth rate raise more foreign reserves accumulation. The result is contradicted to the prediction by neoclassical growth model, thus, confirms the existence of allocation puzzle as uncovered by Gourinchas and Jeanne (2013). In brief, the sovereign debt rating and productivity growth rate jointly determine the components of net public capital inflows. Therefore, the allocation puzzle of net public capital inflows is in fact an allocation puzzle on the foreign reserves flows.

Figure 3: Decomposition of International Public Capital Flows

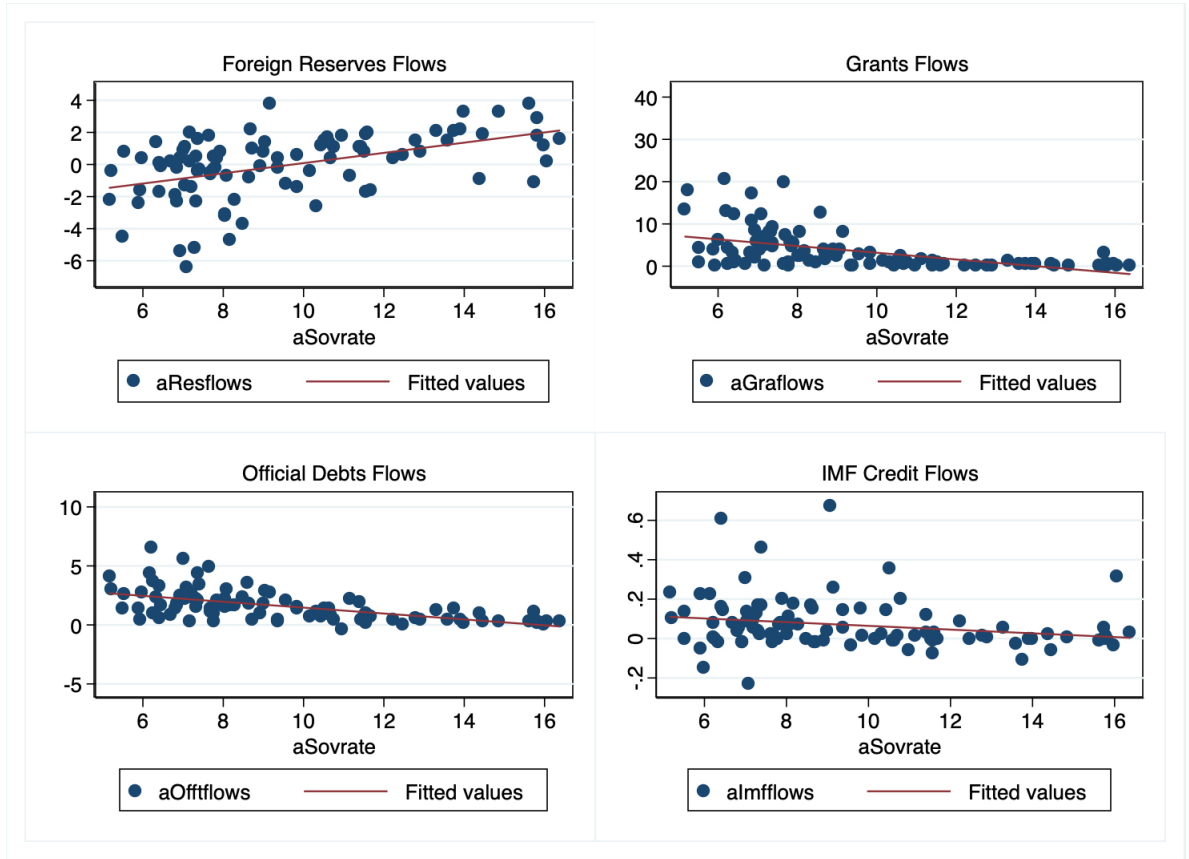


Figure (3) shows the dependence pattern of each component of net public capital inflows on the sovereign debt rating. The sovereign debt rating shapes the dependence pattern of foreign reserves on the produc-

tivity growth rate on Panel A. The insurance motivation underlines the pattern of net grants inflows and IMF credit flows on Panel B and Panel D respectively. The sovereign debt rating joints with the productivity growth rate to determine the net official public debts inflows on Panel C.

