Capital Flows to Developing Countries: the Allocation Puzzle

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Abstract

This paper looks whether the observed pattern of capital flows to developing countries is consistent with the predictions of the textbook neoclassical model of growth. The *prima facie* answer is no. Capital seems to flow more to the countries that invest less. We explore some possible explanations for this puzzle.

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1 Introduction

This paper first establishes, and then attempts to explain, a puzzle in the behavior of capital flows from developed to developing countries. Capital flows from rich to poor countries are not only low (as emphasized by Lucas, 1990), but their allocation across countries seems to be the opposite of the prediction of standard textbook theory. Capital does not seem to flow more to the countries that invest more in the way that a standard open economy growth model would predict.

A standard open economy growth model predicts that other things equal, a country that invests more should receive more capital inflows. This does not seem to be the case in the data. As shown in Figure 1 the average share of net capital inflows in GDP over 1980-2000 seems to be, if anything, negatively correlated with the investment-to-GDP ratio in a sample of 67 nonOECD countries.

To illustrate, Korea received virtually no net capital inflows although it invested one third of its GDP on average, while in Uganda net capital inflows exceeded investment (3.5 percent against 2.8 percent of GDP on average). Far from being outliers, Korea and Uganda are typical of the cross-country correlation between investment and capital inflows in Figure 1 (both countries are close to the regression line).

As we will show, Figure 1 is just one illustration of a range of results that point in the same direction and are difficult to explain in terms of a standard theory. If investment and capital flows were driven primarily by changes in domestic productivity (as suggested by the development accounting literature), the countries that invest more should receive more capital from abroad. Introducing an external credit constraint into the model can reduce the predicted size of capital inflows, but cannot make capital flow more towards the countries that invest less. Thus, explaining the puzzle requires more than a neoclassical growth model with credit frictions.

This puzzle is different from the Lucas puzzle, which is about the small size of capital flows. Our results are not inconsistent with the Lucas puzzle: as Figure 1 shows, capital inflows amount to a much smaller of GDP than investment on average (3.9 percent against 15.4 percent in our sample). We would argue that the small size of aggregate capital flows toward developing countries as a whole is not especially puzzling given the productivity growth rates in these countries. Indeed, we will show that a calibrated model can predict the order of magnitude of capital flows to developing countries pretty well without assuming a high level of financial friction.

Our puzzle is related to the *allocation* of the capital flows across developing countries rather than their overall level. Our calibrated open economy growth model predicts capital inflows to Asia that are much larger than those we observe in the data. Conversely, it predicts relative large capital *outflows* from Latin America and Africa. This rather provocative result reflects a straightforward implication of a standard open economy growth model: the countries whose productivity declines relative to the rest of the world should export, not impoet capital.

Another way of presenting our puzzle is as follows. A standard model can predict level of capital flows to developing countries as a whole that are small and close to the level observed in the data. However, such a model will predict level of capital inflows and outflows for individual countries that are much larger than in the data.

[Robustness to decomposition. To be added.]

[Implications. to be added.]

Our paper is related to different strands of literature. First, on the Lucas puzzle. Here our explanation is consistent with Lucas' original guess (capital flows to poor countries are low because these countries are not very productive). We are the first, to our knowledge, to quantify the level of capital flows to developing countries in a calibrated open economy growth model and compare it to the data.

Our model and calibration methods are close to the recent literature on "development accounting" (although we do not consider human capital explicitly). This literature has emphasized productivity growth as the main proximate cause of economic development (Hall and Jones, 1999; Caselli, others). This view has implications for the behavior of capital flows that have not been systematically explored in the literature (by contrast with investment, whose relationship with productivity is well understood and documented). Whether the observed pattern of capital flows to developing countries is consistent with the dominant theory of growth is an interesting question in its own right, and might teach us one lesson or two on the determinants of growth themselves.

Some recent papers have focused on the determinants of capital inflows to developing countries. Aizenmann et al (2004) construct a self-financing ratio indicating what would have been the stock of capital in the absence of capital inflows. They find that 90 percent of the stock of capital in developing countries is self-financed, and that countries with higher self-financing ratios grew faster in the 1990s. Manzocchi and Martin (1996) empirically test an equation for capital inflows derived from an open-economy growth model on cross-section data for 33 developing countries—and find relatively weak support.

Structure of the paper. Section 2 will compare the predictions of a simple open economy growth model and the data on capital flows. Section 3 will look at the extent to which the puzzle can be explained away by decomposing capital flows into public and private components, reserves accumulation, etc. Section 4 draws implications of our results for the research on growth and on international financial integration.

2 Capital flows to developing countries: theory and data

This section aims to provide a quantitative account of the pattern of capital flows to developing countries using a simple neoclassical model. To do so, we construct a measure of the capital flows associated with either initial capital scarcity, or a catch-up in domestic productivity. The focus is on long term capital flows, so the model abstracts from short term financial frictions and adjustment costs of physical capital that would influence the dynamics of capital accumulation but not the ultimate level of the capital stock.

