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The Underlying Mechanisms of the Lucas Paradox: Political Stability and Public Capital Flows

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Abstract

This study seeks to explain the puzzling phenomenon of *upstream capital flows*, which describes the paradoxical concept of capital moving from developing countries, to developed ones, as they undergo economic growth, instead of vice versa. Recent literature has found that decomposing capital flows into private and public components is an effective way to gain new insights into this complex scene. It has been found that economic growth is negatively correlated with public capital flows, and I try to contribute to this finding by hypothesizing that political stability could act as a possible moderator in this relationship. I continue by decomposing public capital flows into smaller inner parts, namely public and publicly guaranteed (PPG) debt, and reserve accumulation, as a means of discovering the underlying mechanisms behind this happening. I find that economic growth is indeed negatively related to public capital flows, while it is positively associated with private ones. And although I do find that political stability affects PPG debt flows, I do not find that political stability plays a significant moderating role in the overall occurrence of uphill capital streams. To perform such analysis, I conduct cross-sectional and fixed-effects panel regressions, for 98 developing countries over the period 1976-2021. I find that the first lag of GDP growth is the most suitable instrument for economic growth, but that with more careful refinement, a Bartik instrument for regional GDP growth could be used in future research. As a whole, I argue that the public sector plays a crucial role in our currently experienced global imbalances, and that we should be careful not to underestimate the impact that PPG debt, reserve accumulation, and its determinants, have in policy-making.

1. Introduction

For the past three decades, we have seen capital move from rapidly developing countries, such as China, to developed countries, like the United States. This idea of *upstream capital flows* directly contrasts the neoclassical theory of allocative efficiency, predicting that we should see capital flow from more stable countries to emerging markets, driven by investors wanting to take advantage of the high growth potential. It was first studied by Lucas (1990) in his now seminal paper titled, *Why Doesn't Capital Flow from Rich to Poor Countries?*. The author illustrates this occurrence, later becoming known as the *Lucas Paradox*. He utilizes the following example: the return to capital of the quickly expanding India should have been around 58 times that of the United States. According to the neoclassics, this would mean that all the capital should flow from the US to India. In practice, however, we did not see this happen, and the return to capital was only 5 times that of the US (Herrmann & Kleinert, 2014).

Alfaro et al. (2014) enhance this finding in their article titled, *Sovereigns, Upstream Capital Flows and Global Imbalances.* Here, they managed to decompose international capital flows into public and private origins, and from this, conclude that we can rationalize the Lucas Paradox through public capital flows. Although they certainly acknowledge the puzzling behavior of the observed uphill capital flows, they show how a large part of the story is not necessarily paradoxical. It is private capital flows that are actually found to move downstream, like we would expect, from stagnant countries to rapidly-growing ones. And it is rather the public flows component that directly moves counter-current. They particularly denote how *sovereign-to-sovereign transactions*, a recently introduced concept, is imperative to this mechanism. These flows specifically occur when government debt is financed by other sovereigns. They suggest that if these sovereign-to-sovereign flows are subtracted from the equation, we in truth see capital flows move downstream on net. This highlights the importance of the public sector, even more so than the private sector, in the clarification of the Lucas Paradox.

The remarkable finding that the public sector has a more profound impact on upstream capital flows than the private sector has, naturally sparks a desire for further exploration. I suspect that political factors play a detrimental role in the observation of upstream capital flows. To illustrate this, Lambsdorff (2003) found that corruption, an acute measure of political instability, negatively affects net capital flows. The author writes that if the integrity score of Columbia's public sector improved to the level of the United Kingdom, their net annual capital inflows would increase by 3 percent of its GDP. The unanswered question that remains is, 'How does political stability affect the negative correlation between growth and public capital flows?'.

This paper specifically focuses on political stability as a possible moderator in this relationship, using combinations of cross-sectional and time-series analyses to empirically investigate the drivers of the allocation puzzle. I will take a more nuanced approach than previous literature, by discussing the viability

of three different instrumental variables, to capture the suggested reverse causality between public capital and GDP growth, namely age-dependency, a Bartik instrument on regional GDP growth, and the first lag of GDP growth, the latter of which was found to be the most suitable. This article will also touch upon the effect of sample changes, the different proxies for political stability, and private flows. The final generalized fixed-effects two-stage least squares (FE-2SLS) model reads[1]:

First-stage:

$$Growth_{i,t} = \pi_0 + \pi_1(growth_{i,t-1}) + \pi_2(pol{\sim}stability_{i,t}) + \pi_3(controls_{i,t}) + \eta_i + \nu_{i,t}$$

$$Pol{\sim}stability_{i,t} \times growth_{i,t} = \rho_0 + \rho_1(pol{\sim}stability_{i,t} \times growth_{i,t-1}) + \rho_2(pol{\sim}stability_{i,t}) + \rho_3(controls_{i,t}) + \theta_i + \omega_{i,t}$$

Second-stage:

$$Public\ capital_{i,t} = \beta_0 + \beta_1(\widehat{growth}_{i,t}) + \beta_2(pol{\sim}stability_{i,t}) + \beta_3(\widehat{pol{\sim}stability_{i,t}} \times growth_{i,t}) + \beta_4(controls_{i,t}) + c_i + \epsilon_{i,t}$$

The rest of the paper is organized as follows. Section 2 describes the theoretical framework. Section 3 outlines the data and methodology. Section 4 discusses the results. Section 5 elaborates on the findings. Section 6 concludes the paper.

2. Theoretical Framework[2]

2.1 Public capital flows

Although there is no formal approach, there is some consensus on how to break down the capital account into public and private flows. Aguiar and Amador (2011) explored several macroeconomics issues of sovereign and private debt and were one of the first to show that flows can be divided into such components. They defined public capital inflows to be public and publicly guaranteed debt (hereafter: PPG) minus the change in international reserves. Gourinchas and Jeanne (2013), in their paper, used this measure of public capital flows directly. They consider private capital flows to be the result of subtracting public flows from net capital flows. The work by Alfaro et al. (2014) further builds on top of these ideas.

[1] growthi,t−1 is the instrumental variable; *c*i is the individual fixed effects in the second-stage regression; ∈i,t is the error term for entity i at time t in the second-stage regression; ηi and θi are the individual fixed effects for entity i in the first-stage regression; *v*i,t and ωi,t are the error term for entity i at time t in the first-stage regression; βi, πi and ρi are the coefficients in the regressions

[2] Empirical literature on the effect of economic growth on public capital flows is thin. Therefore, I will mostly discuss the findings of a handful of articles, in particular those of: Gourinchas and Jeanne (2013), Alfaro et al. (2014) and Kim and Zhang (2023).

They proceed by decomposing the private and public flows into sub-classes, using the World Bank's Global Development Finance database. The authors manage to split net capital flows into foreign direct investment (FDI), portfolio equity and debt, where only net debt can be further separated into private and public classes. Most of the capital account consists of private flows. Take FDI and portfolio investment as such. The only component that is public, is contained in debt. Net public capital flows are therefore regarded as equivalent to public debt. Formally, this is calculated as PPG debt flows minus reserve accumulation, which is the exact measure that was proposed by Aguiar and Amador (2011). The following figure provides a schematic overview of the decomposition:

<table>
<tr><td colspan="3">Decomposition of capital flows</td></tr>
<tr><td rowspan="2">Foreign direct investment (FDI)</td><td rowspan="2">Portfolio equity</td><td colspan="2">Debt</td></tr>
<tr><td>Private debt</td><td>Public debt = PPG debt - reserve accumulation</td></tr>
</table>

Figure 1. Decomposition of capital flows inspired by Alfaro et al. (2014)

An alternative method to measure public capital flows has been utilized by Kim and Zhang (2023), who used the IMF's BOP/IIP database instead. They define public capital flows as the *net incurrence of external liabilities minus net acquisition of external assets by general governments and central banks from portfolio investment and other investment items minus the net increase in reserve assets*. When using this dataset, however, I found many gaps, and it was not possible to reproduce the results from Kim and Zhang (2023) in my own analysis. The output of this attempt can be viewed in Appendix D. Rather, the data on public capital flows was used by Alfaro et al. (2014).

