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International Financial Integration and Economic Growth: Accounting for the Efficiency Effect

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Abstract

The empirical literature has not been successful in finding a robust positive effect of financial integration on economic development at the aggregate level. We use microeconomic estimates of the effect of foreign finance on firm level productivity to construct macroeconomic estimates of the proximate effect of foreign capital on GDP per capita. The efficiency effect of foreign capital per person can account for approximately 20% of total variation in log of GDP per capita across countries in the 1990s. Calibrations based on a neoclassical model that includes a positive feedback between financial integration and aggregate efficiency shows significant gains to output and welfare following financial integration for a sample of 40 developing countries.

JEL Codes: O4, F36, F41, F43

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1 Introduction

One of the most highly debated questions in policy and academic circles is the merit of international financial integration. Broadly speaking, international capital mobility can increase the growth rate of a country either through an increase in the investment rate or an increase in the efficient use of productive resources. However, in the presence of pre-existing distortions and weak institutional settings, international capital mobility can potentially exacerbate the misallocation of capital, increase the likelihood of financial crises, and impair growth. The empirical evidence on the issue is mixed. Surveying the literature, Kose, Prasad, Rogoff, and Wei (2006) conclude that the macro-economic literature does not seem to find a robust significant effect of financial globalization on economic growth. They also argue that the positive effects of financial growth on productivity would only be realized for countries that are over certain thresholds of institutional quality and financial market development.[1]

Why are the results on financial globalization and growth found in the macro literature not robust? The answer to this question is of first order policy importance. Henry (2006) argues that we should not search for a growth effect in the first place. The neoclassical model makes no prediction about the correlation between capital account openness and long-run growth across countries. Instead, neoclassical theory predicts that opening the capital account will *temporarily* increase the growth rate of GDP per capita via the capital accumulation channel.[2] Sustained growth differences in the long run are related to sustained

[1] They refer to this phenomenon as "collateral benefits." Klein (2007) shows that the positive effect of capital account liberalization on growth depends on institutional quality. Alfaro, Chanda, Kalemli-Ozcan, Sayek (2004, 2007) show that FDI is beneficial for growth only if countries achieve a certain level of domestic financial market development. See Durham (2004) and Hermes and Lensink (2003) for a similar result. Borensztein, De Gregorio, and Lee (1998) and Xu (2000) show that FDI brings technology, which translates into higher growth only when the host country has a minimum threshold of stock of human capital.

[2] Bekaert, Harvey, and Lundblad (2005) and Henry (2003) find that opening stock markets to foreign

differences in the growth of total factor productivity (TFP). Thus, a better avenue might be searching for the long-run effects of financial globalization on TFP levels and growth rates. However, the crux of the issue is that cross-country levels and growth regressions remain unidentified. Foreign capital may increase productivity, or foreign capital may go to productive places, or both may be determined by an unobserved third factor. Hence, it is almost impossible to use aggregate data to determine the structural effect. This is the same problem that the empirical growth literature has suffered in conjunction with other determinants of growth for the past 20 years.

We use the methodology of the recent development accounting literature to quantify the total effect of financial integration on output levels and welfare across countries. Using well identified microeconomic estimates of the direct effect of foreign capital on firm level productivity and efficiency, and aggregate data on foreign ownership differences among countries, we measure the direct effect of foreign capital differences on output differences among countries. The growth literature has already been using this development accounting technique to parse variation in output among countries into the pieces explained by physical capital, human capital in the form of education or health, and residual variation due to differences in total factor productivity.[3] The main message from this literature is that residual productivity is the most significant source of output differences, explaining more than half of the variance of output across countries. Because existing studies do not account for foreign capital, differences in output due to financial integration are included in this productivity residual, along with differences in output due to institutions, geography, culture, and other excluded characteristics of countries.

investors led to a temporary increase in economic growth.

[3]The primary references are Hall and Jones (1999), Bils and Klenow (2000), Klenow and Rodriguez-Claire (1997), Caselli (2006), and Weil (2007).

We pursue a development accounting strategy to establish how much of the unexplained residual is accounted for by the efficiency effects of foreign capital. By efficiency we mean the overall productivity enhancing effects of foreign finance which can occur via channels such as reduced cost of capital, technology/knowledge spillovers, higher risk sharing, lower financing constraints, and increased competition. All of these act to improve upon the existing allocation of capital across firms within the domestic economy.[4]

To undertake this accounting exercise requires a well identified estimate of the elasticity of efficiency with respect to foreign capital. We review the broader literature on this subject in the subsequent section, eventually using the micro level estimates of Javorcik (2004) and Blalock and Gertler (2005) as our primary source. Macro level elasticities such as Galindo, Schiantarelli, and Weiss (2007) deliver similar results. Regardless of the source, the results show that variation in foreign capital is an important source of variation in output across countries. We find that 30% of the unexplained variation in output across countries, or alternately 20% of the cross-country output variation, is due to the efficiency effect of differences in foreign capital per person. It is important to note that this effect of foreign capital is not because foreign capital increases the available capital stock, but rather because foreign capital has a positive effect on aggregate efficiency.

Of course, financial integration does involve the accumulation of foreign capital, and this implies the existence of a virtuous cycle. As foreign capital increases, so does efficiency, which in turn will draw in more foreign capital seeking higher returns.[5] By nesting this

[4]Our concept of efficiency is similar to "efficient production" in Parente and Prescott (2000). They envision an economy where productivity is defined at the firm level and efficiency is at the aggregate level. Productivity refers to the location of the production possibility frontier for a country, and efficiency refers to how close to their frontier a country is.

[5]The optimal capital stock depends on TFP and TFP likely depends on institutional factors such as protection of property rights—the same factors that are important for capital flows as shown by Alfaro, Kalemli-Ozcan, and Volosovych (2006). As suggested by Blomstrom, Lipsey and Zejan (1996) and Clark and Feenstra (2003), in a world of completely mobile capital, the amount of physical capital installed in a

positive feedback within a neoclassical model of optimal savings we can address the ultimate benefits of financial integration. Calibrations show very large potential gains in both output and welfare from full integration.[6]

The paper proceeds as follows. Section 2 reviews the literature on foreign finance, productivity spillovers, and efficiency that will lay out the micro studies from which we derive our estimates of the elasticity of efficiency with respect to foreign capital. Section 3 explains the derivation of these elasticities in detail and section 4 performs the development accounting. Section 5 describes our calibration strategy to examine the gains from full financial integration and section 6 concludes.

2 Background Literature: Foreign Finance, Productivity Spillovers, and The Efficient Allocation of Capital

What are the channels through which financial globalization affects efficiency and hence overall productivity? Several have been identified in the literature, and all work through a better allocation of capital within the domestic economy, which in turn increases aggregate TFP. The individual channels include the easing of financing constraints (Harrison, Love, and McMillan, 2004; Mitton, 2006), increased competition and a reduced cost of capital (Henry, 2003), improved productivity of domestic firms through spillovers/lingakes (Aitken and Harrison, 1999; Javorcik, 2004; Blalock and Gertler, 200), and facilitating risk sharing

country relative to the world average is fully explained by TFP. Kalemli-Ozcan, Reshef, Sorensen, and Yosha (2007) show that capital flows within the United States are consistent with these predictions; states that experience a relative increase in TFP are those who receive out-of-state capital on net.