2.1 Benchmark model

We consider a world with one homogeneous good and a number of countries. In this world, we focus on a subset of small and developing countries. Time is discrete and there is no uncertainty. The population N_t grows at an exogenous rate n that is country specific: $N_t = n^t N_0$. The population of each country can be viewed as a large family that maximizes the welfare function

$$U_t = \sum_{s=0}^{\infty} \beta^s \ N_{t+s} \ u\left(c_{t+s}\right), \tag{1}$$

where c_t is consumption *per capita* and $u\left(c\right) \equiv c^{1-\gamma}/\left(1-\gamma\right)$ is a constant relative risk aversion (CRRA) instantaneous utility function with coefficient $\gamma > 0$. In the case where $\gamma = 1$, the utility function is $u\left(c\right) = \ln\left(c\right).$

The domestic economy produces the homogeneous good according to the Cobb-Douglas production function

$$Y_t = K_t^{\alpha} \left(A_t L_t\right)^{1-\alpha},$$

where K_t denotes the stock of domestic capital, L_t is labor supply and A_t is a labor-augmenting measure of productivity. The labor supply is exogenous and proportional to population ($L_t = N_t$). Factor markets are perfectly competitive. Lastly, labor productivity grows at a gross rate $g_t \equiv A_t/A_{t-1}$, which may differ across countries in the short run but converges towards the same value for all countries.*

$$\lim_{t \to +\infty} g_t = g^*. \tag{2}$$

g^* represents the growth rate of the world productivity frontier A_t^*.

There are no frictions to the installation of capital. We assume that there is a distortion τ in the accumulation of capital, so that investors receive a fraction $(1-\tau)$ of the gross return on capital R_t, equal to $\alpha \left(K_t / \left(A_t L_t\right)\right)^{\alpha-1} + 1 - \delta$, where δ measures the depreciation rate. We call τ the 'capital wedge'. This wedge allows us to account for long run cross country differences in saving rates.†

Given the previous discussion, the country's budget constraint is:

$$n \ k_{t+1} + R^* d_t = n d_{t+1} + \left(1-\tau\right) R_t k_t + w_t A_t + z_t - c_t \tag{3}$$

*We assume further that $\beta n g^{*(1-\gamma)} < 1$ so that the utility is well defined.

†In order to focus on the distortive aspects of this wedge, we assume that the revenues per capita $z_t = \tau R_t k_t$ are rebated in lump sum fashion. Hence, we can interpret the wedge τ naturally as a tax on capital.

where d_t and k_t denote respectively external debt and physical capital per capita at time t and w_t is the wage per efficient unit of labor $(1-\alpha)\,\tilde{k}^{\alpha}$.

A country is characterized by an initial capital stock per capita k_0, a population growth rate n, an initial productivity A_0 together with a productivity path $\{A_t\}_0^{\infty}$, and a capital wedge τ. We use the model to estimate the size and the direction of capital flows following a financial liberalization.

Financial liberalization means that domestic investors can borrow and lend at the world interest rate R^*. We assume that the world interest rate coincides with the long-run growth adjusted discount factor $\beta^{-1}g^{*\gamma}$. This implies that financial integration does not 'tilt' consumption profiles in the long run. The domestic return on investment must equal the world real interest rate:

$$(1-\tau)\,R_{t+1} = R^*$$

Substituting the expression for the gross return on capital, this implies that the capital stock per efficient unit of labor $\tilde{k} = K/AL$ is constant:

$$\tilde{k}_{t+1} = \tilde{k}^* = \left(\frac{\alpha}{R^*/\,(1-\tau)+\delta-1}\right)^{\frac{1}{1-\alpha}} \tag{4}$$

Given our assumption on the world interest rate, the Euler equation for consumption implies that consumption per capita grows at the constant rate g^*. Finally, the initial level of consumption per capita c_0 is determined so as to satisfy the intertemporal budget constraint of the representative household.

2.1.1 Capital Scarcity and Convergence

Consider now the simple scenario where a country starts with an initial capital $\tilde{k}_0$ below the steady state level $\tilde{k}^*$, while productivity growth is constant and equal to g^*. Under financial autarky, the country would accumulate capital domestically, asymptotically reaching $\tilde{k}^*$. In the absence of financial frictions, the country will simply borrow $\tilde{k}^* - \tilde{k}_0^-$, the difference between the initial and steady states capital stocks:

$$\tilde{d}^c = \tilde{k}^* - \tilde{k}_0. \tag{5}$$

The model's prediction is extremely simple: external debt serves to close the capital gap. Notice that in this simple case, saving does not change since consumption adjusts immediately to its new permanent income level.

2.1.2 Productivity Catch-Up

Consider now a situation where the country is initially in steady state, so that $\tilde{k}_0 = \tilde{k}^*$, but experiences a productivity catch-up relative to the world productivity frontier A_t^* between time 0 and time T. To be more precise, suppose that productivity evolves according to:

$$\frac{A_t}{A_t^*} = \frac{A_0}{A_0^*} + x\frac{t}{T}\left(1 - \frac{A_0}{A_0^*}\right),$$

for $t \leq T$, after which the growth rate of domestic productivity goes back to g^*. The fraction x represents the fraction of the gap between A_0 and A_0^* that is eliminated in T years. When $x = 0$, the country maintains the same relative productivity. When $x = 1$, the country catches up to the world frontier in T years. Finally, when $x < 0$, the country experiences a relative productivity decline.