2.2 Economic growth & development

Economic growth is formally defined as the increase in total market value of all the goods and services in an economy in a year. Many academic papers operationalize economic growth by taking the GDP growth rate per capita, which I also choose to use (Alfaro et al., 2014; Kim and Zhang, 2023).

Although often used interchangeably, the concept of economic growth is fundamentally different from development, where the latter aims at expressing a country's quality of living as well. Measuring this degree of development, however, proves to be difficult. It is clear that different definitions of development result in different samples used. As their developing countries group, Gourinchas and Jeanne (2013) included 65 non-OECD countries as well as Turkey, Mexico and Korea. The developing countries sample used by Alfaro et al. (2014) was constructed by taking a Raw World sample of 156 countries that have data on public capital flows for more than half of the time, excluding the 22 advanced OECD countries, resulting in a final sample of 98 developing countries. Another way of measuring development

is by directly looking at income classifications. Kim and Zhang (2023) use the IMF income classifications, considering high income countries to be developed, while both low and high classes of middle income are developing countries. They do not consider low income countries at all. This dispute, on what is considered to be a developed or developing country, has serious effects on the sample chosen. Hence, I will compare and contrast the definitions by Alfaro et al. (2014) and Kim and Zhang (2023) in this paper.

2.3 Relating public capital flows to economic growth

Empirical literature on the effect of economic growth on public capital flows is thin. It is therefore important to reconcile with the findings of the few articles that did study this relationship. One of the first articles that dove into the allocation puzzle, and that successfully split capital flows into public and private flows, was Gourinchas and Jeanne (2013). They used a cross-sectional analysis for the period 1980-2000. Like Alfaro et al. (2014), they simply looked at developing countries and used the productivity catch-up variable as a proxy for economic growth. They initially use savings to explore the occurrence of upstream capital flows. As growth is promoted, so are savings, which are a type of capital withdrawal. The question they raise is whether growth stimulates savings at a higher rate than investments. They secondly found that elevated growth is associated with public capital outflows, while there is a positive correlation between growth and private capital inflows. They do not have a concrete justification for this finding, but explore the possible explanations. One is that higher growth results in a booming trading sector, which leads to a higher current account surplus, which through its relationship in accounting[3], directly means there are negative pressures in the capital account. Another explanation is that as a country grows, there is an increase in reserve accumulation by the Central Bank, a type of public capital outflow.

Alfaro et al. (2014), with their data concerning the time period of 1980-2007, successfully add on to this study. They find that the same overarching relationships hold as observed by Gourinchas and Jeanne (2023). They especially provide evidence that the reserve account is indeed a main contributor to these public capital outflows. Still, they suggest that it is rather sovereign-to-sovereign flows that fully account for upstream capital flows. They propose that developing countries tend to engage more in sovereign-to-sovereign transactions as they grow, since they face higher private capital inflows which raises their ability to send out capital to other governments, essentially financing the debt of other sovereigns. They furthermore find that growth is only positively correlated with public savings, and that there is no statistical evidence for an effect on private savings. This makes them believe that policy

[3] Through the concept of Balance of Payments, a current account surplus is associated with a capital account deficit, and vice versa.

makers have overemphasized the role of private savings in uphill capital flows, and should be more careful to consider the public sector.

To further digest these results, a more recent study has been conducted by Kim and Zhang (2023). They were able to implement fixed-effects panel regressions in the allocation puzzle. Like previous literature, they decompose net capital flows into private and public flows, but they extend onto this by providing data on developed countries as well, an approach that Gourinchas and Jeanne (2013) and Alfaro et al. (2014) did not manage to do mostly due to data constraints. Kim and Zhang (2023) focused on the period 1980-2017. Although they used a different dataset, and therefore a different definition of public capital flows (which I discussed in *2.1 Public Capital Flows*), their results still align with Gourinchas and Jeanne (2013) and Alfaro et al. (2014). They concatenate the growth-savings story by Alfaro et al. (2014) with their own findings. Along with other academic literature, they suggest that when growth is high, the government is more incentivized to start saving and less debt is accumulated, which corresponds to public capital outflows (Kim and Zhang, 2023; Omrane B & Omrane H, 2017). This is associated with a lower probability of debt crises, which results in higher private inflows. Similarly, when growth is low, the government reduces savings, which increases aggregate debt, associated with public capital inflows. The probability of debt crises increases, and this decreases private capital inflow. Accordingly, Kim and Zhang (2023) suggest that public and private capital flows are strongly interrelated. As developed countries grow, it is the private inflows that dominate, whereas for developing countries, it is the public outflows that take over. The implication is that we see capital move upstream for developed countries, while we see it move downstream for developing ones, which aligns well with the findings of Gourinchas and Jeanne (2013), and Alfaro et al. (2014).

2.4 Adding political stability

In this section, I will explore and hypothesize the possible effects of political stability on capital flows, while touching upon the various operationalizations of this variable that are commonly used in academic literature. One of the most common metrics of political stability is the *Political Stability and Absence of Violence/Terrorism Estimate* by the World Bank (2023). It measures the *perceptions of the likelihood of political instability and/or politically-motivated violence, including terrorism*. Eisl (2017) used this variable when studying the effect of political factors on the variation in public debt. He finds that political stability reduces the incentive for governments to borrow, lowering their accumulation of public debt. Other researchers have used the political regime as a proxy for political stability. Kim (2010) discusses how FDI flows from politically stable countries to politically unstable ones, consistent with Lucas (1990). The author uses three measures for political stability: corruption from the International Country Risk Guide, political freedom by Freedom of the World, and the democracy index by Polity III. This

democracy index was found to be associated with higher private inflows. Intaek (2006) and Jäger (2016) find that democratic regimes are correlated with higher reserve accumulation. Quazi (2003) showed how political instability, as measured by a dummy in different periods of time where there was severe political chaos, decreased the domestic savings rate in Bangladesh. All in all, it is expected that political stability, and a higher degree of democracy, are associated with public capital outflows through the reduction of public debt, an increase in savings, private inflows and higher reserves. Considering the differences in operationalization, both the World Bank estimate and the democracy index will be referred to in my analysis.

High-growth countries are associated with stronger public capital outflows than low-growth ones due to greater savings, reserve accumulation and sovereign-to-sovereign transactions. If the country's economy deteriorates, we expect public capital outflows to be reduced considerably. If the country becomes more politically stable, it can buffer this effect by incentivizing additional savings, private inflows and reserve accumulation. Therefore, I expect that as countries grow, public capital flows out, the effect of which is less prominent for politically stable countries. Formally, the hypotheses read:

Hypothesis I. There is a negative relationship between economic growth and net public capital flows.

a. *There is a negative relationship between economic growth and PPG debt.*
b. *There is a positive relationship between economic growth and reserve accumulation.*

Hypothesis II. Political stability weakens the relationships in hypothesis I.

3. Data & Methodology

3.1 Variables

To unravel the Lucas Paradox empirically, I perform a fixed-effects panel regression where I take economic growth as my independent, and public capital flows as my dependent variable. Apart from adding political stability, and its interaction effect with economic growth, I include several controlled variables. Firstly, I control for economic openness, inspired by Gourinchas and Jeanne (2013) who control for this through the Chinn-ito index (the degree of financial openness). Yet, there is more recent evidence that financial openness does not have as strong of an effect on capital flows as thought (Cerdeiro & Kimaromi, 2021). Therefore, I control for economic openness through a more broad measure - trade openness. The volatility of the exchange rate is added as a control, inspired by Kim and Zhang (2023), as a measure for the overall volatility of the economy. Ng'ambi (2015) finds that exchange rate volatility has

a significant negative impact on the capital flows of South Africa, supporting the inclusion of this variable in the regression. Inflation is included as a way to control for policy changes; its value and stability indirectly capture the performance of certain fiscal and monetary policies. In addition, Bengui & Coulibaly (2022) find that capital flows from low-inflation economies to high-inflation ones, further solidifying its explanatory power.