[6]This contrasts with the results of Gourinchas and Jeanne (2006), who calibrate a neoclassical model and find limited welfare gains from full financial integration. Their analysis assumes zero feedback between foreign capital stocks and aggregate efficiency.

and hence investment in riskier and high yielding projects (Obstfeld, 1994; Kalemli-Ozcan, Sorensen, and Yosha, 2003).[7]

All of these channels improve efficiency if they allocate capital to more productive uses. Henry (2006) argues that the most important shortcoming of aggregate data is its limited ability to tell us whether countries that liberalize allocate the capital that flows in efficiently. The rise in aggregate stock prices and investment indicate some efficient movement of capital *between* countries but says nothing about the efficiency of capital allocation *within* countries. Henry (2006) argues better allocation of capital within countries is directly related to reduced cost of capital after the liberalization.[8]

The extent of these misallocations may be quite large. Micro evidence from developing countries suggests very high returns to productive investment. The lending rates of informal lenders and bankers vary from 20% to 120% within India. The direct estimates of marginal product of capital can be as high as 100% for some firms, whereas average marginal product is only 22% across firms.[9] Hsieh and Klenow (2007), using micro data from India and China find that the misallocation of resources can reduce manufacturing TFP as much as 50%. Dollar and Wei (2007) designed a survey covering a stratified random sample of 12400 firms in China and find that capital is allocated inefficiently. They find that state owned firms have marginal returns 50 percentage points lower than private and foreign owned firms. By reallocating the wasted capital, China can reduce its capital stock by 8% without sacrificing

[7]Note that this is a selective list of references and the reader must see the extensive survey of Kose, Prasad, Rogoff, and Wei (2006) for a full list.

[8]By using firm level data from International Finance Corporation's Corporate Finance Database for Jordan, Korea, Malaysia, and Thailand, Chari and Henry (2007) investigate whether or not the common shock to cost of capital cause the average investment rate of all firms to rise. They find the growth rate of the average firm's capital stock exceeds its pre-liberalization mean by an average of 3.8 percentage points per year (an effect much larger than the corresponding increase in aggregate capital stock).

[9]There are similar findings for other developing countries. Evidence also shows that the high rates does not reflect high risk of default or having no collateral. See Banerjee and Duflo (2005)'s excellent survey on this topic.

growth. In all of these cases, significant gains in aggregate efficiency are possible from a better allocation of capital.

Cho (1988) is one of the early papers that shows financial liberalization improves the allocation of capital. Using firm level data from Korea, he estimates the variance of expected marginal returns to capital across industries and compare this variance before and after financial deregulation. A falling variance is interpreted as an equalization of marginal returns across industries following liberalization. Of course reverse causality is plausible and in fact Jaramillo, Schiantarelli and Weiss (1993) found that more efficient Ecuadorian firms were able to access more credit (from any source) following financial liberalization.

There are also macro level studies relying mostly on cross-sectional or panel regressions. Wurgler (2000) measures allocative efficiency as the elasticity of investment growth with respect to value added growth controlling for country fixed effects in an panel regression framework. Using macro-industry level data from UNIDO, he finds that this elasticity varies from 0.2 in Indonesia to 0.9 in Germany. He also shows that this elasticity is positively correlated with investor protection and domestic financial development. Building on his results, Almeida and Wolfenzon (2004) show a positive correlation with Wurgler's elasticity for allocative efficiency and the external finance dependence of the specific industry using data from Rajan and Zingales (1998). They conclude that the extent of reliance on external finance reflects certain financial arrangements and that affects allocative efficiency and hence informative about the degree of domestic financial development and misallocated capital.

None of these studies address directly whether financial liberalization has resulted in a more efficient allocation of investment.[10] Galindo, Schiantarelli, and Weiss (2007), using a

[10] A parallel literature looks at the question of how firms' performance change when capital controls is imposed (Forbes, 2006). Capital controls tighten the financing constraints faced by domestic firms (Laeven, 2003; Harrison, Love, and McMillan, 2004) and can decrease competition and market discipline exacerbating misallocation of capital (Johnson and Mitton, 2003).

panel of firm level data from 11 developing countries, identify an effect of financial liberalization on the efficiency with which capital is allocated across firms. Their measure of allocative efficiency is based on whether investment funds are going to firms with a higher marginal return to capital, and is estimated using firm level data from Worldscope. They, then, develop an index for each country as a weighted average of this firm-level measure and show that this index of allocative efficiency improves after financial liberalization for all 11 countries. Nevertheless, the caveat, as in the previous macro papers, remains that the estimated effects could be due to reverse causality or an omitted variable that determines both liberalization and efficiency.

At the other end of the scale, there is an extensive micro literature that attempts to quantify the productivity gains due to flows of FDI at the firm level. These studies find ambiguous results. Starting with the pioneering work of Caves (1974), researchers originally focused on country case studies and industry level cross sectional studies.[11] These studies find a positive correlation between the productivity of a multinational enterprise (MNE) and average value added per worker of the domestic firms within the same sector.[12] Of course a positive cross-sectional correlation between firms productivity and wages and FDI suffers from the same problem of endogeneity as in macro studies and hence is not necessarily informative. It does not reveal whether FDI raises productivity or whether multinationals are attracted to regions and industries in which domestic firms are more productive and workers are more skilled.

[11] See also Blomstrom (1986).

[12] A multinational enterprise (MNE) is a firm that owns and controls production facilities or other income-generating assets in at least two countries. When a foreign investor begins a green-field operation (i.e., constructs new production facilities) or acquires control of an existing local firm, that investment is regarded as a direct investment in the balance of payments statistics. An investment tends to be classified as direct if a foreign investor holds at least 10 percent of a local firm's equity. This arbitrary threshold is meant to reflect the notion that large stockholders, even if they do not hold a majority stake, will have a strong say in a company's decisions and participate in and influence its management.

A more promising approach is to investigate the change in firm productivity and the change in FDI, where the unobserved time-invariant industry and region factors that affect firm productivity are removed. The standard regression of this approach is as follows:

$$\Delta y_{it} = \Delta X_{it}\beta + \Delta FDI_{it}\delta + \epsilon_{it}$$

.

A positive estimate of δ is interpreted as positive spillovers. There are many studies within this framework. However, starting with Aitken and Harrison (1999) most of these studies find a negative effect or no effect of foreign presence.[13] The positive spillover effects are found only for developed countries.[14] Moran (2005) argues that the original industry and case studies underline the importance of competitive environment and this might explain why studies undertaken in countries such as Venezuela who pursued inward oriented policies during the period of the study find negative results.[15] More importantly, these panel studies suffer from another identification problem. The underlying assumption that changes in FDI are exogenous to unobserved shocks to firm's productivity is hard to justify. There are two ways to proceed: 1) To find an instrument for FDI, a hard task given the difficulty in thinking of a factor that is correlated with attractiveness of an industry or region which is at the same time uncorrelated with domestic firm's productivity; or 2) To find a natural experiment, i.e., a control group that takes care of the unobserved shock.

Papers by Javorcik (2004) and Blalock and Gertler (2005) have made an important con-

[13]See surveys by Gorg and Strobl (2001) and Lipsey (2004).

[14]Haskel, Pereira and Slaughter (2002) find positive spillovers from foreign to local firms in a panel data set of firms in the U.K.