Define $\pi_t = A_t/A_0 g^{*t}$ as the ratio of the productivity trend to the trend without catch-up. We have,

$$\pi_t = \frac{A_t}{A_0 g^{*t}} = 1 + \frac{t}{T}(\pi - 1),$$

where $\pi = A_T/\left(g^{*T}A_0\right) > 1$ is the long-term level of π_t.

Solving forward the budget constraint (3), using $c_{t+1} = g^* c_t$, we find the initial consumption level per efficient unit of labor:

$$\tilde{c}_0 \equiv c_0/A_0 = (R^* - ng^*)\,\tilde{k}^* + \chi\left(1 - \frac{ng^*}{R^*}\right)\sum_{i=0}^{T}\left(\frac{ng^*}{R^*}\right)^i \pi_i + \chi\left(\frac{ng^*}{R^*}\right)^{T+1}\pi,$$

where $\chi = (1-\alpha)\,\tilde{k}^{*\alpha} + \frac{\tau}{1-\tau}R^*\tilde{k}^* > 0$.

From the the dynamic budget constraint (3), we can solve for the path of external debt d_t :

$$\widetilde{d}_{t+1} = \frac{1}{g^* n}\left[\frac{\pi_t}{\pi_{t+1}}R^*\widetilde{d}_t - \tilde{k}^{*\alpha}\frac{\pi_t}{\pi_{t+1}} + \frac{\tilde{c}_0}{\pi_{t+1}}\right] + \tilde{k}^*.$$

Substituting for $\tilde{c}_0$, the debt per efficient unit $\widetilde{d}_t$ stabilizes at:

$$\widetilde{d}^a = \tilde{k}^*\left(\frac{\pi - 1}{\pi}\right) + \chi\left[\frac{1}{R^* - g^* n}\left(1 - \left(\frac{ng^*}{R^*}\right)^{T+1}\right) - \frac{1}{R^*}\sum_{i=0}^{T}\left(\frac{ng^*}{R^*}\right)^i \frac{\pi_i}{\pi}\right].$$

$\widetilde{d}^a$ represents the net cumulated capital inflows and provides us with our second measure of the predicted capital flows, associated this time with a productivity catch-up.

There are a few things interesting to note about equation (**??**). First, as expected, $\widetilde{d}^a = 0$ if $\pi_t = 1$ for all t. There are no capital flows in the absence of productivity catch-up, since the economy remains in a steady state with zero external debt.

Second, if there is some productivity catch-up ($\pi > 1$) the first term on the right hand side of (**??**),

$$\widetilde{d}^i = \tilde{k}^*\frac{\pi - 1}{\pi}.$$

is positive. It represents the external borrowing that goes toward financing domestic *investment*. To see this, observe that since capital *per efficient unit of labor* remains constant at $\tilde{k}^*$, capital *per capita* needs to increase. Without the productivity catch-up, capital per capita at time T would be $\tilde{k}^* A_0 g^{*T}$. Instead, it is $\tilde{k}^* A_T$. The difference, $(\pi - 1)\,\tilde{k}^* A_0 g^{*T}$, corresponds to the first term. By contrast if $\pi < 1$ there is a capital outflow.

The second term on the right-hand-side of (**??**) represents the change in external debt brought about by changes in domestic saving. Faster productivity growth increases consumption today and so decreases saving. The domestic agent borrows on the international markets in order to sustain a higher level of consumption. Analytically, if $\pi_t < \pi$:

$$\widetilde{d^s} = \frac{1}{R^*} \sum_{i=0}^{T} \left(\frac{ng^*}{R^*} \right)^i \left(1 - \frac{\pi_i}{\pi} \right) > 0.$$

Note that a country in relative productivity decline ($\pi_t > \pi$) will tend to export capital because of consumption smoothing. The representative resident mitigates the relative decline in his future consumption by investing abroad.

It is important to emphasize that different theories have different implications for the aggregate relationship between saving and growth. In Modigliani's original life cycle model, faster growth increases aggregate savings by increasing the saving of richer young cohorts relative to the dissaving of poorer older cohorts. In the neoclassical growth model, faster growth tends to depress saving (consumption smoothing) while more saving will increase growth temporarily. The empirical literature does find that faster growth is associated with more saving, and the consensus view is that the causality runs from growth to saving (see Carroll and Weil (XX)) and not the reverse. We recognize that the implications of our benchmark model in terms of saving might not be robust. Hence, we would put less weight on the contribution of $\widetilde{d^s}$ than that of $\widetilde{d^i}$ in our prediction of capital flows. One can interpret $\widetilde{d^i}$ as the cumulated capital inflows that would arise in a model with a collateral constraint on international borrowing stipulating that capital inflows cannot exceed physical investment: $D_t - D_{t-1} \leq K_t - (1 - \delta)\, K_{t-1}$.

2.2 Predicted capital flows

The previous section discusses two components of predicted cumulated capital inflows: $\widetilde{d^c}$ in response to initial capital scarcity and $\widetilde{d^a}$ following a productivity catch-up. We quantify each component by calibrating the model using data from the Penn World tables (PWT). Table 1 reports the values of the parameters of the model. We assume that the U.S. economy remains on the world productivity frontier. Accordingly, we set $g^* = 1.012$, in line with U.S. long-run multifactor productivity growth. We also assume that the capital share is constant across countries, and equal to 0.3.[‡] We assume a rate of depreciation of physical capital equal

[‡]Recent estimates by **?** suggest that the capital share is roughly constant within countries, and varies between 0.2 and 0.4 across countries.