Table 5: Regression Results of Each Components of Net Public Capital Inflows on Sovereign Debts Rating, Productivity Growth Rate and Their Interaction Term

VARIABLES	(1) aResflows	(2) aGraflows	(3) aOfftflows	(4) aImfflows
Sovereign Debts Rating (<i>aSovrate</i>)	0.344** (0.132)	-0.992*** (0.170)	-0.340*** (0.0569)	-0.00976* (0.00565)
Productivity Growth Rate (<i>aGDPpcgrowth</i>)	0.936*** (0.259)	0.304 (0.334)	0.285** (0.112)	0.00609 (0.0111)
Interaction between (<i>aSovrate</i>) and (<i>aGDPpcgrowth</i>)	-0.113* (0.0640)	0.128 (0.0826)	0.00962 (0.0276)	-0.00135 (0.00274)
Constant	-0.142 (0.346)	3.212*** (0.447)	1.601*** (0.149)	0.0712*** (0.0148)
Observations	98	98	98	98
R-squared	0.282	0.299	0.306	0.053

Notes: Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. The net public capital inflows (*aPubflows*) are measured by the sum of grants flows (*aGraflows*), officially public debts (*aOfftflows*), IMF credit (*aImfflows*), subtracting by foreign reserves flows (*aResflows*). The variables is from panel dataset by Alfaro, Kalemli-Ozcan and Volosovych (2014) The sovereign debts rating (*aSovrate*) is ranged from 1 to 21, and a greater index means safer. The variable is from World Bank Cross-Country Database of Fiscal Space database. The net productivity growth rate (*aGDPpcgrowth*) is measured by net growth of output per capita. The variable is from the World Bank Development Indicators.

Table (5) shows the regression results of each components of net public capital inflows on the sovereign debt rating, productivity growth rate and their interaction term. The patterns of each type of public flows are preserved as the regression without the interaction term, as recorded on Table (4). In details, the sovereign debt rating is more crucial than the productivity growth on determining the grants and IMF credit flows.

But it shares the role with productivity growth rate on the foreign reserves and net official public debts flows.

Moreover, the interaction between the productivity growth rate and sovereign debt rating only has a significant coefficient with respect to the foreign reserves flows. In particular, the coefficient of productivity growth ($\beta^{Growth} = 0.936$) and that of interaction term ($\beta^{Inter} = -0.113$) implies a threshold value of sovereign debt rating at 8.28. Thus, for a high sovereign debts rating ($aSovrate > 8.28$), the foreign reserves accumulation is decreasing on the productivity growth rate. Then, the neoclassical growth model holds: $\frac{\partial aResflows}{\partial aGDPpcgrowth} < 0$. But for low sovereign debts rating ($aSovrate < 8.28$), the foreign reserves accumulation is increasing on the productivity growth rate. Then, the allocation puzzle applies: $\frac{\partial aResflows}{\partial aGDPpcgrowth} > 0$. In brief, the sovereign debt rating can solve the allocation puzzle on the dependence pattern of foreign reserves accumulation on the productivity growth rate.

3.3 Instrument Variable Results.

Table (6) shows the instrument-variable (IV) analysis of net public capital inflows. The IV result confirms the evidence by OLS regression that the sovereign debts ratings shape the pattern of public capital flows. In particular, on controlling for the macroeconomic fundamentals and institutional quality, the safe assets accumulation is the main driver of the pattern of net public capital inflows on Column (1). The sovereign debt rating is more important than the productivity growth rate on determining the net public capital inflows on Column (1), the foreign reserves flows on Column (2) and the net grants inflows on Column (3). And on Column (4), on controlling for sovereign debt rating, the productivity

growth rate raises the net official public debts inflows.