[15]This is also true for the panel studies of Colombia, India, and Morocco. Note that famous Rodrik (2003) dictum that "One dollar of FDI is worth no more (or no less) than a dollar of any other kind of investment" is based on Venezuela and Morocco studies.

tribution to the literature in this respect. These papers belong to the new generation of studies arguing that since multinationals would like to prevent information leakage to potential local competitors, but would benefit from knowledge spillovers to their local suppliers, FDI spillovers ought to be between different industries. Hence, one must look for vertical (inter-industry) externalities instead of horizontal (intra-industry) externalities.[16] Javorcik (2004) uses the Olley-Pakes methodology to deal with the endogeneity between unobserved productivity shocks and total capital. She finds evidence of positive spillovers from FDI to firm level productivity. Blalock and Gertler (2005) use Indonesia's financial crisis as a natural experiment and ask whether foreign plants had higher growth relative to domestic ones after the Asian financial crisis. By exploiting this source of exogenous variation, they can evaluate the effect of access to foreign finance on domestic firm performance. Given their careful consideration of the endogeneity problems, we rely on the estimates of Javorcik (2004) and Blalock and Gertler (2005) primarily. As an additional comparison, we also extend and use the macro results of Galindo, Schiantarelli, and Weiss (2007), which can be found in the appendix.

3 The Productivity Effects of Foreign Capital

To explore the role of foreign capital per person on the cross-country distribution of output, we use development accounting techniques similar to those found in Klenow and Rodriguez-Clare (1997) and Weil (2007).

[16]Alfaro and Rodriguez-Clare (2004) find evidence for the existence of backward linkages between the downstream suppliers and the MNE in Venezuela, Chile, and Brazil.

We begin with a production function of the form,

$$Y = (k^F)^\gamma A K^\alpha (hL)^{1-\alpha} \tag{1}$$

where K is the capital stock, h is human capital per person, L is the size of the labor force, and A is a residual measure of total factor productivity. A captures all the other influences on aggregate output not captured by factor supplies or foreign capital per person. k^F is foreign capital per person, with an elasticity of γ.

Defining TFP_i for any unit i, which might be either a firm or a country depending on the level of analysis, as

$$TFP_i = (k_i^F)^\gamma A_i \tag{2}$$

we can write the relationship of log TFP and log foreign capital as

$$\ln TFP_i = \gamma \ln k_i^F + \ln A_i. \tag{3}$$

If we assume i indexes firms, then k_i^F is a measure of firm-level foreign capital per person, and this may represent either direct foreign investment in the firm or foreign capital present in upstream or downstream sectors (allowing for spillovers). If we have a firm-level estimate of γ, we can create an estimate of country-level TFP by assuming that within countries each firm has $k_i^F = k^F$, where k^F is the aggregate foreign capital stock per person. Making this stark homogeneity assumption is similar to using average years of schooling or average health status combined with individual level Mincerian regressions to estimate country-level stocks of human capital as in Klenow and Rodriguez-Clare (1997) and Weil (2007).

Alternately, if the unit i is a country, then macro level estimates of γ can be used to create estimates of the efficiency effects of foreign capital stocks. We need to be careful with the size of the macro estimates. If they are biased upwards due to endogeneity, then we will attribute too much importance to foreign capital. Regardless of the method, we will arrive at an estimated efficiency level based on foreign capital effects. We use this to do a development accounting exercise and determine the importance of foreign finance in determining variation in output per capita across countries. First we describe our estimates of γ in detail.

3.1 Micro-level Estimates

Javorcik (2004) and Blalock and Gertler (2005) both estimate positive productivity spillovers from FDI using firm-level data. The identification strategy of each paper was discussed in the previous section, and we feel they represent the best identified estimates of γ that are available.

In Javorcik (2004), significant effects of FDI are found when firms act as suppliers to foreign-owned firms. The measure of downstream FDI is a proxy for the share of output that is sold to foreign-owned firms. As this data is not available by firm, the study assumes that each firm in sector j supplies to sector k according to the national input-output tables. The foreign share in sector k is based on a measure of horizontal FDI in that sector. The combined measure is written as

$$DownFDI_j = \sum_k \alpha_{jk} \sum_{i \in j} \frac{(K_i^F/K_i)Y_i}{\sum_{i \in j} Y_i}. \tag{4}$$

This shows that downstream FDI depends on the parameters of the input-output tables, α_{jk}, as well as the foreign share of firm capital (K_i^F/K_i). As this share increases in any sector k, the $DownFDI_j$ index increases.

To use this estimate at a country level, we presume that (K_i^F/K_i) is equal to K^F/K, or the aggregate ratio of foreign direct investment to the capital stock. As explained above, setting aside the heterogeneity across firms is similar to the work of Klenow and Rodriguez-Clare (1997) and Weil (2007).

With this homogeneity assumption, and noting that $\sum_k \alpha_{jk} = 1$, the downstream measure collapses to

$$DownFDI_j = K^F/K. \tag{5}$$

In other words, every sector j has an identical downstream FDI measure, and therefore the economy-wide measure of downstream FDI is simply K^F/K.

The results of Javorcik take the form

$$\frac{\partial \ln TFP_i}{\partial DownFDI_j} = \delta \tag{6}$$

or the response of log total factor productivity of firm i to a change in downstream FDI is equal to δ, the parameter estimate from her regressions. Given our homogeneity assumption this means that

$$\frac{\partial \ln TFP_i}{\partial K^F/K} = \delta. \tag{7}$$

For our purposes we are interested in the role of foreign capital per person, so we perform several manipulations to this δ estimate to obtain an estimate of $\partial \ln TFP_i/\partial \ln K^F/L$,[17] which is denoted as

$$\gamma = \frac{\partial \ln TFP_i}{\partial \ln K^F/L} = \delta \frac{K^F}{K}. \tag{8}$$

[17] The value of $\partial \ln TFP_i/\partial \ln K^F/L$ is equal to the product of three terms: $\partial \ln TFP/\partial(K^F/K)$, $\partial(K^F/K)/\partial(K^F/L)$, and $\partial(K^F/L)/\partial \ln K^F/L$. Evaluating each of these terms yields equation (8)

From table 7 in Javorcik we obtain several estimates of δ, and these can be converted to estimates of γ that range from 0.170 to 0.199, using the mean value of K^F/K of 4.9 percent from Javorcik's sample.[18]

Turning to the work of Blalock and Gertler (2005) we analyze their work on Indonesian firms response to the currency crisis to establish a value for the elasticity of firm TFP levels with respect to foreign capital per person in the economy.[19] An issue with this analysis is that as part of their identification strategy they only concern themselves with exporting firms, which might not be representative. However, this strategy does provide indication of the differential effect on productivity of foreign ownership.

Blalock and Gertler's work estimates that the effect of the level of foreign ownership on the log of firm level output following the currency crisis is 0.205.[20] As this coefficient measures the effect of foreign ownership (measured as zero or one) on log TFP, we must convert it to an elasticity of firm TFP with respect to foreign capital per person. A similar conversion as in equation (8) can be applied to find the value of γ from Blalock and Gertler. The overall sample value of K^F/K is 0.45, resulting in an estimate of γ of 0.092.

The values from Javorcik (2004) and Blalock and Gertler (2005) are close, providing some assurance that we have identified the appropriate elasticity. These estimates suggest that γ lies between 0.092 and 0.199. There is no clear reason to consider one value as preferable to

[18] We specifically use the Olley-Pakes estimates from panel A of Javorcik's table 7, 0.0347 and 0.0407. The sample is 11,630 observations from between 1,918 and 2,711 Lithuanian firms a year between 1996–2000.

