The Marginal Product of Capital, Capital Flows and Convergence

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This draft: February 2009

First draft: June 2007

Abstract

The neoclassical theory of economic growth suggests that capital inflows increase output because foreign financial capital is transformed into physical capital. This study quantifies the output gains from capital inflows by exploiting fluctuations in the price of investment relative to output. The theory predicts that capital inflows are positively correlated with the domestic price-adjusted return to capital. It also predicts that a fall in productivity in the investment good sector reduces the gains from capital inflows. In the empirical part, we find weak evidence that capital flows are driven by movements in return to capital. The gains from capital flows are found to be quite small.

Keywords: marginal product of capital; capital flows; convergence

JEL Classifications: F21, F43, O47

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1 Introduction

In the world of free capital mobility, capital flows from low-return to high-return locations. In theory, capital inflows are transformed to physical capital and increase output in the recipient countries. In the empirical literature, the effects of capital inflows on economic growth have been extensively investigated using cross-country growth regressions. However, these studies have been silent about the scale of the benefits from capital inflows.

This study proposes a new methodology to quantify the benefits from capital inflows. We derive the estimation equation from a small open-economy growth model with an incomplete asset market. There are two goods: consumption good and investment good, which is produced from the consumption good. The model has two key features. First, the investment good is assumed to be nontraded and produced from output, which is homogeneous across countries. Second, the country-specific price of investment is driven by exogenous shocks on productivity of the investment good sector. These two assumptions are motivated by the following stylized facts.

First, imported investment goods such as machinery occupy a small share in the aggregate investment expenditure.[1] This suggests that prices of investment goods are largely driven by fluctuations of price of nontraded investment goods such as structure. Second, the price of investment goods relative to output is volatile particularly in developing countries.[2] Third, fluctuations in the price of investment goods relative to output is largely driven by the price of investment goods, not the price of output.[3]

With fluctuations in price of investment, the return to capital in our model must be adjusted by the price of investment goods relative to output. This adjustment was also proposed by Caselli and Feyrer (2007) and Hsieh and Klenow (2007), which study differences in price of investment across countries. In the long run, capital mobility reassures that the domestic and foreign returns are equalized up to the financial frictions. In the short run, productivity shocks in the domestic investment good sector cause the domestic return to

[1] See Figure 1.
[2] See Figure 2.
[3] See Figure 3.

fluctuates and thus create reallocation of capital. Our model gives three main predictions concerning the dynamics of current account.

The first is about the direction of capital flows. Regardless of the long-run level of capital stock, positive productivity shocks in the investment good sector raise the return to capital trigger capital inflows. For this reason, high-income countries can attract foreign capital and benefit as recipients of capital flows. Thus, an improvement in productivity in the investment good sector offers an explanation why capital flows from low-income to high-income countries as in Lucas (1990). To the contrary, negative productivity shocks in the investment good sector lowers the return to capital trigger capital outflows. Hence, we can exploit data on both capital inflows and outflows to estimate the model-based correlation between capital flows and domestic return. The existing empirical studies, however, exploit only information about capital inflows in their estimation.

The second finding is related to the scale of capital inflows. The correlation between the scale of capital inflows and domestic return is theoretically decreasing in the productivity in the investment good sector. This prediction results from the nontradedness of the investment good. To be specific, imported financial capital is subject to the domestic technology when it is transformed into domestic physical capital. Hence, an improvement in efficiency in producing investment good reduces the quantity of imported financial capital for a given level of domestic capital.

The last finding is about the scale of gains from capital inflows. The gain from capital inflows in terms of output per worker is increasing in productivity in the investment good sector. Again, this is because foreign financial capital is subject to the domestic technology in the investment good sector. Improvements in efficiency then increases the quantity of physical capital financed by capital inflows and the eventual output of final good.

In the empirical part, we employ a panel of 47 countries from 1970 to 2003 to construct time series of country returns. The adjustment for price of investment goods roughly doubles the standard deviation of returns. That allows us to exploit the volatility of return to estimate the correlation between net capital inflows and changes in return. The estimation also takes into account possible shifts in the world return. Then, we use the predicted scale of capital inflows to compute the output gains from capital flows. This is because the theory suggests that capital inflows contribute to output growth when they are driven by fluctuations in return to capital. In theory, capital outflows also benefit households in the source countries by allowing them to reap higher return than the domestic return and increase consumption as a result. However, our study focuses on the impact of capital flows in the recipient countries.

We find weak evidence that in the capital inflows respond to movements in returns in the short run. In particular, banking flows are found to be positively correlated with the domestic return and negatively correlated with the world return, as predicted by the model. 42 out of 47 countries in our sample reap positive gains from the capital inflows. However, the inflows raise output by less than 1 percent over the entire period. The quantitative impact is actually in line with the estimate by Caselli and Feyrer (2007). The results contrast with the finding in Henry (2003). For all countries, gains from capital inflows are short-lived and no countries reap gains in all years in which they import capital.

Our study does not take into account potential gains through other channels such as risk-sharing in Obstfeld (1994) and Athanasoulis and van Wincoop (2000). We also abstract from a possibility that capital inflows may raise productivity in the recipient countries. In this aspect, ours is closely related to the work by Gourinchas and Jeanne (2006), who theoretically investigate the effect of capital inflows on convergence of a small open economy. However, their work is abstract from the price of investment goods and found that capital flows substantially increase output although the welfare gains are quite small.

The paper is organized as follows. The model is in the next section. Section 3 discusses the empirical methodology and results. Section 4 concludes.