β	γ	α	δ_k	g^*
0.96	1	0.3	0.06	1.012

Table 1: Common parameters

to 6 percent per annum as in **?**. We also assume logarithmic preferences, with a discount factor of 0.96. Given these values, the world real interest rate is equal to $R^* - 1 = 5.42$ percent.

Our sample consists of an unbalanced panel of 79 non OECD countries between the 1970 and 2000. We first construct estimates of the capital stock per capital k_t using investment rates from PWT and a perpetual inventory method as in Bernanke and Gűrkaynak (2001). Given estimates of output per capita y_t from PWT, we infer the productivity level as $A_t = (y_t/k_t^\alpha)^{1/(1-\alpha)}$. Our measure of the catch-up in productivity π is constructed as $\exp(\ln \bar{A}_T - \ln \bar{A}_0)/g^{*T}$ where $\ln \bar{A}_t$ is obtained from a Hodrick-Prescott filter of $\ln A_t$. This filtering removes short term fluctuations in productivity.

We construct the steady state capital level $\tilde{k}^*$ from equation (4). The only unknown quantity in this equation is the capital wedge τ.

We construct an estimate of τ by observing that under perfect financial integration, the average investment rate to GDP is given by

$$\bar{s}_k = \frac{\alpha\left(\delta + n\bar{g} - 1\right)}{R^*/\left(1-\tau\right) + \delta - 1},$$

where $\bar{g}$ is the average growth rate of productivity over the period. When productivity growth is constant at g^*, this reduces to the usual formula for the investment rate in steady state: $s_k^* = \left(\delta + ng^* - 1\right)\tilde{k}^{1-\alpha}$. In our model, faster productivity growth increases the investment rate above s_k^*.

Inverting, we obtain the capital wedge as a function of the average investment rate and the average productivity growth rate:

$$\tau = 1 - \frac{R^*}{\alpha\left(\delta + n\bar{g} - 1\right)/\bar{s}_k + 1 - \delta} \tag{6}$$

We measure $\bar{s}_k$ as the average investment rate between 1970 and 2000, and $\bar{g}$ as the average gross growth rate of the Solow residual A_t [non-filtered?].

Our approach to constructing τ is valid if countries are perfectly integrated. When this is not the case, our estimates of the contribution of capital scarcity and productivity catch-up to capital flows are likely to be biased. To see in which direction the bias goes, assume that the saving rate is decreasing with capital scarcity. [CHECK WITH BARRO SALA-I-MARTIN: I think this is the case with logs, or perhaps it is constant then. Even better!!]

For a capital scarce country, the investment rate should be higher than in steady state. This would lead us to overerestimate the steady state capital stock, and overestimate the contribution to capital inflows due to both capital scarcity and productivity catch-up.

For a capital abundant country, the observed saving rate should be lower than in steady state. This would lead us to underestimate the steady state capital stock and the contribution of productivity catch-up, and overestimate the contribution of capital abundance to capital outflows.

Data on $\tilde{k}^*$ and π allow us to construct $\widetilde{d^a}$ and its components $\widetilde{d^i}$ and $\widetilde{d^s}$ according to (**??**), as well as $\widetilde{d^c}$ according to (5). One can also construct the increase in the capital stock predicted by the model. Table [] reports the regional totals, in billions of 1996 international dollars over the period 1980-2000. A few points are worth making.

First, the model does a very good job at predicting the increase in the capital stock over the period. The increase observed in the data, Δk^r, is remarkably close to the level predicted by the model, Δk^p, both in agrregate and across regions. This success may not come as a surprise, given that the productivity changes have been calibrated based on the changes in the capital stock in the data.

Columns 3 to 7 show how well the model performs in predicting capital flows. The model predicts that our sample of countries, taken as a whole, should have imported 2.34 trillions constant dollars, or 13 percent of the capital it accumulated during the period (see column d^t). The total level of capital flows predicted by the model is of the same order of magnitude as the level observed in the data (compare d^t and d^r). The model solves the Lucas puzzle, and furthermore provides an explanation for why the capital inflows should not be expected to be a large fraction of capital accumulation. On average, developing countries do not catch up with the US in terms of producitivity. Thus the productivity component is a small fraction of total capital flows (it is in fact negative, i.e., the model predicts a small capital outflow because of productivity changes). Most of the capital inflows are the result of initial capital scarcity, which is not a very large fraction of total capital accumulation.

The model performs much more poorly to explain the allocation of capital flows across regions. It predicts that Asia should have received much more capital inflows than it did in the data, while Africa and Latin America export capital. Our results point in the same direction whether or not we include the consumption smoothing component. If we exclude it (a reasonable assumption, given that it magnifies the flows to magnitudes that may seem implausible) we find that Asia should have imported 3.2 trillion dollars, that is 24 percent of its capital accumulation. By contrast, Latin America and Africa should have exported respectively 17 percent and 50 percent of their capital accumulation in capital outlows. This reflects a relative productivity decline in both regions (and initial capital abundance in Africa).