Table 6: Instrument-Variable (IV) Regression Results of Net Public Capital Inflows on Sovereign Debts Rating, Productivity Growth, Their Interaction Term, Inflation Rate and Rule of Law

VARIABLES	(1)	(2)	(3)	(4)	(5)
	aPubflows	aResflows	aGraflows	aOfftflows	aImffflows
Sovereign Debts Rating (<i>aSovrate</i>)	-2.054*** (0.484)	0.752** (0.372)	-1.296*** (0.423)	-0.596*** (0.166)	-0.00676 (0.0161)
Productivity Growth Rate (<i>aGDPpcgrowth</i>)	-0.0701 (0.403)	0.670** (0.310)	0.0747 (0.351)	0.355** (0.138)	0.00238 (0.0134)
Interaction between (<i>aSovrate</i>) and <i>aGDPpcgrowth</i>)	0.213** (0.102)	-0.157** (0.0781)	0.152* (0.0887)	0.0407 (0.0349)	-0.00215 (0.00338)
Inflation Rate (<i>aCpi</i>)	-0.0131** (0.00616)	0.00111 (0.00473)	-0.00937* (0.00537)	-0.00290 (0.00211)	0.000421** (0.000205)
Rule of Law (<i>aLaw</i>)	3.217** (1.289)	-0.800 (0.991)	2.114* (1.125)	0.732* (0.442)	0.0175 (0.0429)
Constant	4.781*** (0.516)	-0.298 (0.396)	4.105*** (0.450)	1.857*** (0.177)	0.0648*** (0.0172)
Observations	93	93	93	93	93
R-squared	0.567	0.253	0.431	0.300	0.101

Notes: Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. The net public capital inflows (*aPubflows*) are measured by the sum of grants flows (*aGraflows*), officially public debts (*aOfftflows*), IMF credit (*aImffflows*), subtracting by foreign reserves flows (*aResflows*). The variables is from panel dataset by Alfaro, Kalemli-Ozcan and Volosovych (2014) The sovereign debts rating (*aSovrate*) is ranged from 1 to 21, and a greater index means safer. The variable is from World Bank Cross-Country Database of Fiscal Space database. The net productivity growth rate (*aGDPpcgrowth*) is measured by net growth of output per capita. The variable is from the World Bank Development Indicators. Moreover, the institutional quality, denoted by (*aLaw*), is the rule of law index. The data is from the institutional quality dataset constructed by Kunčič (2014). And the inflation rate, denoted by (*acpi*), is the annual Consumer Price Index (CPI). The variable is from World Development Indicators database.

Moreover, the significance of the coefficient of interaction term on Column (2) illustrates that the sovereign debt rating shapes the dependence pattern of foreign reserves on the productivity growth rate. And the evidence also reveals that the inflation is main driver of IMF credit, since coefficient of other independent variables are insignificant. Moreover, the institutional quality raises the net public inflows on Column

(1), especially the net grants flows on Column (3) and the net officially public debts inflows on Column (4). In brief, the IV evidence is still consistent with the OLS evidence.

Table 7: Steps of IV Regression of Net Public Capital Inflows on Sovereign Debts Rating: Sovereign Debts Rating is instrumented by Ratio of Public Debts Supply per GDP

Panel A: Two-Stage Least Squares for Net Public Capital Inflows	
Sovereign Debts Rating	-2.154**
(<i>aSovrate</i>)	(0.545)
Panel B: First Stage for Sovereign Debts Rating	
Public Debts per GDP Ratio	-0.0446***
(<i>aggdy</i>)	(0.0130)
R-squared	0.110
Panel C: Ordinary Least Squares for Net Public Capital Inflows	
Sovereign Debts Rating	-1.260***
(<i>aSovrate</i>)	(0.157)

Notes: Panel A reports the two-stage least-squares estimates, instrumenting for sovereign debts rating using supply of public debts per GDP ratio; Panel B reports the corresponding first stage. Panel C reports the coefficient from an OLS regression of the dependent variable against sovereign debts rating. All regressions include a constant. Standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. The net public capital inflows (*aPubflows*) are measured by the sum of grants flows (*aGraflows*), officially public debts (*aOfftflows*), IMF credit (*aImflows*), subtracting by foreign reserves flows (*aResflows*). The variables is from panel dataset by Alfaro, Kalemli-Ozcan and Volosovych (2014). The sovereign debts rating (*aSovrate*) is ranged from 1 to 21, and a greater index means safer. The ratio of public debts supply per GDP (*aggdy*) is the publicly guaranteed debts divided by GDP. These two variables are from World Bank Cross-Country Database of Fiscal Space database.