2 Model

We first derive the investment demand function in a closed-economy growth model. The setup is similar to the Ramsey-Cass-Koopmans model. There are two goods: consumption and investment goods. The numeraire is the consumption good. The key feature is that the efficiency in transforming financial capital into physical capital exogenously changes over time. For this reason, the MPK is adjusted by the price of investment good. The return on capital is also influenced by fluctuations in the price of investment good. Henceforth we refer to the price of investment good simply as price, because it is the only price variable in our model. We abstract from uncertainty for simplicity. Then we extend the model to a multi-country world in which one international risk-free bond is traded, subject to financial frictions.

2.1 Closed economy

The production function is given by a Cobb-Douglas form.

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

K_t is the reproducible capital stock, A_t is the total factor productivity (TFP) and L is the labor input.

The households maximize their lifetime utility given by

$$U = \sum_{t=0}^{\infty} \beta^t \frac{C_t^{1-\gamma}}{1-\gamma}.$$

The households are also producers of the investment good. The investment good is produced from $1/\lambda_t$ units of the consumption good.

$$I_t = \lambda_t(Y_t - C_t)$$

With perfect competition in the investment-good market, the price of investment good relative to consumption is $P_t = 1/\lambda_t$. Hence, the production function of the investment good also defines the budget constraint for the households. Capital accumulation is given by:

$$K_{t+1} = (1-\delta)K_t + I_t.$$

The households choose C_t maximize their utility subject to their budget constant and the capital accumulation dynamics. The first-order condition or the Euler equation as follows:

$$C_t^{-\gamma} P_t = \beta C_{t+1}^{-\gamma} [F_k(K_{t+1}) + (1-\delta) P_{t+1}] \tag{1}$$

Define the real interest rate as the marginal rate of substitution of consumption between Periods t and $t+1$, $R_{t+1} = (C_t/C_{t+1})^{-\gamma}/\beta$. Thus, the Euler equation implies that the real interest rate and the return to capital are equal.

$$R_{t+1} = \alpha \frac{y_{t+1}\lambda_t}{k_{t+1}} + (1-\delta)\frac{\lambda_t}{\lambda_{t+1}}, \tag{2}$$

where $R_{t+1} = u_c(C_t)/(\beta u_c(C_{t+1}))$.

The return to capital is the sum between the MPK and the capital gain net of depreciation. The MPK is adjusted by the price, as in Caselli and Feyrer (2007). Define capital per effective unit of labor as $k_t = K_t/(A_t L_t)$. Then output per effective unit of labor is a function of capital per effective unit of labor, $y_t = k_t^{\alpha}$. Thus, the capital-output ratio $k_t/y_t = k_t^{1-\alpha}$. The first-order condition gives the planned level of future capital stock per effective unit of labor.

$$k_{t+1} = \left[\frac{\alpha}{R_{t+1}/\lambda_t - (1-\delta)/\lambda_{t+1}} \right]^{\frac{1}{1-\alpha}} \tag{3}$$

(3) and the capital accumulation give the investment per effect unit of labor:

$$i_t = gnk_{t+1} - (1-\delta)k_t \tag{4}$$

The investment demand has the following properties.

$$\frac{\partial i_t}{\partial R_{t+1}} = \frac{\partial i_t}{\partial k_{t+1}} \frac{\partial k_{t+1}}{\partial R_{t+1}} = -gn \left(\frac{k_{t+1}^{2-\alpha}}{\alpha(1-\alpha)\lambda_t} \right) \equiv \beta_t^R < 0 \tag{5}$$

$$\frac{\partial i_t}{\partial (1/\lambda_t)} = \frac{\partial i_t}{\partial k_{t+1}} \frac{\partial k_{t+1}}{\partial (1/\lambda_t)} = -gn \left(\frac{k_{t+1}^{2-\alpha} R_{t+1}}{\alpha(1-\alpha)} \right) < 0 \tag{6}$$

The investment is decreasing in the rental rate of capital, as in the standard models with investment. The new insight here is that the slope in Equation (5) is decreasing in the efficiency in producing the investment good, due to the effect of efficiency on the cost of capital. To rent one unit of capital, the user of capital demands one unit of investment good or $1/\lambda_t$ units of consumption good. Therefore the effective cost per unit of capital is R_{t+1}/λ_t. As a result, a fall in the efficiency raises the effective cost of capital besides raising the price of investment good. The multiplicative effect of price of investment good on the rental rate then raises the sensitivity of investment the rental rate.

The other insight is that a fall in the efficiency shifts the investment curve downward, according to Equation (6). This is because low efficiency reduces the MPK. This mechanism thus produces a negative correlation between investment and price of investment good.

In equilibrium, the goods markets clear and thus the saving rate is equal to the investment rate. In the long run, the return on capital is determined by the growth rate of consumption. Suppose that the TFP grows at the gross rate g and the population grows at the gross rate n in all countries. In the steady state, output and capital stock per effective unit of labor are constant. Thus, output, capital stock and consumption grow at the rate gn. The Euler equation gives the steady-state gross real interest rate, $R_T = (gn)^\gamma/\beta$, where the subscript T denote the steady state.

Then Equation (3) gives the steady-state capital stock per effective unit of labor, $k_T = [\alpha\lambda_T/(R_T - 1 + \delta)]^{1/(1-\alpha)}$. Although the long-run return is common, cross-country differences in the capital share and in efficiency create differences in the capital stock. The countries producing the investment goods efficiently have higher income per capita, all else equal.