An important part of this study, and not often tackled by researchers, is to account for the suggested reverse causality between economic growth and public capital flows. Robert Solow and Trevor Swan, who introduced the neoclassical growth model in 1956, claim that economic growth is the result of labor, capital and technology (Solow, 1956). They frame capital as a fundamental determinant of economic growth, and many papers before Gourinchas and Jeanne (2013) actually explored the Lucas Paradox in this reversed way. Prasad et al. (2007) were one of the first researchers to quantitatively investigate the allocation puzzle using a cross-sectional OLS regression for the period 1970-2004. They used capital flows as the independent variable, and GDP per capita as the dependent variable, finding that there is indeed an effect of capital flows on economic growth. A more recent article by Benigno et al. (2022) backs this idea further by suggesting that it is reserve accumulation that drives the negative correlation between net capital flows and growth. Fast-growing countries accumulate reserves, and by doing this, the government allows the exchange rate to depreciate, allowing trade to flourish, and making it possible to allocate trade revenue to growth, again demonstrating the reverse relationship between economic growth and capital flows.

Inspired by this reverse causality argument, I test several instrumental variables in my regressions. From the models of Solow (1956), it is evident that the age dependency ratio, which can indirectly tell us about the productivity of an economy, could act as a suitable instrument for economic growth. Many articles find that changes in demographics, like the age dependency ratio have an effect on economic growth (Cruz and Ahmed, 2018; Dao, 2012; Prasad, 2007). Maestas (2023) even shows how a 10% population aging increase in the US is associated with a 5.5% decrease in GDP per capita. As a second candidate, a Bartik instrument is constructed. The seminal paper by Goldsmith-Pinkham et al. (2020) thoroughly discusses the use of this instrument, interacting local industry shares with national industry growth rates as an instrument for industry growth rates. The Bartik instrument created in my paper parallels this reasoning: it is a cross between a country's contribution of GDP to its region (%), and the overall GDP growth rate of the region. I aim at using the economic growth rates of the country's neighbors as an instrument for its own economic growth, suspecting that there are spill-over growth effects from bordering countries. Cherif et al. (2018) use a similar method, taking the averages of different (lagged) variables of neighboring countries as an instrument. Lastly, since it is common practice to use the first lag of an endogenous variable as an instrument, this is explored as well (Wang &

Bellemare, 2019). It is believed that the economic growth of the previous year has momentum-like effects on current economic growth. To summarize, in this paper, I test the viability of three instruments: (I) the age dependency ratio, (II) regional GDP growth rates as a Bartik instrument, and (III) the lagged growth rate, in the relationship between growth and public capital flows. They all are suspected to have a strong correlation with growth, and are not expected to be affected by public capital flows or the error term. The following table provides an overview of the variables used in my analysis.

Table 1. Glossary of the variables used

Variable	Description
Public capital flows	Public capital flows = PPG debt flows - Reserve accumulation, % GDP USD (Alfaro et al., 2014)
PPG debt	Public and publicly guaranteed debt flows % GDP USD (Alfaro et al., 2014)
Reserve accumulation	Annual flows of foreign reserve assets (excluding gold), with sign reversed, so that accumulation of reserves is positive, % GDP USD (Alfaro et al., 2014)
Private flows	Net private equity and private debt flows, % GDP based on IMF-IFS (Alfaro et al., 2014)
Economic growth[4]	GDP per capita growth (%), based on levels in 2010 USD (Alfaro et al., 2014)
Political stability	Political Stability and Absence of Violence/Terrorism Estimate (World Bank, 2023)
Democracy index	Polity2 index, from -10 (autocratic) to +10 (democracy) (PolityProject)
Trade openness	Sum of exports and imports of goods and services, % GDP (World Bank, 2023)
Exchange rate volatility	Exchange rate volatility, calculated by taking the standard deviation of the first logarithm of the exchange rate (local currency units relative to the U.S. dollar)) (World Bank, 2023)
Inflation	Measured as the annual % in CPI (World Bank, 2023)
Age dependency	Ratio of people younger than 15 or older than 64-to the working-age population - those ages 15-64 (World bank, 2023)
Bartik[5]	Share of GDP in region * total GDP growth for countries in region (Alfaro et al., 2014)
Lag economic growth	1Y lag of GDP growth (Alfaro et al., 2014)

Several data transformations have been performed to the variables. Generally, all the variables were collected as 5-year averages. This was decided to make the variables roughly move at the same velocity over time (age dependency was not expected to change value at the same rate as inflation for instance). By making each observation a 5-year average, the added benefit is that outliers are smoothed out. After

[4] Using GDP growth by the World Bank (2023) yielded similar results.
[5] Only the countries with a share of GDP that was less or equal to 10% of the regional GDP, in all the periods, were included in the regression. This is to make sure the countries were small enough to be affected by the region, instead of them driving the regional GDP.

creating the 5-year averages, trade openness and inflation both showed positively skewed distributions (see Appendix B), which is why the logarithms were taken of these variables. Since inflation contained negative values, the data was shifted so that the minimum starts at +1, and then the logarithm was applied. The exchange rate volatility variable was created before taking the 5-year averages, so that the volatility would be concerning the annual rate.

3.2 Descriptive statistics

A statistical description of the transformed variables can be found in table 2.

Table 2. Summary statistics (raw world sample)

	n	Mean	STD	Skewness	Kurtosis	Min	Max
Public capital flows	982	1.24	5.60	1.33	14.43	-30.04	42.31
PPG debt flows	1061	2.55	5.47	4.52	44.78	-23.11	66.52
Reserve accumulation	1043	1.22	2.90	0.79	18.37	-19.94	21.63
Private flows	953	4.10	7.19	1.79	53.51	-82.73	86.95
Economic growth	1133	1.77	4.27	-0.21	12.76	-30.18	31.58
Political stability	676	38.88	24.44	0.38	2.19	0.10	97.99
Democracy index	484	1.03	6.57	-0.18	1.45	-10	10
Log trade openness	975	4.16	0.53	-0.72	5.88	0.24	5.72
Exchange rate volatility	1107	0.21	0.54	8.53	105.38	0.00	9.17
Log inflation	963	2.65	0.85	2.56	13.31	0.00	7.90
Age dependency	1233	74.33	19.27	-0.05	1.86	35.90	120.36
Bartik	1170	0.05	0.31	8.53	105.38	-1.47	4.09
Lag economic growth	1027	1.86	4.13	-1.82	32.87	-43.33	35.36

From table 2, it can be inferred that the raw world sample (which is discussed more extensively in *3.3 Sample selection*) contains countries with an average political stability estimate of around 39, which indicates a weak political stability. The average age dependency ratio is roughly 74 for these countries, suggesting that they have a high proportion of non-working individuals. On average, these countries receive 2.55 billion USD in PPG debt flows, while 1.22 billion USD flows out as reserve accumulation. On net, they receive 1.24 billion USD flowing in as public capital flows.[6] These countries receive considerably more as private flows, 4.10 billion USD on average. Table 3 displays the correlation matrix.