[19] Blalock and Gertler also provide a production function estimate involving downstream FDI similar in some ways to Javorcik's work. However their analysis is not free of concerns regarding endogeneity of the input stocks and is done in levels, not differences, which raises some concerns about omitted firm-specific variables.

[20] Blalock and Gertler actually estimate equations for the log of firm output, the log of firm labor, and the log of firm capital. Assuming that capital's share in output is 0.3, then we can back out the effect of foreign ownership on log TFP. From their table 4.6, the effect foreign ownership (a binary variable) on log value added is 0.339. The estimated effect on log labor is 0.154 and on log capital is 0.088. Given $\alpha = 0.3$, the effect on log TFP is found as $0.339 - 0.3 * 0.154 - 0.7 * 0.088 = 0.205$.

the others. The larger the estimate of γ, the more important we will find foreign capital to be for output per capita, so to be conservative we select a value at the low end of our range and use 0.10 as our primary estimate.

3.2 Macro-level Estimates

Most cross-country studies on the effect of FDI (or foreign capital broadly defined) on growth are problematic for our purposes given the problems of endogeneity. In addition there are many channels through which foreign capital affects growth. As outlined in the previous section there is one study considered the role of foreign capital on aggregate efficiency. Galindo, Schiantarelli, and Weiss (2007) look specifically at the effect of financial liberalization on the efficiency with which capital is allocated across firms in a sample of 11 developing countries. They do not consider any effect of foreign capital on firm-level productivity or spillovers. Thus their analysis could be seen as a lower bound for the macro effect of foreign capital. The advantage of their study is that it is on the specific channel of allocative efficiency whereas we do not have any micro studies estimating the effect of foreign capital on misallocation of capital that we know of. Based on their work, we adopt an elasticity of allocative efficiency with respect to foreign capital per person of $\gamma = 0.15$.[21] This is relatively close to the values found from the micro regressions of the previous section.

[21] See Appendix for details.

4 Accounting for the Total Effect of Foreign Capital

To start, we write the production function in (1) in per person terms and take logs, yielding

$$\ln y = \gamma \ln k^F + \ln A + \alpha \ln k + (1-\alpha) \ln h \tag{9}$$

and we can provide estimates for all the terms here except for $\ln A$. Output per capita, capital per person, and human capital per person (based on schooling only) are obtained from Bernanke and Gurkaynak (2004). The value of $\ln k^F$ is obtained from Lane and Milesi-Ferreti (2006). Finally, $\ln A$ can be found as the residual once the other terms are known.

The object of interest is the variation in log output per capita, or $Var(\ln y)$, and which of the four elements above are driving this variation. To explore this we report the variances and covariances of the different terms of (9) in table 1 under different assumptions about the size of γ, in an analysis similar to that used by Weil (2007) in his study of health.

The very first row of the table simply shows the variance of log output per capita across countries. The subsequent rows show the size of the variance or covariance term listed with respect to the variance of log output per capita. These values can thus be interpreted as the share of variation in output per capita that is explained by each term.

If we examine the first three columns, we have results for a sample of 74 countries that includes 18 developed nations.[22] Column 1 presumes that $\gamma = 0$, or that foreign capital per person has no effect of productivity through any channel. In this case the direct variation in residual TFP (A) explains 26% of all variation in output per capita. Reading down the column, the second panel shows the maximum fraction of variance of log output that can be attributed to A. This value is the sum of $var(\ln A)$ and two times the covariance of $\ln A$ with

[22] See Appendix for the list of countries.

both $\ln k$ and $\ln h$. This maximizes the unknown residual's share, a conservative approach that presumes this unknown factor drives all the covariance of A with capital stocks. This indicates that we don't know how to explain 70% of the variation in log output per capita given our simple production function.[23]

The final line of the second panel of table 1 is the variation in log output per capita that remains when we eliminate all variation in k^F across countries and therefore eliminate this source of efficiency differences. In column 1 this is trivially equal to one as $\gamma = 0$.

Moving to columns 2 and 3 we can see the role of foreign capital. Column 2 uses the micro estimate of $\gamma = 0.10$, and column 3 uses the macro estimate of $\gamma = 0.15$. In these cases, the direct variation in productivity due to foreign capital, $var(\gamma \ln k^F)$, accounts for 3.5–8% of all variation in output per capita. This value is larger than the direct variation due to human capital (1.7%) and between two and five time lower than the direct variation due to physical capital (18.2%).

In the second panel, we see that the measure of our ignorance, the maximum share attributable to $\ln A$, has fallen markedly to 0.494 in the case of our micro estimate of γ. There are two ways to interpret this number. First, one could say that the efficiency effects of foreign capital can account for about 20% (0.701 - 0.494) of variation in output per capita. Alternatively, foreign capital can account for about 30% ((0.701 - 0.494) / 0.701) of the unexplained variation in output per capita. Regardless, there is a large efficiency effect of foreign capital per person across countries.

[23] The 70% figure is found by summing $var(\ln A) = 0.262$ with $2 * cov(\ln A, \alpha \ln k) = 2(0.170) = 0.340$ and $2 * cov(\ln A, (1-\alpha) \ln h) = 2 * 0.049 = 0.098$. As mentioned, this is an upper bound estimate. Previous work by Klenow and Rodriguez-Clare (1997) examined a measure of the role of A by summing the variance of $\ln A$ with only one times the covariance of $\ln A$ with $\ln k$ and $\ln h$. If we use this method, the residual explains 48.1% (26.2 + 17.0 + 4.9) of variation in income per capita. There is no obvious reason to prefer one method over the other, and we default to the more conservative estimate that maximizes our measure of ignorance.

The final row of table 1 shows that if we were to eliminate all variation in k^F across countries, the remaining variation in output per capita would be only 71% as high as we actually observe. This suggests a potentially important role for foreign capital in contributing to the convergence of output levels across countries.[24]

With the macro estimate of γ in column 3, the role of foreign capital is even more pronounced. Here the share of variation in output per capita that is unexplained has fallen to only 0.365, or nearly half as large as when we do not account for foreign capital. If we were to eliminate all variation in foreign capital across countries, variation in output per capita would be only 60% as high as it actually is.

One concern may be that the role of FDI in efficiency is primarily a developing country phenomenon, and in that case we are biasing our results upwards by comparing developed and developing nations. First, the value of γ may be quite different in developed nations and developing nations, and secondly comparing these groups of countries may be overstating the variation in k^F. We therefore limit the sample by eliminating the 18 developed nations and recalculate all the values. The results of this are in columns 4, 5, and 6 in table 2. As can be seen, the results are quite close to the full sample results. Variation in foreign capital per person across developing countries appears to be an important source of variation in output per capita across these countries.

[24]This type of calculation is used by Caselli (2006) in his analysis of the importance of TFP in cross-country income variation. The value of 0.71 can be found by adding together the variances and two times the covariances of all terms *not* involving k^F. Therefore 0.71 = 0.147 + 0.182 + 0.017 + 2*0.104 + 2*0.030 + 2*0.050.

5 The Gains from Financial Integration

The static development accounting is useful in establishing the importance of foreign capital per person in the current output distribution. However, foreign capital accumulation is a dynamic phenomenon, and the development accounting does not address the dynamic impact of financial integration on nations. In this section we explore the gains from financial integration.