2.2 Open economy

Assume that the domestic output and output in the rest of the world is homogeneous. The international asset market is incomplete, and every household can issue the real one-period bond paying the gross real interest rate $R^\star_{t+1}$. There are domestic financial frictions τ $(0 < \tau < 1)$. When the domestic residents buy the bond, they receive the gross interest rate $(1-\tau)R^\star_{t+1}$. When the domestic residents sell the bond, they pay the gross interest rate

$(1+\tau)R^{\star}_{t+1}$. Hence, in equilibrium:

$$R_t = \phi R^{\star}_t, \tag{7}$$

where $\phi = 1-\tau$ for lenders and $1+\tau$ for borrowers. Let f_t be the net capital inflows per unit of effective labor, and its negative value represents net outflows. Denote savings per effective unit of labor by s_t. The output market clearing condition requires that the current account deficit is financed by capital inflows as follows.

$$f_t = \frac{i_t}{\lambda_t} - s_t \tag{8}$$

We can rescale the scale of capital inflows with output per effective unit of labor as follows.

$$\left(\frac{f}{y}\right)_t = \left(\frac{i}{\lambda y}\right)_t - \left(\frac{s}{y}\right)_t, \tag{9}$$

where (f/y) is the capital-flows-to-GDP ratio, $(i/(\lambda y))$ is the investment rate and (s/y) is the saving rate. Denote the steady state variable by $\bar{x}$.

In the short run, the world is subject to country-specific exogenous changes in efficiency in the investment good sector. Define percentage deviation from the steady state as $\hat{x}_t = (x_t - \bar{x})/\bar{x}$. With $k_t/y_t = k_t^{1-\alpha}$, (5) and (7), we can transform (9) to percentage deviations:

$$\widehat{(f/y)}_t = \frac{1}{\mu_t \lambda_t}\widehat{R}_{t+1} - \widehat{(s/y)}_{j,t} \tag{10}$$

where

$$\mu_t = \frac{\lambda_t}{gn}(k/y)_t^{\frac{\alpha}{1-\alpha}}(k/y)_{t+1}^{-\frac{2-\alpha}{1-\alpha}}$$

Short-run deviations of capital flows from the steady state now depend on the distance between the current and future capital stock summarized in μ_t. If the capital stock is far below its the steady state, it receive large volume of inflows, due to the diminishing return property of the production function. This economy will then increase output as it converges back to its steady state, in which output and consumption are higher than when the price shocks arrive. In contrast, the economy will export capitals if its capital-output is higher than the steady state. In the economy exporting capital, output falls due to capital outflows. However, such an economy reap gains from capital outflows through higher return on capital and thus higher consumption and welfare.

Equation (10) illustrates three effects of efficiency in the investment good sector on the dynamics of capital flows. The first effect is the direct multiplier effect on the domestic return, which is captured by $_t$. For borrowers, low efficiency implies importing large volume of foreign output for a given level of investment. For lenders, for a given level of investment low efficiency reduces the supply of output for lending to the rest of the world. For these reason, a rise efficiency in transforming financial capital reduces the volume of capital flows.

The remaining two effects of efficiency are embedded in other variables. One is its effect on the slope of investment demand in the coefficient μ_t. The other one is its effect on the MPK and capital gains in R_{t+1}. These effects have been discussed in the previous section.

In this study, we focus on quantifying the gain from capital inflows in the recipient countries. The impact of capital inflows on the output can be computed as η_t,

$$\eta_t \equiv \frac{\partial \Delta (k/y)_{t+1}}{\partial (f/y)_t} d(f/y)_t \left(\frac{\alpha}{1-\alpha} \right). \tag{11}$$

The first ratio in (11) is the percentage change in the capital-output ratio caused by capital inflows in each period. The second ratio is the elasticity of output per worker with respect to capital-output ratio. [4] Consequently, η_t measures the growth rate of output per worker caused by capital inflows. From (10),

$$\eta_t = \left(\frac{(f/y)_t - \overline{(f/y)}\lambda_t}{gn(k/y)_t} \right) \left(\frac{\alpha}{1-\alpha} \right) \tag{12}$$

The output growth rate depends negatively on price of the investment good, because foreign financial capital is subject to the domestic technology in the investment-good sector. The gains from capital flows also depend on the current level of capital stock. Countries reap

[4] $\Delta ln\left(\frac{Y}{L}\right)_t = \Delta ln A_t + \frac{\alpha}{1-\alpha} \Delta ln \left(\frac{k}{y}\right) t$

large benefits when they are far from their steady state due to diminishing returns.

Admittedly, our one-final-good model ignores the potential benefits from cross-sector differences in the return on capital. In a multi-sector world, countries can specialize in different set of goods and reap gains from cross-investing in each other. However, we do not have the industry-level data on capital flows and capital shares. For this reason, our model is constructed with a goal to evaluate the gains from capital flows at the aggregate level.

2.3 Estimating equation

We can write μ_t as a function of observables.

$$\mu_t = \frac{I_t}{K_{t+1}} \left[\left(\frac{IP}{Y} \right)_t \left(\frac{K}{Y} \right)_{t+1} \right]^{-1}$$

We multiply Equation (10) by μ_t to obtain the estimating equation.

$$\widehat{(f/y)}_t \mu_t = \gamma_1 \frac{\hat{R}_{t+1}}{\lambda_t} + \gamma_2 \widehat{(s/y)}_t \mu_t + v_t \tag{13}$$

where $\gamma_1 = (\alpha(1-\alpha))^{-1}$, and $\gamma_2 = 1$.