[6] Since net public capital flows = PPG debt - reserve accumulation, the calculation of 1.24 billion roughly aligns with the calculation (2.55-1.22=1.33 billion)

Table 3. Correlation matrix

	Public capital	PPG debt flows	Res~ accum	Private flows	Econ~ growth	Pol~ stability	Democ~ index	Log trade openness	Exchang e ~vol	Log inflation	Age ~cy	Bartik	Lag~gro wth
Public capital flows	1.00												
PPG debt flows	0.86	1.00											
Reserve accumulation	-0.66	-0.20	1.00										
Private flows	0.17	0.30	0.08	1.00									
Economic growth	-0.09	0.08	0.30	0.24	1.00								
Political stability	0.04	0.03	-0.05	0.26	0.08	1.00							
Democracy index	0.02	-0.03	-0.10	0.05	-0.21	0.11	1.00						
Log trade openness	0.04	0.12	0.12	0.32	0.06	0.46	-0.03	1.00					
Exchange rate volatility	0.03	-0.05	-0.14	-0.28	-0.10	-0.04	-0.03	-0.05	1.00				
Log inflation	0.02	-0.06	-0.12	-0.16	-0.01	-0.26	-0.14	-0.05	0.56	1.00			
Age dependency	-0.11	-0.15	-0.02	-0.30	-0.28	-0.14	-0.06	-0.20	-0.01	-0.08	1.00		
Bartik	-0.08	-0.06	0.08	-0.10	0.19	-0.20	0.08	-0.27	-0.05	-0.03	-0.13	1.00	
Lag economic growth	-0.06	0.09	0.25	0.18	0.90	0.04	-0.22	-0.01	-0.12	0.03	-0.25	0.19	1.00

There is a 0.56 correlation between the log of inflation and the exchange rate volatility, and a 0.46 correlation between the log of trade openness and political stability. Therefore, caution should be taken when including these pairs in the regression, as discussed further in *4.1 Fixed effects panel regression*. Regarding the instrumental variables, only the lag of economic growth is highly correlated with economic growth (corr = 0.90). The other instruments, age dependency (corr = -0.28) and the Bartik instrument (corr = 0.19) are only weakly correlated.. Their strength will be tested in *4.1 Fixed effects panel regression.*

3.3 Sample selection

In the field of developmental economics, careful sample selection is crucial. Alfaro et al. (2014) find that there is a negative correlation between growth and net capital flows using smaller samples that included mostly Asian and African countries. But in larger samples of developing countries, they found a weakly positive relationship (Alfaro et al., 2014; Prasad et al., 2007). Since the influential articles by Alfaro et al. (2014) and Kim and Zhang (2023) use different interpretations for developing countries (as discussed in *2.2 Economic growth & development*), I will compare and contrast both sample definitions. Table 4 shows an overview of the sample compositions, with sample A being the benchmark sample used by Alfaro et al. (2014), and sample B being my own constructed sample, inspired by Kim and Zhang (2023).

Table 4. Samples overview[7]

Large region	Raw world	Sample A[8]	Sample B
East Asia & Pacific	22	11	17
Europe & Central Asia	24	10	21
Latin America & Caribbean	29	23	28
Middle East & North Africa	13	8	12
South Asia	8	5	4
Sub-Saharan Africa	46	35	16
Total	142	92	98
Income group	Raw world	Sample A	Sample B
LIC	42	29	0
LMC	55	35	53
UMC	45	28	45
Total	142	92	98

Appendix A lists the full raw world sample. Comparing the samples, I consider sample B to be a more representative sample. It contains countries that are more evenly spread out over different regions; sample A contains a large concentration of African countries and little European countries. Also, I agree with

[7] Montenegro, Serbia, Kosovo, West Bank and Gaza did not have regions assigned in the dataset. Europe and Central Asia were chosen for the first three, and Asia for the last country.
[8] In neither sample A or B, China or India did not happen to be present. They were not purposefully excluded.

Kim and Zhang (2023) on excluding low income countries. This paper focuses on countries that have emerging markets properties. Low income countries are not considered to be rapidly-growing, and have more stagnant properties. Therefore, in the main body of this paper, I deliberately only display the results for sample B. Still, in *4.1 Fixed effects panel regression*, I discuss the differences between the outputs of sample A and B.

4. Results

4.1 Fixed effects panel regression

Under the raw world sample, I use the specific-to-general method, adding possible explanatory variables gradually in each model. The interaction term is calculated by multiplying the difference of the means (Balli & Sørensen, 2013). The results can be viewed in table 5.

Table 5. Fixed-effects panel regression using spec-to-gen modeling (raw world)

	Dependent variable: Public capital flows					
	(1)	(2)	(3)	(4)	(5)	(6)
Economic growth	-0.292***	-0.245	-0.248^+	-0.497***	-0.505***	-0.539***
	(0.077)	(0.177)	(0.169)	(0.092)	(0.091)	(0.095)
Political stability		-0.010	-0.005	-0.015	-0.014	-0.010
		(0.019)	(0.019)	(0.020)	(0.020)	(0.021)
Econ~growth × pol~stability			-0.017^+	-0.007	-0.007	-0.009
			(0.011)	(0.011)	(0.011)	(0.011)
Log inflation				-1.142**	-1.020*	-1.046*
				(0.474)	(0.608)	(0.545)
Exchange rate volatility					-0.299	-0.028
					(0.565)	(0.531)
Log trade openness						-1.525
						(1.341)
Constant	1.688***	0.657	0.458	4.173***	3.905**	10.327*
	(0.143)	(0.741)	(0.761)	(1.448)	(1.702)	(6.076)
Obs.	964	570	570	550	547	478
R^2	0.039	0.001	0.002	0.010	0.010	0.007
F-Stat	14.34	1.47	3.04	8.8	7.7	6

Note: ^+p<0.15, *p<0.1, **p<0.05, ***p<0.01

I consider model 5 to be the preferred model. In model 6, log trade openness has a VIF of 28.45, signifying high multicollinearity with other variables (likely with the political stability variable as discussed in *3.2 Descriptive statistics*). It therefore cannot be included. Model 5 has a slightly better average VIF, of 2.25 compared to 2.40 for model 4. The full output of the VIF test can be inspected in Appendix C. Although there is a 0.56 correlation between the log of inflation and the exchange rate volatility, I will keep them both in the regression, since there is no evidence of high multicollinearity.

Furthermore, there is enough economic reasoning to include both as explanatory variables for public capital flows, as discussed in *3.1 Variables*. Table 6 shows the first-stage regression outputs for three different instrumental variables on the model, using sample B.

Table 6. First-stage output for different instruments (sample B)

	Dependent variable: economic growth		
	Age dependency instrument	Bartik instrument	Lagged economic growth instrument
Age dependency	0.018		
	(0.020)		
Bartik instrument		21.758***	
		(7.57)	
Lagged economic growth			0.830***
			(0.029)
Political stability	-0.016	0.003	-0.015*
	(0.026)	(0.017)	(0.008)
Age~depen × pol~stability	0.003		
	(0.003)		
Bartik × pol~stability		0.135	
		(0.931)	
Lagged~growth × pol~stability			0.002
			(0.005)
Log inflation	0.147	0.365	-0.002
	(0.511)	(0.644)	(0.190)
Exchange rate volatility	-1.672**	-1.379**	-0.175
	(0.798)	(0.574)	(0.271)
Constant	2.176	1.388	1.074
	(1.875)	(1.883)	(0.639)
Obs.	382	343	382
R^2	0.001	0.005	0.827
F-Stat	1.17	13.73	205.45

Note: ^+p<0.15, *p<0.1, **p<0.05, ***p<0.01

Both the Bartik (F-stat = 13.73) and lagged growth instrument (F-stat = 205.45) have a significant effect on economic growth at a 1% level. I consider a strong instrument to have an F-stat of above 10, and therefore age dependency (F-stat = 1.17) does not satisfy this criterion. To test the validity criterion, endogeneity tests[9] were performed. For the lag of economic growth, it yielded a p-value of 0.7155 and 0.0744 for the lagged and Bartik instrument respectively, meaning that for both, we cannot reject the null that the instrument is exogenous at a 5% significance level. However, further tests on the strength of the instruments show that the Bartik instrument is much weaker (Kleibergen-Paap rk LM stat[10] = 2.477;

[9] The endogeneity test is defined as the difference of two Sargan-Hansen statistics: *one for the equation with the smaller set of instruments, where the suspect regressor(s) are treated as endogenous, and one for the equation with the larger set of instruments, where the suspect regressors are treated as exogenous.*

[10] Cannot reject the null hypothesis of a weak instrument

Cragg-Donald Wald F stat[11] = 2.218; Kleibergen-Paap rk Wald F stat[12] = 1.331). There is statistical evidence that the first lag of economic growth is a much stronger instrument (Kleibergen-Paap rk LM stat[13] = 28.214; Cragg-Donald Wald F stat[14] = 238.480; Kleibergen-Paap rk Wald F stat[15] = 62.636). Table 7 shows the second-stage regression outputs.