We look at the model's ability to predict capital accumulation and capital flows across countries (as opposed to across regions) by comparing the average to GDP ratios in the model and in the data (the metric we used in the introduction, see Figure 1). As shown in Figure [.], the model does a good job of explaining the average investment to GDP ratio. By

Predicted Capital Flows	Δk^r	Δk^p	b^r	b^c	b^a	of which:		b^t	b^{ti}	Obs.
(bn of 1996 intl' dollar)						b^i	b^s			
Non-OECD countries	16,758	17,036	-2,097	-2,445	104	218	-114	-2,341	-2,227	65
Low Income	3,232	3,383	-1,192	-608	-607	-22	-585	-1,215	-630	23
Lower Middle Income	8,523	8,024	-82	-666	-2,167	-387	-1,780	-2,833	-1,053	23
Upper Middle Income	2,749	2,943	-970	-788	4,044	1,027	3,018	3,256	238	14
High Income (Non-OECD)	2,254	2,687	148	-383	-1,167	-400	-766	-1,549	-783	5
Africa	884	935	-306	82	2,412	389	2,023	2,494	471	30
Latin-America	2,752	2,970	-1,318	-858	5,477	1,356	4,121	4,619	498	21
Asia	13,122	13,131	-473	-1,669	-7,786	-1,527	-6,259	-9,455	-3,196	14
except China and India	9,340	10,454	-2,280	-2,292	6,262	1,218	5,045	3,971	-1,074	63
China and India	7,418	6,582	183	-153	-6,159	-1,000	-5,159	-6,312	-1,153	2

Table 2: Predicted and Actual Capital Flows between 1980 and 2000, billions of 1996 international dollars.

contrast, Figure [.], which plots the data against the model prediction for the average capital inflow to GDP ratio, confirms how poorly the model does at explaining capital inflows. The regression coefficient is not only different from 1 but it is negative (significant at the 1 percent level). The capital flows predicted by the model are negatively correlated with the data.[§]

Figures [.] and [.] shed some light on the source of the discrepancy by looking at the relationship between capital inflows and productivity growth in the model and in the data. The calibrated model predicts a strongly positive correlation between average productivity growth and the average ratio of investment to GDP. This correlation is significantly negative in the data. Taken together, these two findings explain the paradoxical correlation shown in Figure 1 in the introduction. Countries with higher productivity growth have both a higher investment to GDP ratio and a lower capital inflows to GDP ratio. This is the opposite of the correlation predicted by the model.

(note: replace b by d and change the signs: to be done)

3 Decomposing capital flows

As a matter of accounting, the current account is a measure of the domestic savings that flow abroad. This savings flow, however, can take various and sometimes very different forms: FDI, aid and transfers, remittances, IMF loans, accumulation of reserves by the central bank, etc.. Can we identify flows that seem to account more than others for the puzzling allocation of capital flows across countries that we uncovered in the previous section? We present a methodology by which this question can be addressed, and then apply it to the available data.

Empirically, there are two (closely related) ways to proceed (closely related):

[§]This result is robust when one looks at the correlation between the model predicted values and the data inside regions.

1. establish the correlations between productivity growth and the average components of the flows as a share of GDP

2. establish the correlations between productivity growth and the cumulated levels of the different components

3.1 A Decomposition of capital flows

One distinction that we expect to be significant is whether the source and the recipient of the capital flow are public or private. Table 4 below decomposes capital flows into four components according to this criterion: public-to-public, public-to-private, private-to-public and private-to-private. The first upper index refers to the source, with p denoting the private sector and g denoting the governmental (or public) sector. The second upper index refers to the recipient sector with similar notations. For example, KF^{pg} denotes the volume capital flows going from foreign private investors to the domestic public sector. The change in reserves is included in the public-to-public category, since it is a change in the domestic government's (or central bank's) holdings of short-term claims on foreign governments.

Table 4.

		recipient	
		public	private
source	public	KF^{gg}	KF^{pg}
	private	KF^{pg}	KF^{pp}

We would expect the predictions of the textbook neoclassical model to apply the most to the capital flows in the private-to-private category (FDI, portfolio flows etc.). Capital flows that involve the government are a different story. For example, one would not necessarily expect the countries that have invested the most to be also those where the government has issued the largest quantity of debt abroad. Similarly, multilateral and bilateral loans do not necessarily go in priority to the countries that invest the most. Many of these loans are meant to finance productive investment in developing countries, but often giving some priority to the countries that have problems attracting the funds of private investors.

We use the balance-of-payments data available from the World Bank's Global Development Finance (GDF) data set. This data set covers 136 developing countries from 1970 to the present. The appendix explains in details how we estimate the different capital flow components based on the GDF data. One problem with the GDF data is that they are not netted of the foreign assets accumulated by the domestic public and private sectors. Hence, this data set does not provide a complete breakdown of the balance-of-payments equation (**??**). Nevertheless, this problem can be solved if we are willing to assume that the only foreign assets accumulated by the domestic public sector are foreign exchange reserves. Conditional on this assumption it is possible to derive the net flows to the private sector as a residual in

Capital Flows Components (bn of 1996 international dollar)	d^r	FDI	RES	KF^{pp}	KF^{pg}	KF^{gg}	KF^g	KF^p	Obs
Non-OECD countries	2,118	2,300	1,785	4,304	1,049	1,356	620	1,494	54
Low Income	1,088	137	326	413	153	649	476	612	20
Lower Middle Income	145	1,296	1,020	2,234	536	542	58	88	19
Upper Middle Income	977	797	273	1,458	353	129	210	763	14
High Income (Non-OECD)	-93	70	167	199	7	36	-124	31	1
Africa	281	69	113	185	41	244	173	108	22
Latin-America	1,268	808	232	1,455	387	202	356	908	20
Asia	569	1,423	1,440	2,664	622	910	91	477	12
except China and India	2,301	1,286	904	2,531	578	1,030	705	1,592	52
India	-183	1,014	882	1,773	471	326	-84	-98	2

Table 3: Predicted Capital Flows between 1970 and 2000, billions of 1996 international dollars.

the balance-of-payments equation. This gives us (by construction) an exact decomposition of the current account balance in terms of net flows to the domestic public sector and private sector. One drawback of this decomposition is that it contains no information about the source of the flows.