3 Empirics

3.1 Data

To calculate the return to capital, we need data on capital stock, the share of capital in output and a measure of productivity in the investment sector. We employ data of 47 countries from 1970 to 2003. Our sample is limited by the availability of the capital share data from Caselli and Feyrer (2007). Their paper employs capital share data for 1996 for a sample of 47 countries. They employ the "'correct"' capital share which accounts for two things. One is the use of natural capital (from the World Bank) and the second is the true labor share (Bernanke and Gurkaynak (2001)). Since our paper focuses on the rate of conversion of financial flows to reproducible capital, it is crucial that our measure of the share of reproducible capital is as accurate as possible. Accounting for the natural capital share in total capital reduces the estimates of the share of reproducible capital. The labor share computed uses the methodology in Gollin(2002). Since the capital share data are available only for 1996, we assume constant capital shares over time. Although Jones (2003) argues that the capital shares are not constant, his data are not publicly available.

The capital stock is computed from the investment data in the Penn World Tables (PWT) Version 6.2 with perpetual inventory method at the 6-percent depreciation rate. The measure for output is the PPP dollar output in the PWT. The investment data we thus compute is measured in PPP dollars in terms of the output. To measure the efficiency in producing investment goods, we use the inverse of its relative price. This is the ratio between the domestic price of investment goods and that of output in the PWT.

Note that we use market risk-free interest rate as the measure of the world return. To be specific, we use 1-year U.S. treasury bill rate adjusted by inflation. Both series are from the international financial statistics (IFS). Financial flows series are also from the IFS. We exclude the public flows from our measures.

We display the summary statistics of net returns in Table 1. Each column displays the 34-years average, standard deviation, minimum, maximum and the contribution of capital gain into the overall variance of return, respectively.[5]

There are three main characteristics of returns in the Table. First, returns in developing countries are much more volatile than those in developed countries. The pattern is consistent with previous studies of real interest rate using data on financial return and expected inflation such as Neumeyer and Perri (2005). Second, the volatility of returns are predominantly driven by fluctuations of investment goods for all countries except for Korea, Spain, Jordan and Malaysia.

Finally, the U.S. average return is 6.5 percent and not necessarily much highest among industrialized countries. It ranks the 16th out of 22 industrialized countries. It is still below Ireland, Netherlands, Israel, Singapore and Korea. In this aspect, our finding is similar to that in Curcuru, Dvorak and Warnock (2007) rather than Gourinchas and Rey (2005). The

[5]The contribution of capital gain is calculated as $var((1-\delta)P_t/P_{t-1}-1)/var(R_t-1)+cov((1-\delta)P_{t+1}/P_t, MPK)/var(R_t-1)$.

highest average return is 10 percent in El Savador. The lowest average return is -0.19 in Burundi.

Figure (3) displays the variance decomposition of year-on-year change in the logarithm of the price of investment goods relative to output, into what is driven by fluctuations in the price of investment good and those in the price of output. There is no clear pattern of variance decomposition for the country in which the relative price of investment goods is quite stable. However, for the countries in which the relative price is quite volatile, the share of price of investment goods in the variance decomposition mostly exceeds 50 percent. This pattern confirms that the source of fluctuations are in the investment good sector, not the output sector.

3.2 Empirical strategy

Although two coefficients in (13) are country-specific, estimating country parameters will limit the observations to the number of sample years. For this reason, we assume that the parameters are common across countries and work with a panel of 47 countries which covers the years 1970-2003. Since our panel is unbalanced due to missing observations of capital flows data, we subject the dependent and explanatory variables in (13) to the Fisher unit root test. We reject the hypothesis of unit root for all variables.

To avoid the endogeneity problem in (13), we proxy the explanatory variable with its one-period lagged variables. This is the same as assuming that the investors have adaptive expectations. In addition, we allow for the possibility that there are shifts in the world return. We calculate the world return as the real return on 10-year U.S. Treasury bill, by subtracting the inflation rate from the annual rate of return. The shocks on the world return is also subject to the multiplicative effect of efficiency in the investment good sector. Eventually we estimate the following equation.

$$\widehat{(f/y)}_t \mu_t = \gamma_0 + \gamma_1 \widehat{R_t P_{t-1}} + \gamma_2 \widehat{R_t^\star P_{t-1}} + \gamma_3 \widehat{(s/y)}_t \mu_t + v_t \tag{14}$$

Theoretically, $\gamma_1 > 0, \gamma_2 < 0$ and $\gamma_3 < 0$. The standard errors in our regression are robust to heteroskedasticity within-country correlation of errors.

The unique feature of our model is that fluctuations in the efficiency in producing investment good cause countries to switch from exporters of capital to importers, and vice versa. To focus on the output gains from capital inflows, we apply some criteria to obtain "model-consistent" gains. The calculated output gains are considered "model-consistent" if all of the following conditions are satisfied. First, the model predicts capital inflows, not outflows. This is because the model-based output gains are a function of inflows only. Second, actual flows data also indicate capital inflows.

3.3 Estimation results

Table 2 shows coefficient estimates. The coefficient of the return terms are both significant and has the same sign as predicted by the model for only banking flows. For portfolio flows, the coefficient of the domestic return is significant but its sign contradicts the model. Overall, we find weak evidence that capital inflows respond to the fluctuations of return to capital. It is reasonable that the evidence is present only in the case of banking flows, since our model features only one asset and abstracts from portfolio diversifications.