Table (7) shows the results of the two stage least squares regression in Panel A, the associated first stage regression in Panel B, and the OLS counterpart in Panel C. In Panel A, when the sovereign debt rating is instrumented by the supply of public debt per GDP ratio, the coefficient of sovereign debt rating is negative at (-2.15) . In Panel B, the first stage regression shows that the sovereign debt rating is negatively affected by the supply of public debt per output ratio, with $R^2 = 0.11$. Thus, the result validates the correlation of instrument variable with the independent variable. Moreover, the estimated coefficient by two-

stage least squares in Panel A is higher on absolute value than the OLS counterpart shown in Panel C (2.15 compared with 1.26 respectively). Since the IV regression correct for both reverse causality and attenuation bias caused by measurement error, the result suggests that the reverse causality is less serious than the measurement error. In brief, the evidence validates the use of IV regression method in our analysis.

4 Conclusion.

The empirical evidence on a cross-section data sample of 132 economies shows that the sovereign debt rating, a proxy for the safety of safe assets, determines the net public capital inflows. A higher sovereign debt rating is associated with less net public capital inflows but more net private capital inflows. Moreover, more foreign reserves are associated with higher productivity growth only for the economy with low sovereign debt rating. Thus, for that economy, the public capital flows fuels a buffer stock which can be used to insure against future uncertainty.

The result provides an important implication for public policy. The public capital flows are driven by the insurance motivation while the private capital flows are determined by the investment motivation. Thus, with an upgrade of domestic sovereign debt rating, an economy can rely more on the private capital flows to build up its domestic capital stock. Otherwise, with low sovereign debt rating, it can only rely more on the public capital flows.

For the future research avenue, we can focus on the pattern of public debts flows. The public debts can be financed by foreign government or by foreign private sector. Thus, they are decomposed into sovereign-

to-sovereign and other public debts flows. Understanding each type of public debts flows is promising to shed a new light on the international movement of sovereign debts at the financial globalization.

A Appendix

Table 8: Instrument Variabe (IV) Regression Results of Net Public Capital Inflows and Their Components on Sovereign Debts Rating and Productivity Growth Rate

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)
	aPubflows	aPubflows	aResflows	aGraflows	aOfftflows	aimfflows
Sovereign Debts Rating (<i>aSovrate</i>)	-2.154*** (0.545)	-2.742*** (0.922)	0.881* (0.535)	-1.773** (0.701)	-0.732*** (0.256)	-0.00727 (0.0200)
Productivity Growth Rate (<i>aGDPpcgrowth</i>)		1.859 (1.155)	0.144 (0.670)	1.407 (0.879)	0.754** (0.321)	0.000975 (0.0250)
Constant	24.40*** (5.226)	25.59*** (6.335)	-8.990** (3.677)	17.12*** (4.821)	6.844*** (1.762)	0.135 (0.137)
Observations	97	97	97	97	97	97
R-squared	0.198	0.040	0.056	0.049		0.044

Notes: Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. The net public capital inflows (*aPubflows*) are measured by the sum of grants flows (*aGraflows*), officially public debts (*aOfftflows*), IMF credit (*aImfflows*), subtracting by foreign reserves flows (*aResflows*). The variables is from panel dataset by Alfaro, Kalemli-Ozcan and Volosovych (2014) The sovereign debts rating (*aSovrate*) is ranged from 1 to 21, and a greater index means safer. The variable is from World Bank Cross-Country Database of Fiscal Space database. The net productivity growth rate (*aGDPpcgrowth*) is measured by net growth of output per capita. The variable is from the World Bank Development Indicators.

On Table (8), the IV results confirm that the sovereign debt rating affects the public capital flows (on Column (1)), and also is more important than the productivity growth on shaping the pattern of foreign reserves, grants and IMF credit flows. For the official public debts flows, the sovereign debt rating joints with the productivity growth as key determinants.