Note: we have

$$\begin{aligned} d^r &= -CA = KF^p + KF^g \\ KF^g &= KF^{pg} + KF^{gg} - RES \end{aligned}$$

4 Discussion

Depending on how far we go in explaining the puzzle with reserves and public capital flows, we might devote more or less effort to thinking about explanations that deviates more from the neoclassical model of growth, by making productivity endogenous. In particular,

- Could this be about export-led growth based on a depreciated real exchange rate? (Productivity growth is an increasing function of gross exports, and the current account is a byproduct of the depreciated real exchange rate. This could be tested by controling for the level of the real exchange rate.)

- Could this be an infant industry argument applied to the domestic financial sector? (Protection leading to development of domestic financial sector leading to increase in domestic productivity. One could try to control for a measure of financial protection.)

5 Concluding Comments

[to be completed]

APPENDIX

The GDF data

GDF reports gross capital flows. When it calls them “net” this just means that loans are net of repayments. But this is gross in the macroeconomic sense: it reports the accumulation of claims on residents by nonresidents, but not of claims on nonresidents by residents. Also, GDF includes only long-term credit flows with a maturity longer than one year.

The capital flows can be decomposed by originators and recipients as follows,

KF^{pp} =Foreign Direct Investment + Portfolio Equity Flows + Net Flows on Private NonGuaranteed (PNG) Debt

KF^{pg} =Net Flows on Public and Publicly Guaranteed (PPG) Debt from Private Creditors

KF^{gg} =Net Flows on PPG Debt from Official Creditors+ IMF Purchases -IMF repurchases.

GDF does not report flows from foreign public lenders to the domestic private sector (KF^{gp}). This is so even though some loans from the World Bank and regional development banks go to private borrowers, because these loans are publicly guaranteed and so fall in the PPG category.

FK^{gg} is close to the GDF concept of "official net resource flows", which is equal to net flows on PPG debt (official creditors)+Grants. The difference is that FK^{gg} does not include grants but includes IMF loans. The GDF concept of "private net resource flows" corresponds to $FK^{pp} + FK^{pg}$.

One problem with this decomposition is that it refers to gross flows. So these flows do not add up to the change in reserves minus the current account. This problem can be solved if one does the breakdown by recipient sector (and not by the sources), conditional on some assumptions. Let us denote by KF^g and KF^p the *net* flows to the domestic public and private sectors respectively. If one assumes that the only foreign assets that are purchased or sold by the domestic public sector are foreign exchange reserves, then the net flows to the public sector are equal to the gross flows minus the change in reserves,

$$KF^g = KF^{pg} + KF^{gg} - \Delta R.$$

The net flows to the domestic private sector can then be derived from the balance-of-payments equation,

$$CA_t + KF_t^g + KF_t^p = 0,$$

where the change in reserves does not appear because it is counted in KF^g.This equation can be used to estimate KF_t^p, using the data for the other variables in GDF.

GDF provides data expressed in current US dollars. These data must be converted into constant international dollars in order to be comparable to the Penn World Table data that we used to compute I, S and CA. IWe have to make an assumption on the relative price that we use to go from dollars to international dollars (both current). If the flows clearly refer to investment—for example to compute intertemporal FDI—we could use the price of investment.

Otherwise we have used the price of GDP, P (this is what we did for the difference between GNP and GDP in order to compute GNP). We also mentioned the possibility of taking a price of 1, i.e. assume that the values of the BOP components were the same in current international dollars as in current dollars (on the grounds that the current account relates to traded goods). The formula to convert current into international dollars is $E_t^{i\$} = 100E_t^{\$}/P_t$ in the first case, and $E_t^{i\$} = E_t^{\$}$ in the second one.

Then current international dollars have to be converted into constant ones. Here we could simply use the ratio of real to nominal GDP from the PWT. The conversion formula would be,

$$E_t^{ci\$} = \frac{RGDPL_t}{CGDP_t} E_t^{i\$},$$

where $E_t^{i\$}$ is the value in current dollars, $E_t^{ci\$}$ the value in constant international dollars, and $RGDPL_t$ and $CGDP_t$ are taken from the PWT.