Table 7. Second-stage output different instruments (sample B)

	Dependent variable: public capital flows			
	Without instrument	Age dependency instrument	Bartik instrument	Lagged economic growth instrument
	(1)	(2)	(3)	(4)
Economic growth	-0.526***	-3.537	-1.763^+	-0.503***
	(0.104)	(5.182)	(0.152)	(0.123)
Econ~growth × Pol~ stability	-0.014	0.003	-0.005	-0.014
	(0.024)	(0.065)	(0.021)	(0.024)
Political stability	-0.013	-0.085	-0.053	-0.015
	(0.012)	(0.229)	(0.016)	(0.016)
Log inflation	-1.822***	-1.292	-1.960**	-1.838***
	(0.611)	(1.877)	(0.693)	(0.616)
Exchange rate volatility	0.118	-5.093	-1.606	0.154
	(0.494)	(9.334)	(0.641)	(0.488)
Constant	5.792***	12.546	9.294**	5.771***
	(1.950)	(14.216)	(1.931)	(1.982)
Obs.	382	382	343	382
R^2	0.024	0.020	0.015	0.024
F-Stat	7.36			
Wald		1.88	12.08	30.72

Note: ^+p<0.15, *p<0.1, **p<0.05, ***p<0.01

As discussed prior in *3.3 Sample selection*, sample B was chosen as the preferred model. It is why the outputs displayed in the main body are concerning this sample only. Appendix D presents how sample A and B produced only slightly different outputs. It is clear that sample B has higher F-stats / Wald test scores, as well as higher R-squared values, supporting the use of this sample over the other.

Considering model 4, with the lagged economic growth instrument, to be the preferred model, economic growth has a significant negative correlation with public capital flows. As there is an increase of economic growth by one percent, a country faces an outflow of 503 million USD. There is no significant correlation between political stability or its interaction effect with public capital flows. The log of inflation has a significant negative effect on public capital flows, as there is an increase of one percent

[11] Value is below the threshold of 25 for very strong instruments
[12] Value is below the threshold of 25 for very strong instruments
[13] Rejects the null hypothesis of a weak instrument
[14] Value is above the threshold of 25 for very strong instruments
[15] Value is above the threshold of 25 for very strong instruments

of the log of the transformed inflation, there is a decrease of 1.838 million USD.

4.2 Private flows

I also test the model on private flows, since it is crucial in understanding the direction of flows in the Lucas Paradox. This is table 8.

Table 8. Private capital flows

	Dependent variable: private capital flows
Economic growth	0.551**
	(0.253)
Political stability	-0.011
	(0.042)
Economic growth × political stability	-0.034
	(0.026)
Log inflation	1.903*
	(1.069)
Exchange rate volatility	-3.115***
	(0.885)
Constant	0.901
	(3.747)
Obs.	376
R^2	0.016
Wald	68.92

Note: ^+p<0.15, *p<0.1, **p<0.05, ***p<0.01

Economic growth has a positive effect on private flows, aligning well with previous literature (Alfaro et al., 2014; Kim and Zhang, 2023). There is a significant effect of inflation on private flows: as prices surge, private capital flows in. As the economy becomes more volatile, private capital flows out. There is no effect of political stability.

4.3 Decomposition of net public capital flows

I decompose net public capital flows into PPG debt and reserve accumulation, to uncover the underlying drivers of net public flows. Table 9 shows the regression output.

Table 9. Decomposed public capital flows (FE, lagged growth instrument)

	Dependent variable		
	(1)	(2)	(3)
	Public capital flows	PPG debt flows	Reserve accumulation
Economic growth	-0.503***	-0.170***	0.284***
	(0.123)	(0.058)	(0.108)
Political stability	-0.014	-0.029*	0.027
	(0.024)	(0.015)	(0.053)
Econ~growth × pol~stability	-0.015	-0.010	0.001
	(0.016)	(0.008)	(0.013)
Log inflation	-1.838***	-1.359***	-0.328
	(0.616)	(0.451)	(0.731)
Exchange rate volatility	0.154	0.194	0.656
	(0.488)	(0.396)	(0.886)
Constant	5.771***	6.117***	0.502
	(1.982)	(1.377)	(1.778)
Obs.	382	392	416
R^2	0.024	0.004	0.049
Wald	30.72	41.80	11.16

Note: ^+p<0.15, *p<0.1, **p<0.05, ***p<0.01

From column 2, it is evident that there is a negative relationship between economic growth and PPG debt flows, as expected (see Hypothesis Ia, in *2.4 Adding political stability*). There is a negative effect of political stability on these flows: the more stable a country, the less PPG debt flows they receive. Still, there is no significant interaction effect found between political stability and economic growth. The plausible reasons for this are discussed in *5.1 Theories*.

Looking at column 3, concerning reserve accumulation, it is clear that there is a positive relationship between economic growth and reserve accumulation, as anticipated (see Hypothesis Ib in *2.4 Adding political stability*). There is no significant effect of political stability on these flows, neither as a moderator or by itself. This is further discussed in *5.1 Theories*. I continue by testing the decomposed models at a cross-sectional level, which can be viewed in table 10.

Table 10. Decomposed public capital flows (OLS, lagged growth instrument)

	Dependent variable		
	(1)	(2)	(3)
	Public capital flows	PPG debt flows	Reserve accumulation
Economic growth	-0.209**	0.038	0.211***
	(0.092)	(0.051)	(0.073)
Political stability	0.004	0.021***	0.018**
	(0.010)	(0.007)	(0.008)
Econ~growth × pol~stability	-0.002	-0.008	-0.013
	(0.015)	(0.008)	(0.016)
Log inflation	-0.830^+	-0.611^+	-0.358
	(0.558)	(0.391)	(0.522)
Exchange rate volatility	0.348	-0.234	0.267
	(0.629)	(0.459)	(0.762)
Constant	1.811	1.659^+	1.210
	(1.561)	(1.036)	(1.317)
Obs.	382	392	416
R^2	0.027	0.048	0.054
F-stat	2.31	9.13	3.78

Note: ^+p<0.15, *p<0.1, **p<0.05, ***p<0.01

At a cross-sectional level, it can be seen that economic growth has no effect on PPG debt flows, while it does have a significant positive relationship with reserve accumulation, as expected. Political stability has a positive effect on PPG debt flows and reserve accumulation, but not on a net public capital flow level. The possible reasons for this, and the lack of an interaction effect, is discussed in *5.1 Theories*.

4.4 Political regime

As an additional robustness check, I see what happens when the democracy index is used as a proxy for political stability.

Table 11. Decomposed public capital flows with the democracy index (FE, lagged growth instrument)

	Dependent variable		
	(1)	(2)	(3)
	Public capital flows	PPG debt flows	Reserve accumulation
Economic growth	-0.259^+	-0.049	0.230***
	(0.160)	(0.146)	(0.060)
Democracy index	-0.181*	-0.145*	0.034
	(0.110)	(0.078)	(0.055)
Econ~growth × dem~ index	-0.007	0.027	0.033
	(0.062)	(0.041)	(0.032)
Log inflation	0.376	0.675^+	0.515*
	(0.533)	(0.453)	(0.267)
Exchange rate volatility	0.145	-0.324	-0.593*
	(0.753)	(0.673)	(0.342)
Constant	0.444	0.202	-0.770
	(1.560)	(1.249)	(0.766)
Obs.	234	239	254
R^2	0.075	0.035	0.043
Wald	73.53	115.07	37.22

Note: ^+p<0.15, *p<0.1, **p<0.05, ***p<0.01

Including the democracy index and its interaction effect with growth, there is no influence of economic growth on PPG debt flows at a fixed-effects level. But there is a positive effect on reserve accumulation, as expected. The overall impact of growth on public capital flows is negative and significant at a 15% level.