With full integration, foreign capital flows in until the economy reaches its steady state level of capital per *efficiency unit of labor*. The actual amount of foreign capital *per person* that flows in depends on the efficiency level of the country. But as we've seen, foreign capital per person has a direct effect on the efficiency level itself. So a virtuous circle is set up in which financial integration leads to an inflow of foreign capital, which raises efficiency, which leads to further inflows of foreign capital and further efficiency gains.

The stock of foreign capital per efficiency unit following integration can be written as,

$$\tilde{k}^F = \tilde{k}^* - \tilde{k}^0, \tag{10}$$

the difference between the steady state value of capital per efficiency unit, $\tilde{k}^*$, and the current value of capital per efficiency unit, $\tilde{k}^0$.

Using our production function from equation (1) we denote the efficiency of labor, E, as

$$E = \left((k^F)^\gamma A h^{1-\alpha}\right)^{\frac{1}{1-\alpha}} \tag{11}$$

which depends on the stock of foreign capital per person. Note that this does not depend on the *existing* stock of foreign capital, but is increasing in the level of foreign capital per person. Thus the efficiency of labor will climb as the foreign capital stock increases. The stock of k^F by definition can be written as

$$k^F = E\frac{K^F}{EL} = E\tilde{k}^F \tag{12}$$

so that equations (11) and (12) form a feedback system. Foreign capital increases in a country in order to bring it to its steady state, but this additional foreign capital actually helps push the steady state farther away at the same time.

Solving (11) and (12) together yields a level of efficiency following integration of

$$E^F = \left(\tilde{k}^F\right)^{\frac{\gamma}{1-\alpha-\gamma}} A^{\frac{1}{1-\alpha-\gamma}} h^{\frac{1-\alpha}{1-\alpha-\gamma}}. \tag{13}$$

Efficiency following integration depends on the stock of foreign capital per person, which in turn depends on the stock of foreign capital per efficiency unit required to reach a steady state. Thus the farther away a country is from its steady state, $\tilde{k}^F$, the higher the efficiency gain due to financial integration.

5.1 Output Levels and Financial Integration

Given (13) we can calibrate the output level of a country immediately following financial integration and compare that to actual output. This ratio is

$$\frac{y^F}{y^0} = \frac{E^F\left(\tilde{k}^*\right)^{\alpha}}{y^0} \tag{14}$$

where output following integration is higher due not only to increased levels of capital per efficiency unit, but also to higher efficiency due to the inflow of foreign capital. The ratio shows how much higher current output could be following full financial integration. The ratio itself depends on the value chosen for γ, which determines the size of (13).

The value of $\tilde{k^F}$, which determines E^F, requires a value of $\tilde{k^*}$, the steady state level of capital per efficiency unit. Neoclassical theory tells us this value can be found as

$$\tilde{k^*} = \left(\frac{\alpha}{R^* + \delta - 1} \right)^{\frac{1}{1-\alpha}}. \tag{15}$$

The world return to capital is R^* is set to 1.054, a value that can be obtained by assuming that the world follows an optimal savings model with a discount rate of 0.96 and a long run growth rate of 1.2% per year (see appendix C for an exposition of this optimal savings model). Combining r^* with values of $\alpha = 0.3$ and $\delta = 0.06$ we arrive at a value of $\tilde{k^*} = 3.98$.

Table 2 shows the output ratio from (14) for a sample of 40 emerging nations, using data from 1995, under two different assumptions regarding the value of γ. The first column uses our micro estimate of 0.10 and the second column uses the macro estimate of 0.15. As can be seen, current output is well below the predicted value following financial integration for every nation. Output in Argentina would be nearly six times larger if it were fully integrated, India almost 16 times larger, and in Uganda nearly 30 times larger. There are substantial gains available to countries from financial integration once we allow for the positive productivity feedback effects of foreign capital. The average country in our sample would have income nearly ten times larger under full financial integration.

5.2 Welfare Levels and Financial Integration

In their analysis of financial integration, Gourinchas and Jeanne (2006) examined the welfare gains of integration using a neoclassical optimal savings model. They produce a measure of the equivalent variation the percentage gain in permanent consumption that is equivalent to the welfare gain due to full financial integration.

Without going through the entire derivation (see appendix C), we can show that the equivalent variation measure of financial integration that includes the productivity effects of foreign capital, which we denote μ^{HKV}, is related to the equivalent variation found by Gourinchas and Jeanne, denoted μ^{GJ}, as follows

$$\frac{\mu^{HKV}}{\mu^{GJ}} = \frac{E^F}{E^0}\left(\frac{R^* - ng}{R^* - ng^{1/(1-\gamma)}}\right). \tag{16}$$

The value R^* is the steady state world return to capital, n is the population growth rate, and g is the growth rate of residual productivity A. In practice the second ratio is close to one, regardless of the parameters. If the value of $\gamma = 0$, then $\mu^{HKV}/\mu^{GJ} = 1$ and there is no difference in welfare. E^0 is the efficiency of labor prior to financial integration, and it remains fixed in the Gourinchas and Jeanne analysis.

Gourinchas and Jeanne provided the lower bound for welfare gains by ignoring any productivity feedback from foreign capital. Once we allow γ to be positive we are able to size the gains from integration and determine if these productivity effects have consequential results for welfare.

Table 2 reports the values of μ^{HKV} under our estimates of γ, 0.10 and 0.15. In addition, it lists the values of μ^{GJ}. As can be seen, the relative size of the welfare differences is quite large. For our preferred estimate, the welfare gain for Malaysia is only 0.5% when we ignore the productivity spillovers, as in Gourinchas and Jeanne, but the welfare gain is nearly five times as large when spillovers are accounted for. For a country like Pakistan, the welfare gains of financial integration are as large as a 7% permanent increase in consumption, as compared to less than one percent if we ignore the productivity effects. Average welfare gains are nearly 6%.

6 Conclusion

The existing evidence on the benefits of financial integration has been mixed, and this had left an important policy question without a clear answer. In this paper we have undertaken a new analysis of financial integration and growth using a different methodology than cross-country regressions. Our results suggests strong positive effects of financial integration for output levels.

Drawing on well identified microeconomic estimates of the efficiency effects of foreign capital, we were able to evaluate the role that existing variation in foreign capital per person has on the distribution of output across countries. Due to its positive productivity effects alone, foreign capital is able to explain approximately 20% of the variation in log output per capita across countries. Alternately, foreign capital variation is able to explain 30% of the currently unexplained variation in residual productivity across nations.

Nesting these productivity effects inside a neoclassical model of optimal savings, we are able to evaluate the gains in output and welfare due to financial integration. Across 40 developing nations, we find that output would be nearly ten times larger, on average, under full financial integration. The average welfare gain is equivalent to a nearly 6% permanent increase in consumption, six times the amount that was found elsewhere.

In future work we plan to estimate the elasticity of efficiency with respect to foreign capital per person from firm level data and hence use a wider range of microeconomic estimates with well specified channels. However, the current indication of this analysis is that financial integration is of first-order importance in explaining output differences across nations today.