As a sensitivity analysis, we remove the adjustment by μ_t suggested by model and re-estimate the coefficients. The results are tabulated in Table 3. The dependent variable is the capital-flows-to-GDP ratio. We find that only the estimated coefficient of the world return is significant in the banking flows equation. The scale of the estimates are markedly different. This is due to the fact that μ_t are very small numbers.

Next, we report the model-consistent gains from bank inflows for the countries and years in which bank inflows took place in Table 4. The table report the number of years with net inflows in Column 1, consistent gains in Column 2, and the total output gains over such years in Column 3. The reported gains are "consistent" with the model when (1) the sign of predicted flows are positive; and (2) the sign of the actual flows are positive.

The unit of gains is percent of output per worker. For all countries, the gains from inflows are short lived. No countries reap gains in output over all years with net inflows. Consistent with the model, both low-income and high-income countries reap gains from capital inflows, although the scale is extremely small. No countries reaps more than 1 percent increase in output per worker.

Finally, we report the gains calculated from the coefficients estimated by the reduced-form equation in Table 5. Evidently, the gains appear much larger than the gains obtained from the model-based estimation. Still, the gains are still below 1 percent for most countries.

Our finding are in line with the study by Caselli and Feyrer (2007) who find virtually no gains from reallocating capital to equalize return across countries when the MPK is adjusted by price. The related study by Henry (2003) finds that output per worker rises by 2.3 percent over 5 years after some episodes of stock market liberalization. Alfaro and Hammel (2007) find that financial liberalization increases imports of investment goods and raises the TFP and output per worker by 0.22 percent. In the calibration exercise by Jeanne and Gourinchas (2006), capital inflows raises output per worker by 1-4 percent per year, assuming that takes 5 years to converges to the long run. That implies 5-20 percent increase in output over the transition periods. Although Jeanne and Gourinchas (2006) finds much larger output gain than us, they argue that the welfare gain is not necessarily large.

These studies also emphasize the temporary nature of gains from capital inflows, from the one-time reduction in the frictions in international capital markets. In our study, the mechanism is the cyclical nature of the return to capital which can occur long after financial liberalization. In theory, ones can argue that fluctuations of return can also rise from shocks on total factor productivity, not necessarily shocks on efficiency in producing investment goods in our model. However, the point of our study is to demonstrate that volatility of price of investment goods in the data offers a way to measure the model-based scale of capital inflows.

4 Concluding remarks

Our study sheds light on a classic question on what drives capital flows, and whether capital flows are beneficial. We confirm the new insight in our model with the empirical evidence, that fluctuations in the price of investment goods allow both high- and low-income countries to benefit from capital inflows. We found a number of developed and developing countries to benefit from capital inflows, although the gains are quantitatively small for most countries.

That raises a question why capital flows, particularly bank flows, do not benefit a large number of countries. Based on our model and the studies by Jones (1994), Hsieh and Klenow (2007), the answer is in the price of investment goods. While Jones (1994) view high prices of investment goods in developing countries as a result of frictions in capital market, Hsieh and Klenow (2007) view them as a result of efficiency in the investment-good sector.

Since our study exploits time series variations in the price of investment goods, our methodology and results support the efficiency view. It is rather implausible that frictions in the capital market fluctuate at annual frequency. Another factor, which is outside our model, in the role of market structure in markup variations in the investment-good sector.

The level of financial development is likely to play a role. For instance, Mendoza, Quadrini and Rios-Rull (2007), argue that asymmetry in financial development can influence composition of assets demanded and leave developing countries worse off after financial liberalization. Although our model cannot identify the channel in their study, due to the absence of financial assets, our results seem to support their notion that most developing countries do not necessarily reap gains from capital inflows.

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Figure 1: Share of imported machinery in domestic investment