There is a significant negative effect of the democracy index on PPG debt flows, and public capital flows. The more democratic a country, the lower these flows. The democracy index does have an effect on public capital flows while political stability does not (Table 9), which is rationalized in *5.1 Theories*. There is no relationship between the democracy index and reserve accumulation.

5. Discussion

5.1 Theories

This section tries to rationalize my findings. The most robust relationship discovered is the strong and positive influence of growth on reserve accumulation, supporting hypothesis Ia. As a developing country grows by one percent, the Central Bank is expected to reduce the volume of reserves by 284 million USD. This relationship holds both under the OLS model, and when using the democratic index as a measure of political stability. Hypothesis Ib can also be evaluated. I find that there is a negative effect of growth on public and publicly guaranteed debt, as anticipated, but only under the fixed-effects model. An increase in growth is related to a 170 million USD reduction in debt. At a cross-sectional level, there is no influence

of growth on PPG debt. It could suggest that the relationship is heavily influenced by time-invariant heterogeneity between the countries, something the FE model does control for, but OLS does not. This is supported by the finding that, when swapping the political stability variable with the political regime variable under the FE model, the significance of the growth-capital relationship disappears. The significant coefficient for political stability further demonstrates how it effectively captures the determinants of PPG debt, while the political regime alone does not. In general, I do suggest that there is a significant negative relation between growth and PPG debt, and political stability and PPG debt, but that time-invariant unobserved heterogeneity should be controlled for.

I further find that political stability does not influence reserve accumulation. This is likely due to Central Bank Independence. The Central Bank is not supposed to be affected by the political environment (De Haan & Eijffinger, 2016). As well as that the Central Bank aims at accumulating reserves under both good and bad economical-political conditions, as a precaution for financial crises (De Beaufort & Sondergaard, 2007). Under the OLS model, I do find a significant coefficient of political stability on reserve accumulation, but it could be that there is the presence of reverse causality, that reserve accumulation actually impacts the political environment instead of vice versa. De Beaufort & Sondergaard (2007) discuss how reserve accumulation is a by-product of the exchange rate policy. And that it can have negative effects on neighboring countries. It can lead to inflationary pressures, and protectionist actions by trading partners. They discuss how political authorities believe that no or only gradual currency appreciation of the currency is beneficial to maintaining internal political stability. Therefore, I suggest that political stability does not have an effect on reserve accumulation, but that it could be the reverse relation instead.

In none of the models I find an interaction effect between growth and political stability on public capital flows, also not on a cross-sectional level (Hypothesis II). It suggests that as countries undergo growth, there is no difference in the magnitude of public capital flows between politically stable and politically unstable countries. Although political stability and economic growth both have an influence on how much public debt a country has, I suggest that economic growth has a stronger effect on public debt, diluting the additional effect that political stability might have on this.

5.2 Limitations & future research

One of the very first findings of this quantitative analysis is that trade openness may not be a viable controlled variable in this context. In this section, I discuss the limitations of the controlled variables used. Trade openness and political stability are likely related to each other, from the correlation of 0.46, evident from the correlation matrix. The high VIF value associated with it as discussed in *4.1 Fixed effects panel*

regression also encourages this finding. Interesting is that we do not find a high correlation between the democracy index and trade openness, however, suggesting that the relationship between trade openness and political stability does not have to do with the political regime. This is backed by Grechyna (2021), who also finds that more political distortions are related to lower trade openness and a higher volatility of it, especially for developing economies. Forming trade links is more important for them than for developing countries. They argue that political polarization causes different parties with different views on international trade to choose different policies. And that there is always the threat of the opposition party to be chosen in the subsequent period, elevating volatility in the trade sector. Therefore, if political stability is included in the regression, trade openness should not be included at the same time. Inflation and exchange rate volatility remain as the controlled variables, for the reasons as described in *3.1 Variables*. But we could also critically consider these variables further. Timothy & Chigozie (2016) suggest there is a relationship between exchange rate volatility and inflationary pressures in Nigeria. Although there were no significant issues raised by the VIF test performed in this analysis, it could still introduce endogeneity issues, which should be considered in extended research.

Moreover, we can evaluate the use of the final instrument, the first lag of economic growth, instead of the age dependency ratio or the Bartik instrument. The main problem with the age dependency variable is the weakness of it. It is suspected that age dependency is not as strong of a predictor of economic growth, as the other variables described in the model of Solow (1956) for instance, since it captures the productivity element only indirectly. Alternatively, the Bartik instrument has great potential to be a suitable instrument, but it was likewise not strong enough. Multiple reasons could be underlying, but I suspect that the main issue deals with the calculation of it. It could be that the regions used were too large, and that instead, smaller regions should be used, so that the model describes countries being affected by its direct neighbors instead of the regions. Also, I selected only countries that contribute less than 10% of the regional GDP. Large countries were automatically removed, and this introduces a bias for only small countries. Lastly, the regional GDP was calculated by using information on the countries available in the dataset by Aflaro et al. (2014).

As further extensions to the method, apart from diving into the relationship between reserve accumulation and political stability, I suggest that more research is conducted on the difference between developing and developed countries. An attempt was made, which can be viewed in Appendix E, but since there was a lot of missing data, the outputs are not according to what one would expect, and are likely not valid. This paper also lacks a proper outlier analysis, while it was performed by Alfaro et al. (2014) for instance. I took 5-year averages, to smooth out disproportionate results, but this does not consider issues such as including or excluding China and India, which was a topic that was raised by other researchers (Alfaro et al., 2014; Gourinchas and Jeanne, 2013). Other metrics such as adopting a variable

for productivity catch-up, are also commonly used as proxies for economic growth since economic growth is highly influenced by productivity, as shown by the fundamental models by Robert Solow (Alfaro et al., 2014; Gourinchas and Jeanne, 2013; Solow, 1956). Due to its complicated calculation, this variable has not been utilized in this paper, but could be considered in further academic pursuits.

6. Conclusion

To conclude, this paper provides additional evidence for the existence of the Lucas paradox, and attempts to unravel the mechanism in which it occurs. I find that there is indeed a negative correlation between growth and public capital flows, while there is a positive relation between growth and private capital flows. This is driven by the reduction in public debt, and accumulation of reserves associated with higher rates of growth. Although there is evidence that political stability influences the amount of public and publicly guaranteed debt aggregated, there is no established effect of political stability on the amount of reserves accumulated by the Central Bank. Rather, it is argued that there might even be reverse causality: the amount of reserve accumulation is likely affecting political stability instead of vice versa.

It was hypothesized that political stability, when there is an economic downturn, could act as a buffer to reduce the inflow of public capital associated with it. I find that even though both economic growth and political stability affect public capital flows in developing countries, considering the relatively stronger growth-capital relation, the effect that political stability has on public debt is not strong enough to buffer the impact that a deteriorating economy could have on capital flows - there is no significant moderating effect found. I propose that economic growth is more important than political stability in determining these flows, and that political stability is not a key determinant that drives global imbalances. In this paper, I stress the importance of further researching the variables that affect public and publicly guaranteed debt, as well as reserve accumulation to elucidate the allocation puzzle.