A Allocative Efficiency Index of Galindo, Schiantarelli, and Weiss (2007)

The index of efficiency that Galindo, Schiantarelli, and Weiss (2007) use compares the weighted actual return on investment in a country to the return on investment that would have obtained had investment been allocated to firms based on their existing size. Their index is

$$I_t^G = \frac{\sum_i R_{i,t+1} I_{i,t}}{\sum_i R_{i,t+1} \left(K_{i,t}/\overline{K_t}\right) \overline{I_t}} \tag{17}$$

where $R_{i,t+1}$ is the return to capital at firm i at time $t+1$. $I_{i,t}$ is investment in firm i at time t and $K_{i,t}$ is the installed capital stock of firm i at the beginning of time t. The values $\overline{K_t}$ and $\overline{I_t}$ are the aggregate capital stock and investment at time t.

Galindo, Schiantarelli, and Weiss (2007) consider two different measures of $R_{i,t+1}$ for each firm. The first is the sales to capital ratio, $S_{i,t+1}/K_{i,t+1}$ and the second is the profits to capital ratio $\pi_{i,t+1}/K_{i,t+1}$ where profits are equal to sales minus the cost of goods sold. Both versions give a measure of overall allocative efficiency in the economy.[25]

In panel regressions Galindo, Schiantarelli, and Weiss (2007) find a significant positive effect of liberalization (using liberalization dummies) on the size of I_t^G. We re-create their regressions using K_t^F/L_t as the explanatory variable instead of their liberalization dummy and also expanded their sample from 11 to 18 developing countries. The data sources for these regressions are discussed below in Appendix C. Summary statistics, correlation matrices, and regressions results are provided in tables A-1 and A-2. The elasticity is between 0.12 and 0.2, depending on the specification.[26] On average, this is higher in value than the elasticity estimated by the micro literature, confirming our prior that there is an endogeneity issue in the macro estimates. At the same time these regressions are looking at a different aspect of productivity than the micro literature examined, so direct comparisons of the size of the coefficients might not be appropriate.

[25] Unfortunately, their indices do not have an easily interpreted meaning, as they are not bounded. Values may be below or above one, but the value of one itself does not denote anything specific.

[26] These regressions show the results with the efficiency index that is based on sales to capital ratio. The results with the index that is based on profit to capital ratio are very similar.

B Model of Optimal Savings

Our model of optimal savings is a basic Ramsey model, and we intentionally follow the derivation of Gourinchas and Jeanne (2006).

Individuals are assumed to maximize the following infinite discrete-time utility function,

$$U = \sum_{t=0}^{\infty} \beta^t L_t \frac{c_t^{1-\sigma}}{1-\sigma} \tag{18}$$

where β is the discount rate and L_t is population which evolves according to $L_t = n^t L_0$. Upon financial integration, a country faces the world interest rate $R*$, and with an initial capital stock per person of $k_0 = K_0/L_0$ the budget constraint of the individuals is

$$\sum_{t=0}^{\infty} c_t \left(\frac{n}{R^*}\right)^t = R^* k_0 + \sum_{t=0}^{\infty} w_t \left(\frac{n}{R^*}\right)^t . \tag{19}$$

The production function is as described in equation (1), but allows for growth in residual productivity at the rate g. It is assumed that for each country $\lim_{t\longrightarrow\infty} g_t = g^*$, or otherwise countries would diverge to the point that some countries accounted for all of world output.

The Euler equation for this model states that

$$\frac{c_t}{E_t} = g_{t+1} \frac{c_{t+1}}{E_{t+1}} \left(\frac{1}{\beta R_{t+1}}\right)^{1/\sigma} . \tag{20}$$

where R_{t+1} is the rate of return on capital and E is the measure of the efficiency of labor defined in (13). In the steady state, productivity adjusted consumption must be constant, and by assumption productivity growth is equal to g^*, so that the steady state return to capital is

$$R^* = \frac{g^{*\sigma}}{\beta}. \tag{21}$$

The steady state value of capital per efficiency unit is constant across countries and is equal to $\tilde{k}^* = (\alpha/\left(R^* + \delta - 1\right))^{1/1-\alpha}$.

Initial consumption following integration can be written as

$$c_0 = \left(R^* - ng^*\right) k_0 + \left(1 - \frac{ng^*}{R^*}\right) \sum_{t=0}^{\infty} \left(\frac{n}{R^*}\right)^t w_t \tag{22}$$

where k_0 is capital per person at time zero and w_t is the wage rate at time t. Any increased welfare due to allocative efficiency effects of financial integration thus arise because of differences in the path of wages over time.

Upon financially integrating, the rate of return on capital within an economy will immediately jump to R^*, and capital flows into or out of the economy to achieve this rate of return. From the Euler equation, this means that consumption per person must grow at rate g^* immediately. Using this fact, we can solve for utility using (19) and (20) under financial integration as

$$U_{FI} = \frac{R^*}{R^* - ng^*} N_0 \frac{(c_0)^{1-\sigma}}{1-\sigma}. \tag{23}$$

The equivalent variation of financial integration is defined as

$$\mu = \left(\frac{U_{FI}}{U_A}\right)^{1/1-\sigma} - 1 \tag{24}$$

where U_A is utility under autarky. The ratio of μ under our assumptions to μ under the assumptions of Gourinchas and Jeanne (2006) regarding the productivity effects of foreign capital is

$$\frac{1+\mu^{HKV}}{1+\mu^{GJ}} = \left(\frac{U_{FI}^{HKV}}{U_{FI}^{GJ}}\right)^{1/1-\sigma} \tag{25}$$

and notice that the value of U_A is no longer present, eliminating the need to calculate this. The values of $U_F I^i$ are found using equation (23) and this results in

$$\frac{1+\mu^{HKV}}{1+\mu^{GJ}} = \frac{c_0^{HKV}}{c_0^{GJ}}. \tag{26}$$

The value of initial consumption in either case is given by (22), which depends on the wage rate following integration.

Wages following integration that involves improvements in allocative efficiency can be written as

$$w_t^F = (1-\alpha) E^F \tilde{k^*}^{\alpha} \tag{27}$$

while wages following integration as in Gourinchas and Jeanne are

$$w_t^{GJ} = (1-\alpha) E^0 \tilde{k^*}^{\alpha}. \tag{28}$$

When we put these values into (22) and then use these to evaluate (26), we can arrive at the following expression

$$\frac{\mu^{HKV}}{\mu^{GJ}} = \frac{E^f}{E^0} \frac{R^* - ng}{R^* - ng^{1/(1-\gamma)}}. \tag{29}$$

This is the ratio evaluated in the text regarding the relative gain in welfare from financial integration.

C Data Descriptions and Sources

C.1 Firm Level data for Calculation of I^G

Specific variables from the Worldscope Global Researcher database (2000), sample selection criteria, and the constituent countries of each sample follow.