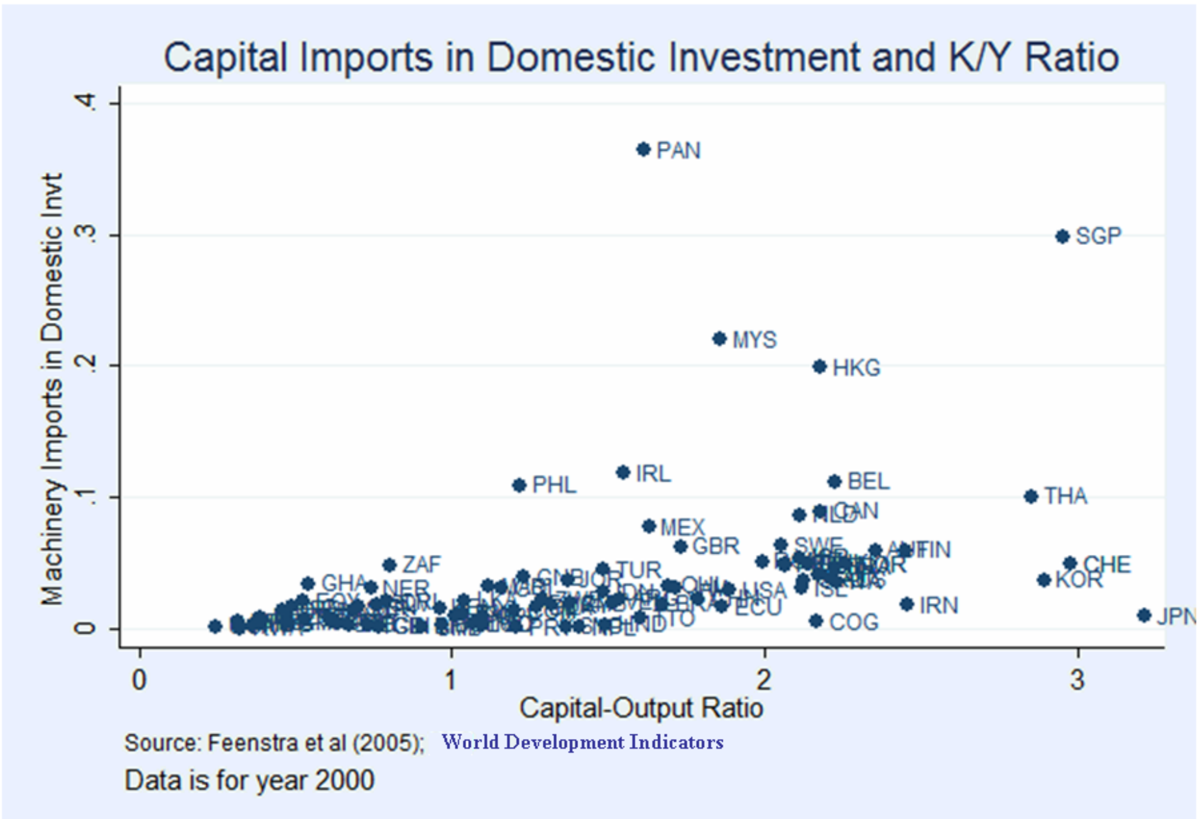

Figure 2: Time series of price of capital, defined as price of investment goods relative to output, in selected countries

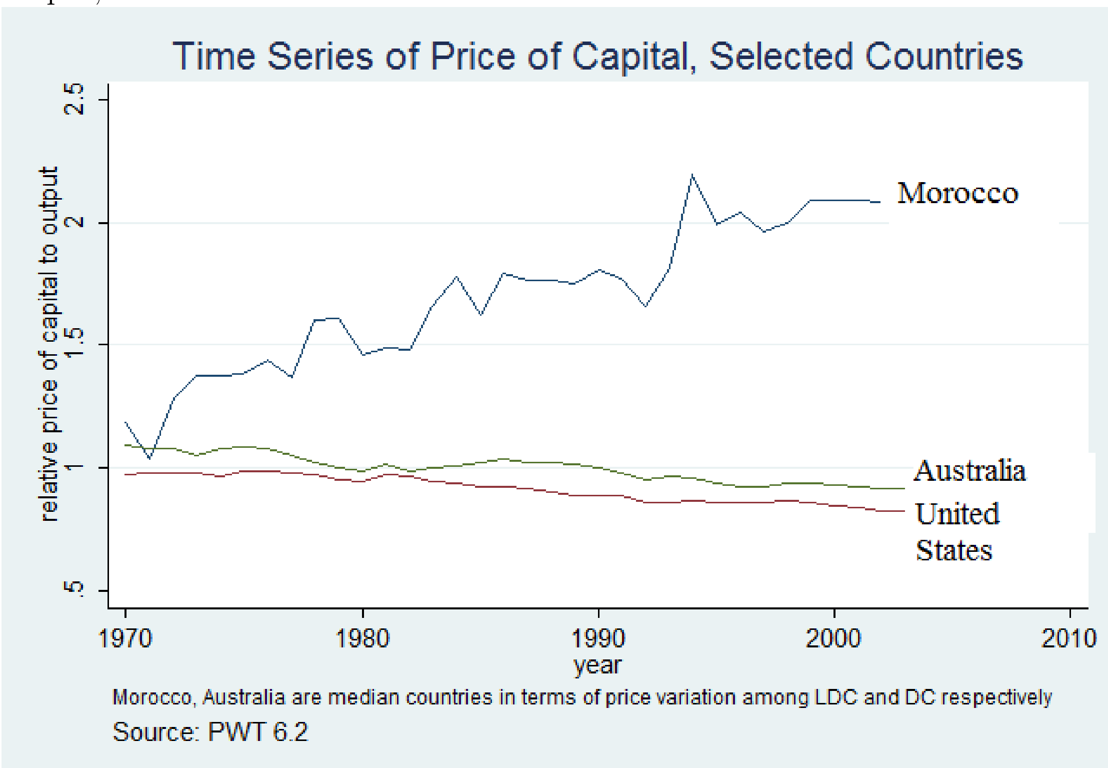

Figure 3: Volatility of price of investment goods relative to output and its variance decomposition