References

- Alfaro, Laura, Sebnem KalemliOzcan, and Vadym Volosovych.** "Sovereigns, upstream capital flows, and global imbalances." *Journal of the European Economic Association* 12.5 (2014): 1240-1284.
- Alfaro, Laura, Sebnem Kalemli-Ozcan, and Vadym Volosovych.** "Why doesn't capital flow from rich to poor countries? An empirical investigation." *The review of economics and statistics* 90.2 (2008): 347-368.
- Bernanke, B. S., Bertaut, C. C., Demarco, L., and Kamin, S. B. (2011).** International capital flows and the return to safe assets in the united states, 2003-2007. FRB International Finance Discussion Paper, (1014).
- Brunnermeier, Markus K., et al.** "The sovereign-bank diabolic loop and ESBies." *American Economic Review* 106.5 (2016): 508-12.
- Caballero, Ricardo J., Emmanuel Farhi, and Pierre-Olivier Gourinchas.** "An equilibrium model of" global imbalances" and low interest rates." *American economic review* 98.1 (2008): 358-93.
- Caballero, Ricardo, and Emmanuel Farhi.** "The safety trap." *The Review of Economic Studies* 85.1 (2018): 223-274.
- Caballero, Ricardo J., Emmanuel Farhi, and Pierre-Olivier Gourinchas.** "The safe assets shortage conundrum." *Journal of Economic Perspectives* 31.3 (2017): 29-46.
- Coeurdacier, Nicolas, Stphane Guibaud, and Keyu Jin.** "Credit

constraints and growth in a global economy.” *American Economic Review* 105.9 (2015): 2838-81.

Durdu, Ceyhun Bora, Enrique G. Mendoza, and Marco E. Terrones. ”Precautionary demand for foreign assets in Sudden Stop economies: An assessment of the New Mercantilism.” *Journal of development Economics* 89.2 (2009): 194-209.

Eaton, Jonathan. ”Foreign public capital flows.” *Handbook of development economics* 2 (1989): 1305-1386.

Farhi, Emmanuel, and Matteo Maggiori. ”A model of the international monetary system.” *The Quarterly Journal of Economics* 133.1 (2018): 295-355.

Fratzscher, Marcel. ”Capital flows, push versus pull factors and the global financial crisis.” *Journal of International Economics* 88.2 (2012): 341-356.

Geithner, Timothy F. ”Liquidity risk and the global economy.” *International Finance* 10.2 (2007): 183-189.

Gourinchas, Pierre-Olivier, and Olivier Jeanne. ”Capital flows to developing countries: The allocation puzzle.” *The Review of Economic Studies* (2013): rdt004.

Gourinchas, Pierre-Olivier, and Hlne Rey. ”External adjustment, global imbalances, valuation effects.” *Handbook of international economics*. Vol. 4. Elsevier, 2014. 585-645.

He, Zhiguo, Arvind Krishnamurthy, and Konstantin Milbradt.

- "A model of safe asset determination." *American Economic Review* 109.4 (2019): 1230-62.
- Hung, Ly Dai.** "Public Safe Assets Determination." *Global Economic Review* (2020): 1-19.
- Hung, Ly Dai.** "Empirics for Marginal Product of Capital." *Journal of International Commerce, Economics and Policy* 11.01 (2020): 2050003.
- Hur, Sewon, and Illenin O. Kondo.** "A theory of rollover risk, sudden stops, and foreign reserves." *Journal of International Economics* 103 (2016): 44-63.
- Jeanne, Olivier, and Romain Ranciere.** "The optimal level of international reserves for emerging market countries: A new formula and some applications." *The Economic Journal* 121.555 (2011): 905-930.
- Kunčič, Alja.** "Institutional quality dataset." *Journal of institutional economics* 10.1 (2014): 135-161.
- Kose, M. Ayhan, Sergio Kurlat, Franziska Ohnsorge, and Naotaka Sugawara (2017).** "A Cross-Country Database of Fiscal Space." Policy Research Working Paper 8157, World Bank, Washington, DC.
- Lucas, Robert E.** "Why doesn't capital flow from rich to poor countries?." *The American Economic Review* 80.2 (1990): 92-96.
- Matsuyama, Kiminori.** "Financial market globalization, symmetry-breaking, and endogenous inequality of nations." *Econometrica* 72.3 (2004): 853-884.

Mendoza, Ronald U. "Was the Asian crisis a wake-up call?: Foreign reserves as self-protection." *Journal of Asian Economics* 21.1 (2010): 1-19.

Prasad, Eswar S., Raghuram G. Rajan, and Arvind Subramanian. Foreign capital and economic growth. No. w13619. National Bureau of Economic Research, 2007.

Solow, Robert M. "A contribution to the theory of economic growth." *The quarterly journal of economics* 70.1 (1956): 65-94.