C.1.1 Firm level variable definitions

Capital stock-K_t: Net Property, Plant And Equipment, which represents Gross Property, Plant and Equipment less accumulated reserves for depreciation, depletion and amortization. (Field 02501)
Sales- S_t: Net Sales or Revenues, which represent gross sales and other operating revenue less discounts, returns and allowances. (Field 01001)
Investment-I_t: Capital Expenditures (Additions to Fixed Assets), which represent the funds used to acquire fixed assets other than those associated with acquisitions. It includes but is not restricted to: Additions to property, plant and equipment, and Investments in machinery and equipment (Field 04601)
Cost of Goods Sold: Cost of Goods Sold(Field 01051)
Profits: calculated as Sales minus Cost of Goods Sold

C.1.2 Sample selection criteria

Our initial sample has 24927 firms in 53 countries covering the years 1988-1999, with a total number of 299100 observations. We follow Galindo, Schiantarelli and Weiss's (2007) sample selection criteria and do the following: We exclude firms in the service sector. We base our classification of firms on their reported Standard Industrial Classification (SIC) code.[27] Firms may report a two digit SIC code, which is the most general level, or they may report three or four digit SIC codes, which subdivide the two-digit industries. Service firms are defined in our analysis as those with SIC codes 60-67 (Finance, Insurance, and Real Estate), 70-89 (Service Industries), 91-97 (Public Administration), and 99 (Non-classifiable establishments). Included SIC codes are 01-09 (Agriculture, Forestry, and Fishing), 10-14 (Mineral Industries), 15-17 (Construction Industries), 20-39 (Manufacturing), 41-49 (Transportation, Communications, and Utilities), 50-51 (Wholesale Trade), and 52-59 (Retail Trade). We also exclude the following observations:
-All firms with less than 3 years of observations;
-All country-years with less than 15 firms;
-Observations with missing data of sales, investment, capital stock and profit

[27]The SIC code system was replaced by the North American Industry Classification System (NAICS) in 1997, but as our observations overlap this period we default to the previous coding system.

-Observations with $I \leq 0$;
-Observations with $K \leq 0$;
-Observations with $S/K \leq 0$;
-Observations with cost of goods $sold \leq 0$;
-Observations with $S/K > 20$;
-Observations with $I/K > 2.5$;
-Observations with $Profits/K > 5$;
-Observations with cost of goods sold/K> 20;

After dropping accordingly we are left with 62961 observations that cover 41 countries. At the end we have 273 country-year observations of I^G that we have calculated in the paper. Merging these data with country level GDP, FDI liability stocks and population, we end up with 266 available observations, 116 of which are for developing countries.

C.1.3 11 countries from Galindo, Schiantarelli and Weiss (2007)

Argentina, Brazil, Chile, India, Indonesia, Malaysia, Mexico, Pakistan, Philippines, South Korea, and Thailand.

C.1.4 18 developing countries

11 country sample plus China, Colombia, Hong Kong, Ireland, Portugal, Singapore, and South Africa.

C.2 Country Level Data

C.2.1 Stocks of Foreign Direct Investment

The primary source is Lane and Milesi-Ferretti (2006). The authors construct estimates of stocks of foreign direct investment using initial stock data and inflow data adjusted to reflect the effect of changes in market prices and exchange rates.

The stock value of foreign direct investment liabilities (FDIL) is obtained by cumulating the dollar amount of yearly inflows (including reinvested profits) adjusted for variations in the price of capital. Instead of assuming that FDI is in the form of investment in some standardized "machinery" whose price in dollar terms follows the price of capital in the U.S. (i.e. the price of capital goods increases at the same rate regardless of location), the authors assume that capital goods are closer to non-traded goods and that the relative price of investment goods across countries follows relative CPIs. These assumptions imply that the change in the domestic price of capital goods is the sum of the change in the relative price of capital between the country and the U.S. (the currency of denomination of flows), plus the increase in the U.S. price of capital; $FDIL_t = FDIL_{t-1}\frac{rerus_t}{rerus_{t-1}}(1+\pi_t^k) + \Delta FDIL_t$, where *rerus* is the country's real exchange rate vis-a-vis the US dollar, and an increase measures an appreciation; and π^k is the rate of change of the price of capital in U.S. dollars. The estimates of stocks of FDI according to this methodology, however, can overstate the actual stock of FDI because a) write-offs of existing capital are not taken into account,[28] and b) given accounting practices, in the presence of inflation, nominal depreciation allowances imply that part of reinvested profits are offsetting real capital depreciation and should not be counted as capital. The inflation adjustment to the stock implies instead that each dollar of reinvested profits is calculated in "real" terms. In order to address these problems, the authors compute the measure of FDI capital based on the above formula but without any correction for inflation in capital goods' prices, $FDIL_t = FDIL_{t-1}\frac{rerus_t}{rerus_{t-1}} + \Delta FDIL_t$.

C.2.2 Development Accounting Data

We take output, human capital, and physical capital data from Bernanke and Gurkaynak (2001) to do the development accounting for 1995. The authors develop their measures by taking output and capital stock data (for the available countries) from Penn World Tables, PWT 5.6 . They estimate capital stocks by a perpetual inventory calculation, using a depreciation rate of 6 percent based as in Hall and Jones (1999). They assume that capital and output grow at the same rate prior to the beginning of the observation period, and calibrate the initial capital stocks. Non-residential capital share is given for 63 countries in PWT 5.6, and authors take the average share of these countries, that is two thirds, as the share of nonresidential capital for the countries for which there are no separated capital data. They take the saving rate of physical capital s_K as the average share of gross investment in GDP. Labor force growth is calculated as rate of growth of the working age (ages 15-64). They do adjust also for quality of labor using Barro-Lee(2000) data on educational achievement, giving more weight to educated workers. They take s_H as average percentage of a country's working-age population in secondary school, which is calculated as percentage of school age population (12-17) attending secondary school times the percentage of the working-age population that is of secondary school age (15-19). The data are available on-line at http://www.princeton.edu/ bernanke/data.htm.

C.2.3 40 countries included in calibration of table 2

Algeria, Argentina, Benin, Bolivia, Botswana, Brazil, Chile, Colombia, Costa Rica, Dominican Rep., Egypt, El Salvador, Greece, Guatemala, India, Indonesia, Ireland, Israel, Jamaica, Malawi, Malaysia, Mali, Mauritius, Mexico, Mozambique, Nepal, Pakistan, Papua New Guinea, Paraguay, Portugal, Rwanda, Senegal, Sri Lanka, Syria, Thailand, Tunisia, Uganda, Uruguay, Venezuela, and Zambia.

[28]Notice that the formula does not include a depreciation term or allowances for when a machine becomes obsolete.

C.2.4 56 developing countries included in accounting in table 1

The 40 countries of the previous subsection plus Dem. Rep of Congo, Ecuador, Ghana, Honduras, Jordan, Kenya, Korea (Rep.), Nicaragua, Niger, Panama, Peru, Philippines, South Africa, Tanzania, Togo, Trinidad and Tobago, Zimbabwe.

C.2.5 74 countries included in accouting in table 1

The 56 countries of the previous subsection plus Australia, Austria, Belgium, Canada, Denmark, Finland, France, Italy, Japan, Netherlands, New Zealand, Norway, Spain, Sweden, Switzerland, United Kingdom, United States.