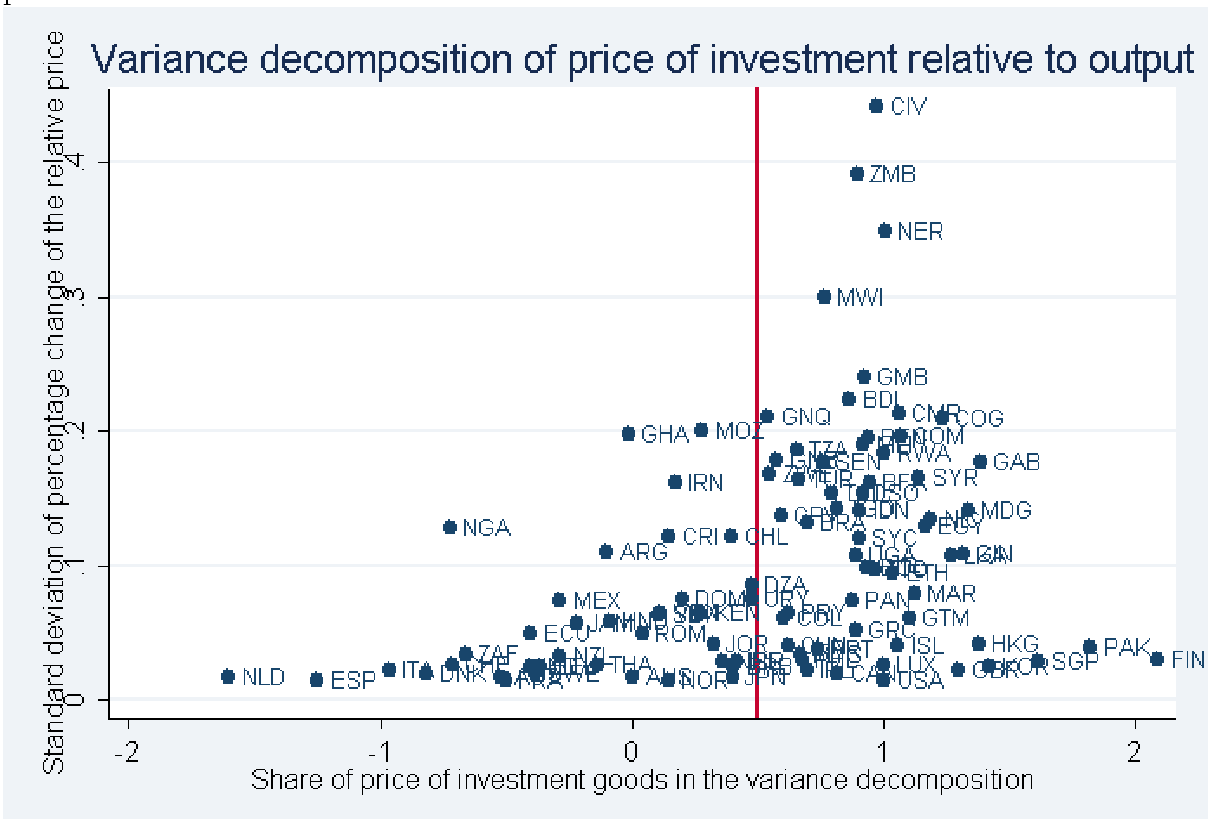

Table 1: Summary statistics of net returns, 1970-2003 (percent)

Countries	Mean	Std dev	Min	Max	Contribution of capital gains in variance)
Developed countries					
Australia	3.21	1.72	0.56	8.30	74.90
Austria	5.85	1.82	0.65	9.01	59.06
Belgium	5.63	2.44	-1.09	10.51	78.40
Canada	3.58	1.89	-0.26	9.76	86.19
Denmark	5.76	2.01	1.66	10.49	81.15
Finland	3.88	3.20	-4.88	8.75	82.72
France	5.07	1.28	1.16	7.61	78.30
Greece	2.14	5.42	-7.51	21.31	92.03
Ireland	6.96	2.37	3.07	12.93	82.62
Israel	8.20	2.83	3.18	15.81	85.43
Italy	5.73	2.27	2.73	10.71	85.23
Japan	5.99	2.47	2.16	11.29	29.83
Korea	11.23	5.04	-0.30	22.02	7.18
Netherlands	7.72	2.02	4.57	12.51	52.02
New Zealand	-0.02	3.12	-6.24	10.81	96.07
Norway	4.19	1.78	-0.34	6.87	63.90
Portugal	5.00	3.86	-1.65	17.12	87.80
Singapore	11.58	3.94	4.17	19.92	62.56
Spain	8.30	1.71	3.69	12.16	45.96
Sweden	3.01	2.04	-2.75	6.38	75.23
Switzerland	1.71	2.86	-3.43	6.70	84.11
United Kingdom	5.94	2.34	-2.25	8.66	85.67
United States	6.49	1.49	2.99	11.51	61.72
Developing countries					
Algeria	0.42	8.20	-24.56	21.09	97.23
Bolivia	0.68	9.83	-18.58	25.38	97.79
Burundi	-0.19	20.55	-46.58	49.31	98.29
Chile	5.37	12.67	-27.32	52.03	96.02
Colombia	2.01	5.52	-22.01	15.75	94.43
Congo	4.60	25.71	-35.89	98.06	98.58
Costa Rica	4.36	14.21	-22.71	72.34	94.49
Cote d'Ivoire	8.44	47.21	-77.00	184.47	99.69
Ecuador	0.71	4.93	-12.21	10.05	91.50
Egypt	3.63	13.62	-23.14	41.57	95.49
El Salvador	16.09	6.89	5.11	44.38	88.34
Jamaica	7.28	6.30	-2.28	26.60	87.62
Jordan	9.74	5.96	-2.11	22.73	27.73
Malaysia	5.41	5.20	-3.95	19.28	47.52
Mexico	9.59	8.68	-3.59	37.42	82.30
Morocco	11.92	10.39	-5.30	47.21	63.37
Panama	4.74	7.36	-13.41	24.09	92.00
Paraguay	8.29	6.98	-3.20	31.12	64.79
Philippines	6.35	2.72	0.66	13.00	87.12
South Africa	7.28	3.38	-2.51	15.26	88.41
Sri Lanka	5.74	12.64	-19.35	66.17	87.39
Uruguay	7.17	7.16	-12.64	24.82	89.84
Venezuela	1.88	5.79	-5.92	18.81	99.40
Zambia	5.73	38.60	-78.69	137.23	99.85