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8. Appendices

Appendix A - Full sample list

Table 12. List of raw world countries with characteristics

Code	Country	Region	Income group	GDP share	Sample A	Sample B
AFG	Afghanistan	South Asia	LIC	0.01	0	0
AGO	Angola	Sub-Saharan Africa	LMC	0.04	1	1
ALB	Albania	Europe & Central Asia	LMC	0.00	1	1
ARG	Argentina	Latin America & Caribbean	UMC	0.11	1	1
ARM	Armenia	Europe & Central Asia	LMC	0.00	0	1
AZE	Azerbaijan	Europe & Central Asia	LMC	0.00	0	1
BDI	Burundi	Sub-Saharan Africa	LIC	0.00	1	0
BEN	Benin	Sub-Saharan Africa	LIC	0.01	1	0
BFA	Burkina Faso	Sub-Saharan Africa	LIC	0.01	1	0
BGD	Bangladesh	South Asia	LIC	0.07	1	0
BGR	Bulgaria	Europe & Central Asia	UMC	0.00	1	1
BIH	Bosnia and Herzegovina	Europe & Central Asia	UMC	0.00	0	1
BLR	Belarus	Europe & Central Asia	UMC	0.00	0	1
BLZ	Belize	Latin America & Caribbean	LMC	0.00	1	1
BOL	Bolivia	Latin America & Caribbean	LMC	0.01	1	1
BRA	Brazil	Latin America & Caribbean	UMC	0.35	1	1
BTN	Bhutan	South Asia	LMC	0.00	0	1
BWA	Botswana	Sub-Saharan Africa	UMC	0.01	0	1
CAF	Central African Republic	Sub-Saharan Africa	LIC	0.00	1	0
CHL	Chile	Latin America & Caribbean	UMC	0.04	1	1
CHN	China	East Asia & Pacific	LMC	0.23	0	0
CIV	Cote d'Ivoire	Sub-Saharan Africa	LMC	0.03	1	1
CMR	Cameroon	Sub-Saharan Africa	LMC	0.03	1	1
COG	Congo, Rep. (Brazzaville)	Sub-Saharan Africa	LMC	0.01	1	1
COL	Colombia	Latin America & Caribbean	UMC	0.05	1	1
COM	Comoros	Sub-Saharan Africa	LIC	0.00	1	0
CPV	Cape Verde	Sub-Saharan Africa	LMC	0.00	1	1
CRI	Costa Rica	Latin America & Caribbean	UMC	0.01	1	1
DJI	Djibouti	Middle East & North Africa	LMC	0.00	0	1
DMA	Dominica	Latin America & Caribbean	UMC	0.00	1	1
DOM	Dominican Republic	Latin America & Caribbean	UMC	0.01	1	1
DZA	Algeria	Middle East & North Africa	UMC	0.07	1	1
ECU	Ecuador	Latin America & Caribbean	LMC	0.02	1	1
EGY	Egypt	Middle East & North Africa	LMC	0.07	1	1
ERI	Eritrea	Sub-Saharan Africa	LIC	0.00	0	0
ETH	Ethiopia	Sub-Saharan Africa	LIC	0.03	1	0
FJI	Fiji	East Asia & Pacific	UMC	0.00	1	1
FSM	Micronesia, Fed. Sts.	East Asia & Pacific	LMC	0.00	0	1
GAB	Gabon	Sub-Saharan Africa	UMC	0.01	1	1
GEO	Georgia	Europe & Central Asia	LMC	0.00	0	1
GHA	Ghana	Sub-Saharan Africa	LIC	0.02	1	0
GIN	Guinea	Sub-Saharan Africa	LIC	0.01	1	0
GMB	Gambia	Sub-Saharan Africa	LIC	0.00	1	0
GNB	Guinea-Bissau	Sub-Saharan Africa	LIC	0.00	0	0
GRD	Grenada	Latin America & Caribbean	UMC	0.00	1	1
GTM	Guatemala	Latin America & Caribbean	LMC	0.01	1	1
GUY	Guyana	Latin America & Caribbean	LMC	0.00	0	1

HND	Honduras	Latin America & Caribbean	LMC	0.00	1	1
HTI	Haiti	Latin America & Caribbean	LIC	0.00	1	0
IDN	Indonesia	East Asia & Pacific	LMC	0.03	1	1
IND	India	South Asia	LMC	0.78	1	0
IRN	Iran	Middle East & North Africa	LMC	0.17	1	1
IRQ	Iraq	Middle East & North Africa	LMC	0.07	0	1
JAM	Jamaica	Latin America & Caribbean	UMC	0.00	1	1
JOR	Jordan	Middle East & North Africa	LMC	0.01	1	1
KAZ	Kazakhstan	Europe & Central Asia	UMC	0.00	0	1
KEN	Kenya	Sub-Saharan Africa	LIC	0.03	1	0
KGZ	Kyrgyzstan	Europe & Central Asia	LIC	0.00	1	0
KHM	Cambodia	East Asia & Pacific	LIC	0.00	1	0
KIR	Kiribati	East Asia & Pacific	LMC	0.00	0	1
KNA	St. Kitts and Nevis	Latin America & Caribbean	UMC	0.00	0	1
LAO	Lao PDR	East Asia & Pacific	LIC	0.00	0	0
LBN	Lebanon	Middle East & North Africa	UMC	0.01	0	1
LBR	Liberia	Sub-Saharan Africa	LIC	0.00	0	0
LBY	Libya	Middle East & North Africa	UMC	0.03	0	1
LCA	St. Lucia	Latin America & Caribbean	UMC	0.00	0	1
LKA	Sri Lanka	South Asia	LMC	0.02	1	1
LSO	Lesotho	Sub-Saharan Africa	LMC	0.00	0	1
LTU	Lithuania	Europe & Central Asia	UMC	0.00	1	1
LVA	Latvia	Europe & Central Asia	UMC	0.00	1	1
MAR	Morocco	Middle East & North Africa	LMC	0.04	1	1
MDA	Moldova	Europe & Central Asia	LMC	0.00	1	1
MDG	Madagascar	Sub-Saharan Africa	LIC	0.01	1	0
MDV	Maldives	South Asia	LMC	0.00	0	1
MEX	Mexico	Latin America & Caribbean	UMC	0.25	1	1
MHL	Marshall Islands	East Asia & Pacific	LMC	0.00	0	1
MKD	North Macedonia	Europe & Central Asia	UMC	0.00	0	1
MLI	Mali	Sub-Saharan Africa	LIC	0.01	1	0
MMR	Myanmar	East Asia & Pacific	LIC	0.00	0	0
MNE	Montenegro	Europe & Central Asia	UMC	0.00	0	1
MNG	Mongolia	East Asia & Pacific	LMC	0.00	1	1
MOZ	Mozambique	Sub-Saharan Africa	LIC	0.01	1	0
MRT	Mauritania	Sub-Saharan Africa	LIC	0.00	0	0
MUS	Mauritius	Sub-Saharan Africa	UMC	0.01	1	1
MWI	Malawi	Sub-Saharan Africa	LIC	0.00	1	0
MYS	Malaysia	East Asia & Pacific	UMC	0.01	1	1
NAM	Namibia	Sub-Saharan Africa	UMC	0.01	0	1
NER	Niger	Sub-Saharan Africa	LIC	0.01	1	0
NGA	Nigeria	Sub-Saharan Africa	LMC	0.23	1	1
NIC	Nicaragua	Latin America & Caribbean	LMC	0.00	0	1
NPL	Nepal	South Asia	LIC	0.01	1	0
PAK	Pakistan	South Asia	LMC	0.11	1	1
PAN	Panama	Latin America & Caribbean	UMC	0.01	1	1
PER	Peru	Latin America & Caribbean	UMC	0.03	1	1
PHL	Philippines	East Asia & Pacific	LMC	0.01	1	1
PLW	Palau	East Asia & Pacific	UMC	0.00	0	1
PNG	Papua New Guinea	East Asia & Pacific	LMC	0.00	1	1
POL	Poland	Europe & Central Asia	UMC	0.02	1	1
PRY	Paraguay	Latin America & Caribbean	LMC	0.01	1	1
RUS	Russian Federation	Europe & Central Asia	UMC	0.06	0	1
RWA	Rwanda	Sub-Saharan Africa	LIC	0.01	1	0
SDN	Sudan	Sub-Saharan Africa	LMC	0.04	1	1
SEN	Senegal	Sub-Saharan Africa	LIC	0.02	1	0