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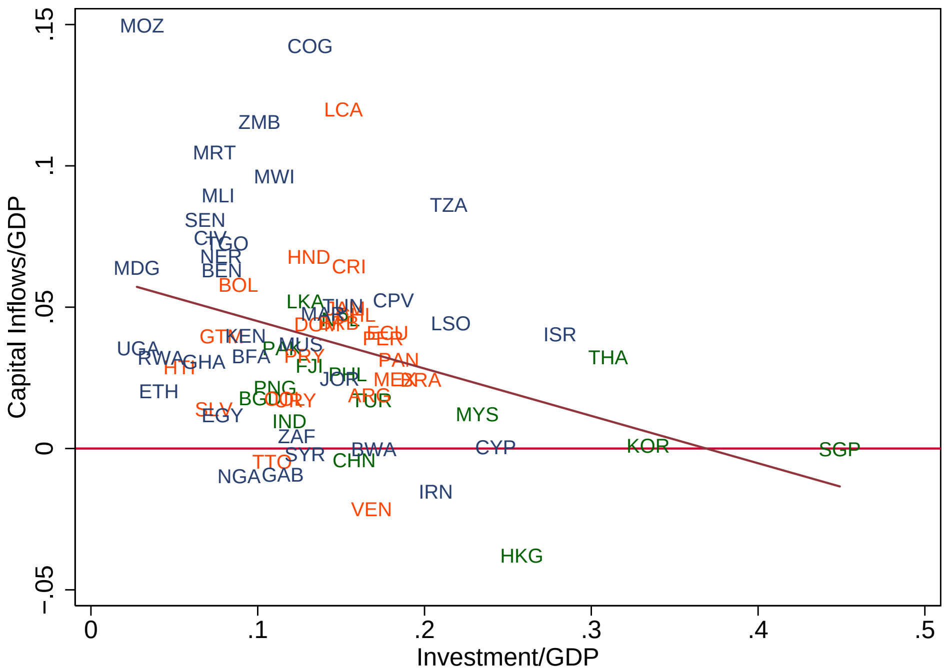

Figure 1: Capital Inflows and Investment Rates, relative to GDP, 1980-2000.

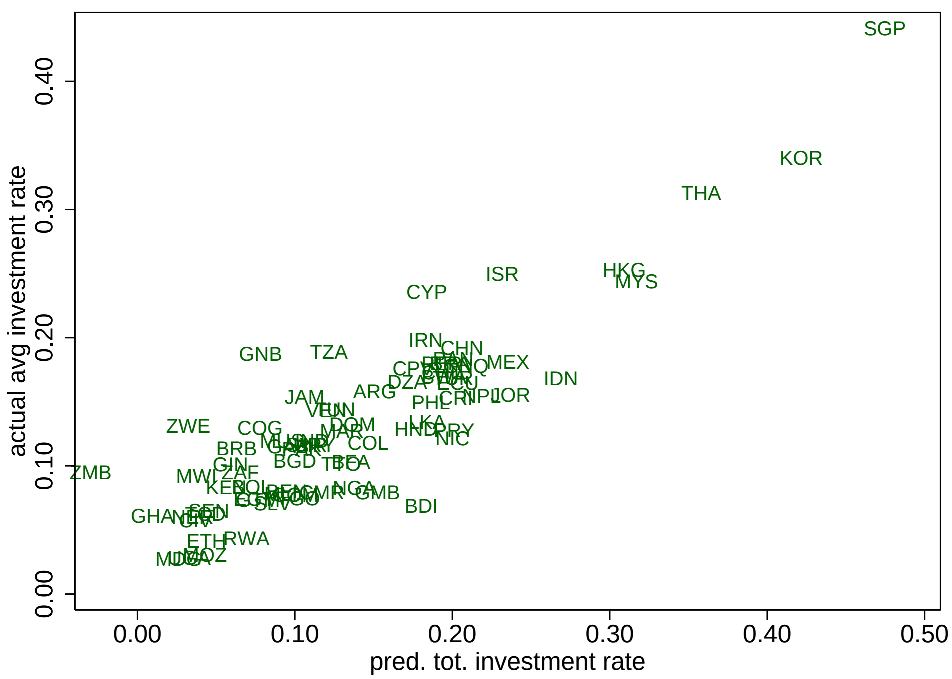

Figure 2: Actual and Predicted Total Investment/GDP rates, 1980-2000.