Table 2: Estimation results (dependent variable: model adjusted inflows-to-GDP ratios)

Variables	All types	Banking flows	FDI flows	Portfolio flows
Domestic R x P	0.104	0.003	0.1	-0.001
	[0.341]	[0.040]*	[0.358]	[0.038]*
World R x P	-0.038	-0.007	-0.031	0.001
	[0.484]	[0.012]*	[0.561]	[0.212]
Saving rate	-0.793	0.003	-0.822	-0.004
(model-adjusted)	[0.104]	[0.742]	[0.089]	[0.240]
Constant	-0.045	-0.0003	-0.043	0
	[0.022]*	[0.016]*	[0.023]*	[0.171]
sample size	1363	1370	1408	1386
R^2	0.01	0.02	0.01	0.001

Robust p values are in brackets. * significant at 5 percent; ** significant at 1 percent.

Table 3: Reduced-form estimation results (dependent variable: inflows-to-GDP ratios)

Variables	All types	Banking flows	FDI flows	Portfolio flows
Domestic R x P	2.438	-0.125	4.042	-0.182
	[0.880]	[0.139]	[0.807]	[0.161]
World R x P	-5.751	-0.29	-4.652	-0.087
	[0.427]	[0.001]**	[0.546]	[0.187]
Saving rate	-2.151	0.022	-0.972	-0.075
	[0.352]	[0.298]	[0.713]	[0.115]
Constant	-5.545	-0.033	-5.254	-0.002
	[0.033]*	[0.032]*	[0.037]*	[0.812]
sample size	1409	1416	1455	1433
R^2	0.01	0.01	0.00	0.02

Robust p values are in brackets. * significant at 5 percent; ** significant at 1 percent.

Table 4: Gains from banking inflows based on the structural estimation (percent of output per worker)

Country	Number years with inflows	Number of years with gains	Gains
Algeria	23	17	0.0012
Australia	29	5	0.0000
Austria	16	3	0.0001
Belgium	32	5	0.0000
Bolivia	20	6	0.0002
Burundi	18	5	0.0001
Canada	20	4	0.0001
Chile	17	8	0.0013
Colombia	20	13	0.0004
Congo	18	13	0.0123
Costa Rica	23	11	0.0003
Cote d'Ivoire	23	21	0.0012
Denmark	24	4	0.0000
Ecuador	14	9	0.0010
Egypt	16	9	0.0005
El Salvador	21	7	0.0004
Finland	19	4	0.0003
France	10	3	0.0000
Greece	30	13	0.0016
Ireland	27	6	0.0001
Israel	19	3	0.0000
Italy	24	5	0.0001
Jamaica	15	11	0.0088
Jordan	22	14	0.0013
Korea	25	6	0.0006

Table 4 (continued): Gains from banking inflows based on the structural estimation (percent of output per worker)

Country	Number years with net inflows	Number of years with gains	Gains
Malaysia	23	10	0.0008
Mexico	25	16	0.0026
Morocco	11	9	0.0030
Netherlands	19	7	0.0008
New Zealand	17	6	0.0001
Panama	17	6	0.0001
Paraguay	17	11	0.0009
Philippines	21	3	0.0001
Portugal	21	17	0.0011
Singapore	22	10	0.0040
Spain	28	5	0.0002
Sri Lanka	18	8	0.0020
Sweden	22	2	0.0000
Switzerland	19	4	0.0001
Uruguay	15	8	0.0012
Venezuela	19	7	0.0002
Zambia	11	10	0.0201

Table 5: Gains from banking inflows based on the reduced-form estimation (percent of output per worker)

Country	Number years with net inflows	Number of years with gains	Gains
Algeria	23	13	0.1010
Australia	29	10	0.0295
Austria	16	3	0.0335
Belgium	32	12	0.1000
Bolivia	20	9	0.0269
Burundi	18	10	0.0059
Canada	20	6	0.1215
Chile	17	7	0.0683
Colombia	20	13	0.0260
Congo	18	12	0.9231
Costa Rica	23	12	0.0211
Cote d'Ivoire	23	19	0.0789
Denmark	24	11	0.1777
Ecuador	14	9	0.1426
Egypt	16	7	0.0280
El Salvador	21	8	0.0380
Finland	19	10	0.2612
France	10	3	0.0055
Greece	30	14	0.8827
Ireland	27	11	0.3202
Israel	19	9	0.4655
Italy	24	10	0.2125
Jamaica	15	10	1.3233
Japan	24	11	0.1186
Jordan	22	9	0.1546
Korea	25	12	1.2984

Table 5 (continued): Gains from banking inflows based on the reduced-form estimation (percent of output per worker)

Country	Number years with inflows	Number of years with gains	Gains
Malaysia	23	8	0.1500
Mexico	25	13	0.2176
Morocco	11	7	0.2118
Netherlands	19	4	0.0708
New Zealand	17	8	0.0503
Norway	21	8	0.2077
Panama	17	8	0.0762
Paraguay	17	13	0.1392
Philippines	21	10	0.0841
Portugal	21	14	0.2252
Singapore	22	12	0.7848
South Africa	9	1	0.0025
Spain	28	8	0.0654
Sri Lanka	18	6	0.2505
Sweden	22	5	0.0505
Switzerland	19	6	0.0337
United Kingdom	3	1	0.0014
Uruguay	15	6	0.2175
Venezuela	19	8	0.1424
Zambia	11	9	2.8507