SLB	Solomon Islands	East Asia & Pacific	LMC	0.00	1	1
SLE	Sierra Leone	Sub-Saharan Africa	LIC	0.00	1	0
SLV	El Salvador	Latin America & Caribbean	LMC	0.00	1	1
SOM	Somalia	Sub-Saharan Africa	LIC	0.00	0	0
SRB	Serbia	Europe & Central Asia	UMC	0.00	0	1
STP	Sao Tome and Principe	Sub-Saharan Africa	LMC	0.00	0	1
SUR	Suriname	Latin America & Caribbean	UMC	0.00	0	1
SWZ	Swaziland	Sub-Saharan Africa	LMC	0.00	1	1
SYC	Seychelles	Sub-Saharan Africa	UMC	0.00	1	1
SYR	Syrian Arab Republic	Middle East & North Africa	LMC	0.02	1	1
TCD	Chad	Sub-Saharan Africa	LIC	0.01	1	0
TGO	Togo	Sub-Saharan Africa	LIC	0.00	1	0
THA	Thailand	East Asia & Pacific	LMC	0.02	1	1
TJK	Tajikistan	Europe & Central Asia	LIC	0.00	0	0
TKM	Turkmenistan	Europe & Central Asia	LMC	0.00	0	1
TON	Tonga	East Asia & Pacific	LMC	0.00	1	1
TUN	Tunisia	Middle East & North Africa	LMC	0.02	1	1
TUR	Turkey	Europe & Central Asia	UMC	0.02	1	1
TZA	Tanzania	Sub-Saharan Africa	LIC	0.02	1	0
UGA	Uganda	Sub-Saharan Africa	LIC	0.01	1	0
UKR	Ukraine	Europe & Central Asia	LMC	0.01	1	1
URY	Uruguay	Latin America & Caribbean	UMC	0.01	1	1
UZB	Uzbekistan	Europe & Central Asia	LIC	0.00	0	0
VCT	St. Vincent and the Grenadines	Latin America & Caribbean	UMC	0.00	1	1
VEN	Venezuela	Latin America & Caribbean	UMC	0.06	1	1
VNM	Viet Nam	East Asia & Pacific	LIC	0.01	0	0
VUT	Vanuatu	East Asia & Pacific	LMC	0.00	0	1
WSM	Samoa	East Asia & Pacific	LMC	0.00	1	1
YEM	Yemen, Rep.	Middle East & North Africa	LIC	0.01	1	0
ZAF	South Africa	Sub-Saharan Africa	UMC	0.30	1	1
ZMB	Zambia	Sub-Saharan Africa	LIC	0.01	0	0
ZWE	Zimbabwe	Sub-Saharan Africa	LIC	0.02	1	0
ASM	American Samoa	East Asia & Pacific	UMC	0.00	0	1
CUB	Cuba	Latin America & Caribbean	UMC	0.02	0	1
KSV	Kosovo	Europe & Central Asia	LMC	0.00	0	1
ROM	Romania	Europe & Central Asia	UMC	0.01	1	1
TMP	Timor-Leste	East Asia & Pacific	LMC	0.00	0	1
WBG	West Bank and Gaza	Middle East & North Africa	LMC	0.00	0	1
ZAR	Congo, Dem. Rep. (Kinshasa)	Sub-Saharan Africa	LIC	0.03	0	0
					92	98

Appendix B - Pre-transformation of variables

Table 13. Pre-transformation of variables statistics

	n	Mean	STD	Skewness	Kurtosis	Min	Max
Trade openness	975.00	72.73	36.73	1.27	6.42	1.28	305.24
Exchange rate[16]	1.09E+04	6.18E+05	6.44E+07	104.32	1.09E+04	0.00	6.72E+09
Inflation	963.00	31.41	172.88	10.67	131.00	-4.07	2.69E+03

Appendix C - VIF output

Table 14. VIF output for table 5

	VIF		
	(4)	(5)	(6)
Economic growth	1.96	1.99	2.08
Economic growth × Political stability	1.02	1.02	1.02
Political stability	3.05	3.09	4.96
Log inflation	3.56	3.99	19.94
Exchange rate volatility		1.16	1.16
Log trade openness			28.45
Mean VIF	2.40	2.25	9.60

[16] Exchange rate was transformed to exchange rate volatility before taking the 5Y averages.

Appendix D - Sample comparison

Table 15. Testing different instruments and samples (extension of table 6)

	Dependent variable: public capital flows							
	Without instrument		Age dependency instrument		Bartik instrument		Lagged economic growth instrument	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Sample A	Sample B	Sample A	Sample B	Sample A	Sample B	Sample A	Sample B
Economic growth	-0.464***	-0.526***	-14.477	-3.537	-0.966	-1.763^+	-0.429***	-0.503***
	(0.122)	(0.104)	(161.271)	(5.182)	(0.893)	(0.152)	(0.152)	(0.123)
Political stability	-0.012	-0.014	0.133	0.003	0.029	-0.005	-0.011	-0.014
	(0.020)	(0.024)	(1.592)	(0.065)	(0.053)	(0.021)	(0.021)	(0.024)
Econ~growth × Pol~ stability	-0.016	-0.013	-0.211	-0.085	-0.118*	-0.053	-0.020	-0.015
	(0.013)	(0.012)	(2.164)	(0.229)	(0.064)	(0.016)	(0.016)	(0.016)
Log inflation	-0.940	-1.822***	-2.864	-1.292	-1.475^+	-1.960**	-0.949	-1.838***
	(0.695)	(0.611)	(21.958)	(1.877)	(0.880)	(0.693)	(0.693)	(0.616)
Exchange rate volatility	0.039	0.118	-21.639	-5.093	-0.423	-1.606	0.095	0.154
	(0.636)	(0.494)	(251.487)	(9.334)	(1.215)	(0.641)	(0.641)	(0.488)
Constant	3.428*	5.792***	38.390	12.546	4.426	9.294**	3.323*	5.771***
	(1.872)	(1.950)	(403.454)	(14.216)	(4.169)	(1.931)	(1.931)	(1.982)
Obs.	407	382	407	382	373	343	407	382
R^2	0.012	0.024	0.010	0.020	0.011	0.015	0.012	0.024
F-Stat	3.53	7.36						
Wald			0.04	1.88	11.97	12.08	14.00	30.72

Note: ^+p<0.15, *p<0.1, **p<0.05, ***p<0.01

Appendix E - Developing vs. developed countries

Table 16. Developing vs developed countries

	Dependent variable: public capital flows			
	FE		OLS	
	(1)	(2)	(3)	(4)
	Developing	Developed	Developing	Developed
Economic growth	0.045	-0.644	-0.007	-0.183
	(0.533)	(0.544)	(0.386)	(0.222)
Political stability	0.104	0.059	0.156*	-0.039
	(0.121)	(0.177)	(0.092)	(0.072)
Economic growth × Political stability	-0.036	-0.214**	-0.028	0.066
	(0.053)	(0.106)	(0.035)	(0.072)
Log inflation	-0.462	-0.641	2.420*	-2.350
	(0.345)	(1.087)	(1.450)	(1.759)
Constant	-1.883	-0.869	-8.384^+	6.291
	(6.393)	(13.400)	(5.436)	(6.206)
Obs.	399	209	399	209
R^2	0.009	0.000	0.021	0.014
F-Stat			0.94	1.36
Wald	7.22	4.59		

Note: ^+p<0.15, *p<0.1, **p<0.05, ***p<0.01