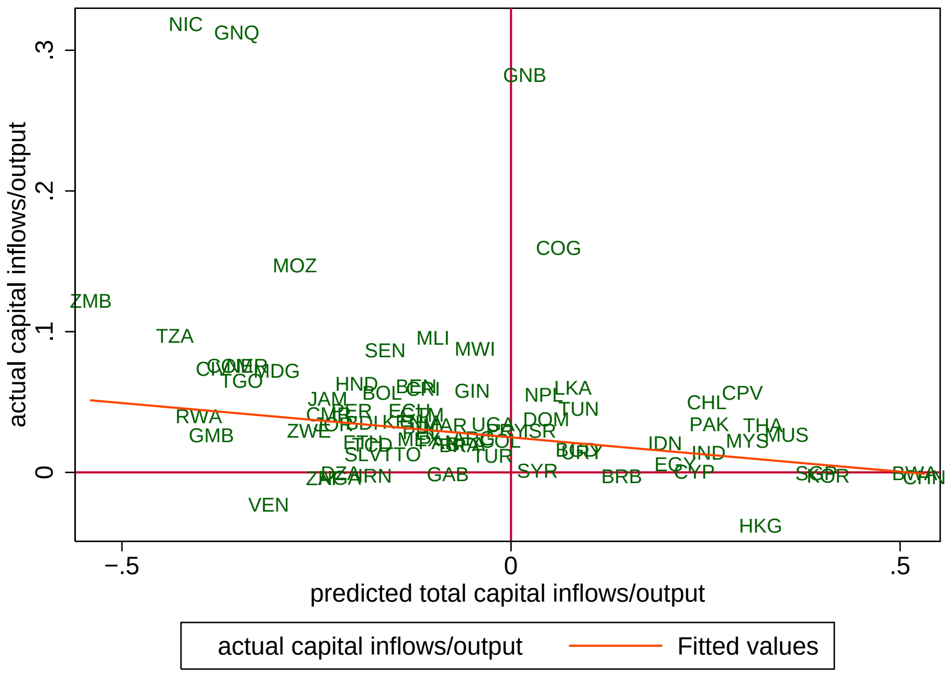

Figure 3: Actual and Predicted Capital Inflows/GDP, 1980-2000

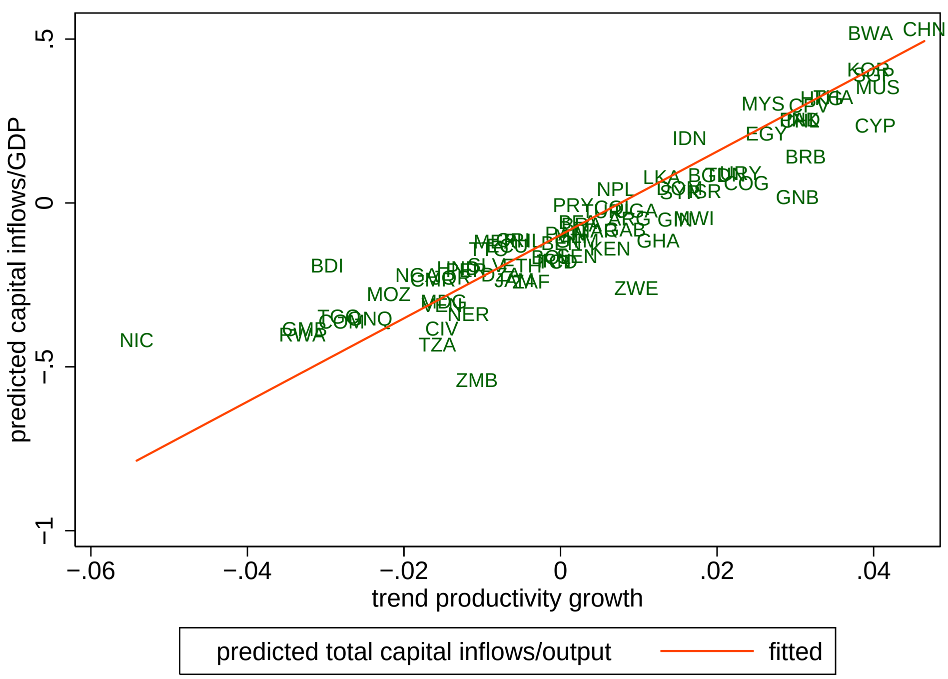

Figure 4: Predicted Capital Inflows/GDP agains Productivity Growth, 1980-2000.

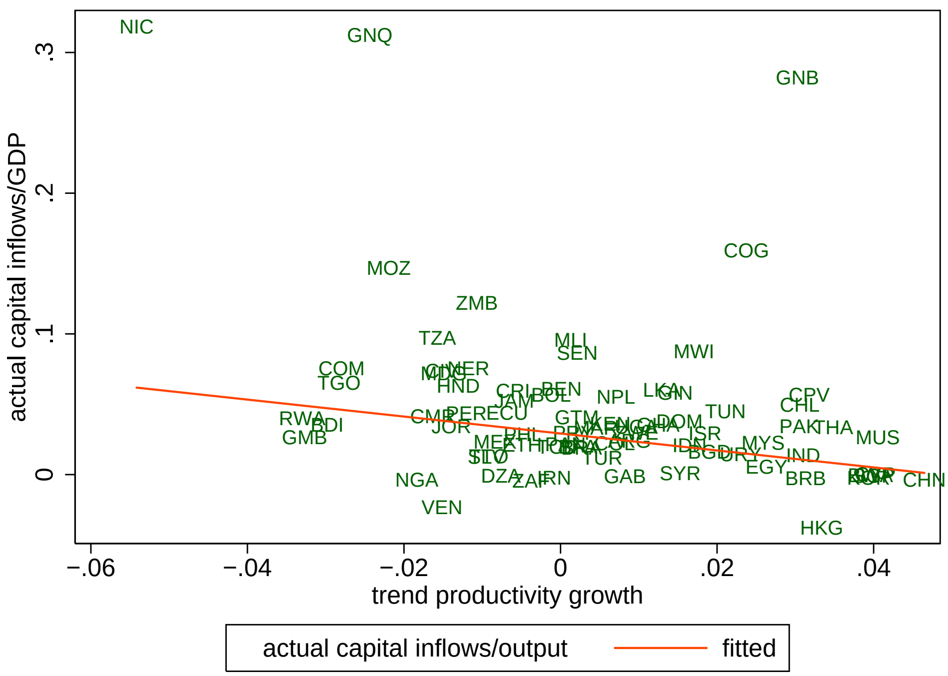

Figure 5: Actual Capital Inflows/GDP and Productivity Growth, 1980-2000