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Table 1: Share of Variation in Log Output per Capita

	All Countries (n=74)			Developing Countries (n=56)		
	γ estimate:			γ estimate:		
	Zero	Micro	Macro	Zero	Micro	Macro
$var(\ln y)$	0.995	0.995	0.995	0.648	0.648	0.648
Source of variation (relative to $var(\ln y)$):						
$var(\gamma \ln k^F)$		0.035	0.079		0.037	0.082
$var(\ln A)$	0.262	0.147	0.115	0.311	0.206	0.181
$var(\alpha \ln k)$	0.182	0.182	0.182	0.183	0.183	0.183
$var((1-\alpha) \ln h)$	0.017	0.017	0.017	0.018	0.018	0.018
$cov(\ln A, \alpha \ln k)$	0.170	0.104	0.071	0.150	0.090	0.060
$cov(\ln A, (1-\alpha) \ln h)$	0.049	0.030	0.020	0.045	0.027	0.019
$cov(\alpha \ln k, (1-\alpha) \ln h)$	0.050	0.050	0.050	0.049	0.049	0.049
$cov(\gamma \ln k^F, \ln A)$		0.040	0.034		0.034	0.024
$cov(\gamma \ln k^F, \alpha \ln k)$		0.066	0.099		0.060	0.090
$cov(\gamma \ln k^F, (1-\alpha) \ln h)$		0.021	0.029		0.018	0.026
Max fraction of $var(\ln y)$ due to $\ln A$	0.701	0.494	0.365	0.700	0.510	0.387
$var(\ln Ak^{\alpha}h^{1-\alpha})/var(\ln y)$	1.000	0.714	0.597	1.000	0.740	0.638

Notes: Accounting is based on the production function $y = (k^F)^{\gamma} Ak^{\alpha}h^{1-\alpha}$. Values for k, h, and y are from Bernanke and Gurkaynak (2004). The value of γ is derived from the microeconomic studies of Javokic (2004) and Blalock and Gertler (2005) and is set to 0.100 in this table, or the macroeconomic work of Galindo, Schiantarelli, and Weiss (2007) and is set to 0.15 in this table. A full description of how γ is calculated is available in the text. The "Zero" columns assume that k^F has no effect on productivity at all, or $\gamma = 0$. The exact countries included in each sample is available in the appendix. The "Max fraction of $var(\ln y)$ due to $\ln A$" is equal to the variance of $\ln A$ plus two times the covariance of $\ln A$ with each other factor, all divided by $var(\ln y)$, and reflects the maximum variation in output per capita that can be attributed to residual productivity.

Table 2: Calibration Results

Country	y^F/y^0 calculated using: $\gamma = 0.10$	$\gamma = 0.15$	μ^{HKV} calculated using: $\gamma = 0.10$	$\gamma = 0.15$	μ^{GJ}
Algeria	7.411	13.189	3.862	6.872	0.574
Argentina	5.910	8.955	1.898	2.876	0.363
Benin	12.770	24.056	3.411	6.426	0.464
Bolivia	10.077	18.011	6.762	12.087	0.999
Botswana	6.775	10.581	2.483	3.879	0.453
Brazil	6.250	9.913	9.250	14.673	1.648
Chile	6.527	9.772	7.249	10.853	1.414
Colombia	9.890	18.052	6.672	12.178	0.953
Costa Rica	6.405	9.715	1.810	2.746	0.346
Dominican Republic	8.103	13.414	7.126	11.798	1.187
Egypt	13.273	24.549	16.366	30.273	2.290
El Salvador	13.642	27.269	7.171	14.334	0.888
Greece	2.722	2.719	1.439	1.438	0.530
Guatemala	11.924	22.160	2.595	4.822	0.360
India	15.643	36.907	15.699	37.040	1.499
Indonesia	9.317	17.321	14.392	26.758	1.998
Ireland	4.270	5.333	3.067	3.831	0.796
Israel	4.744	6.602	1.287	1.791	0.282
Jamaica	4.636	6.193	2.606	3.481	0.608
Malawi	10.669	20.369	3.355	6.405	0.447
Malaysia	5.233	7.290	2.300	3.205	0.502
Mali	13.993	29.330	3.531	7.403	0.406
Mauritius	11.122	21.696	19.129	37.318	2.462
Mexico	5.584	8.406	0.604	0.910	0.117
Mozambique	24.077	55.319	0.275	0.632	0.027
Nepal	16.318	41.872	24.992	64.133	2.091
Pakistan	13.008	27.240	7.374	15.443	0.849
Papua New Guinea	8.577	14.280	5.423	9.030	0.895
Paraguay	10.650	20.056	1.647	3.102	0.224
Portugal	4.722	6.420	9.820	13.352	2.229
Rwanda	13.997	26.762	3.674	7.024	0.488

continued on next page

Table 2: Calibration Results

Country	y^F/y^0 calculated using: $\gamma = 0.10$	$\gamma = 0.15$	μ^{HKV} calculated using: $\gamma = 0.10$	$\gamma = 0.15$	μ^{GJ}
Senegal	12.582	24.075	0.034	0.066	0.005
Sri Lanka	11.678	23.095	16.665	32.958	2.099
Syrian Arab Republic	9.866	17.619	0.900	1.607	0.133
Thailand	3.818	4.710	1.106	1.364	0.292
Tunisia	6.338	9.296	9.713	14.247	1.957
Uganda	28.736	65.419	7.852	17.876	0.793
Uruguay	7.873	13.160	1.788	2.989	0.293
Venezuela, Rep. Bol.	6.260	9.969	1.262	2.010	0.223
Zambia	5.416	7.751	0.214	0.306	0.045
Average	9.770	18.471	5.920	11.238	0.856
SD	5.285	13.365	5.934	13.297	0.724

Notes: Each value in the table is calculated for the year 1995, as described in the text. μ^{GJ} and μ^{HKV} measure the percent permanent gain in consumption that is equivalent to the welfare gained from financial integration. μ^{GJ} is from Gourinchas and Jeanne (2006). y^F/y^0 is the ratio of income with full financial integration relative to actual 1995 output.

Table A-1: Descriptive Statistics and Correlations

Variable	Mean	Std. Dev.	Min	Max
Efficiency Index (I^G)	1.137	0.194	0.763	1.833
FDI Stocks/Population	4754.5	10,160.6	4.9	50,353.7
GDP/Population	9,953.8	6,438.5	1,755.1	24,935.2

	Efficiency Index	FDI Stocks/Population	GDP/Population
Efficiency Index (I^G)	1.000		
FDI Stocks/Population	0.2878	1.000	
GDP/Population	0.2795	0.8020	1.000

Notes: Descriptive statistics are for the sample of 18 developing countries for the period 1990–1998. Statistics are similar for the 11 country sample. 18 country sample: 11 country sample (Argentina, Brazil, Chile, India, Indonesia, Malaysia, Mexico, Pakistan, Philippines, South Korea and Thailand) plus China, Colombia, Hong Kong, Ireland, Portugal, Singapore, South Africa. FDI Stocks are gross liabilities from Lane and Milesi-Ferreti (2006) in 2000 U.S. dollars. GDP is the gross domestic product in PPP basis in 2000 U.S. dollars from World Bank, World Development Indicators (WDI 2006). Population data is also from WDI 2006.

Table A-2: OLS Regressions

Dependent Variable is Log of I^G

	(1)	(2)	(3)	(4)
Log (FDI Stock/ Population)	0.20	0.19	0.15	0.12
	(2.43)	(2.37)	(2.06)	(1.70)
Countries	11	15	18	18
Observations	73	91	115	115
Country Fixed Effects	Yes	Yes	Yes	Yes
Time Fixed Effects	No	No	No	Yes
R^2	0.52	0.59	0.58	0.62

Notes: GDP per capita is included in all regressions which are estimated by OLS. Robust t-statistics are in parentheses. The panel is unbalanced over 1990–1998. The first column use the sample of 11 developing countries. Column 2 uses the sample of 18 developing countries minus Hong Kong, Singapore and Ireland. Columns 3 and 4 uses the sample of 18 developing countries.