How Big are the Gains from International Financial Integration?[†]

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Abstract

We examine whether the observed international capital flows between 1960–2000 had any significant impact on output per capita and welfare. We compare observed consumption behavior to a calibrated neoclassical model of consumption under autarky. The welfare loss from autarky is equivalent to a 10% permanent decline in consumption. Expanding our analysis to include potential productivity gains from the inflow of FDI, the predicted welfare loss from autarky goes up by another 2%. Compared to previous literature, these results indicate substantial gains from international financial integration. Finally, performing development accounting on actual output, we show that foreign capital flows can account for approximately 5.6% of variation in log output per capita across a sample of developing countries in 2000.

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1 Introduction

Debate on international financial integration has typically revolved around two questions. First, Lucas' famous paradox: why doesn't capital flow from rich to poor countries, which in a broader context becomes why countries are not more integrated financially? Second, is financial integration good for growth?[1] We would like to lay these questions aside in this paper and ask a related, but new one: have the observed capital flows between countries had any significant effect on output per capita and welfare? Our focus is thus not on the *possible* gains of financial integration, but rather on the *realized* gains.

To produce our answer we will distinguish the *consumption* effect of foreign capital from the pure *productivity* effect. The consumption effect arises when capital flows towards countries with higher returns. This allows many countries to acquire large stocks of productive capital without sacrificing their own consumption. The productivity effect, as we will conceive of it, arises when foreign capital inflows (specifically, FDI) have a positive effect on the efficiency with which capital is utilized domestically.

To quantify the consumption effect of foreign capital flows, we calibrate a neo-classical savings model and ask what savings and investment would have been during 1960–2000 if a country had been closed completely to foreign capital flows. Comparing the calibrated paths of consumption and capital under autarky to their observed paths, we can establish the implications of foreign capital flows for welfare and capital accumulation. For our sample of 98 developed and developing countries, the average welfare gain from the existence of foreign capital flows is equivalent to a permanent increase in consumption of nearly 10%. At the same time, domestic capital stocks would have been only marginally smaller under autarky for most countries. In other words, foreign capital flows allowed most countries to increase consumption throughout the period without sacrificing investment. Thus, the results suggest that despite the many limitations to financial integration in this period, what capital did flow between nations had a significantly positive impact on well-being.[2]

The welfare gains arise from a persistent separation between savings and investment over this period. Theoretically, this separation is exactly what one would expect to occur when countries with different rates of return are open to capital flows. Theory, though, also suggests that countries should converge to a common

[1] See Alfaro, Kalemli-Ozcan, and Volosovych (2007a, 2007b) for a survey of the literature on the patterns of capital mobility, who also identifies institutional quality as the key determinant of long-term capital flows. Kose, Prasad, Rogoff, and Wei (2006) review that the macro-economic literature does not seem to find a robust effect of financial globalization on growth. Henry (2007) disputes that financial integration should have a growth effect at all, as the neoclassical model predicts a level change in output, but not necessarily any distinct growth effect.

[2] Our results are consistent with the fact that the main form of capital flows in the last 40 years, which is the period of our analysis, has been debt flows instead of FDI and equity flows.

rate of return, causing both the savings/investment separation and the benefits of financial integration to dwindle over time. The observed experience of countries suggests that this convergence occurs only very slowly, if at all, and that enough of a differential in rates of return persisted throughout 1960–2000 to continue the net inflow of foreign capital to most countries.

It is interesting to compare these results to other attempts to quantify the welfare consequences of financial integration. Gourinchas and Jeanne (2006) (GJ hereafter) consider the welfare gains attainable to countries if they were to become completely open to foreign capital, and they find only limited gains. In their analysis full integration yields the equivalent of a 1% increase in permanent consumption.[3] Our results are an order of magnitude larger than this. The difference arises from the way in which we deal with convergence. In Gourinchas and Jeanne, it is assumed that rates of return converge to a world rate, potentially very rapidly, and so the gains of financial integration disappear quickly. We make no assumptions on convergence, and the data indicate that countries maintain differentials in rates of return over time and are able to capture welfare benefits from integration over long periods.

Expanding on our analysis, we also examine the productivity effects of foreign capital. We focus specifically on flows of FDI into countries during 1960–2000. This choice is because the direct productivity effects of FDI are most easily measured by firm-level studies, whereas the positive effects of portfolio investment are harder to identify. By narrowing our focus to FDI we gain confidence in our estimates. At the same time, we are likely underestimating the productivity effect since we use FDI instead of total foreign capital and since the micro estimates we are using are only for the manufacturing sector and they do not take the role of local conditions (or absorptive capacities) into account.[4]

The key to incorporating FDI productivity effects is obtaining a well-identified estimate of the elasticity of total factor productivity (TFP) with respect to FDI. The primary issue here is that foreign capital may flow to those countries or firms that already have high productivity, and therefore any estimated elasticity of TFP with respect to FDI is potentially biased upward.[5] To close in on the true elasticity of TFP with respect

[3]See also Athanasoulis and van Wincoop (2000), who find benefits of increased risk sharing on welfare to be equivalent to a 2% increase in permanent consumption.

[4]These conditions will increase the beneficial effects of foreign capital on the host economy as argued by Kose, Prasad, Rogoff, and Wei (2006). Alfaro, Chanda, Kalemli-Ozcan, and Sayek (2004, 2007) show FDI is beneficial only given a certain level of domestic financial development, and Klein (2007) shows the positive effect of capital account liberalization depends on institutional quality. Borensztain, De Gregorio, and Lee (1998) show that technology transfers through FDI occur only with a minimum threshold of human capital.

[5]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 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;

to FDI we turn to firm-level studies from developing countries and those firms response to foreign ownership. After examining a variety of studies, we found several (Arnold and Javorcik, 2005; Evenett and Voicu, 2003; Javorcik, 2004) able to achieve identification of this effect, and from these we derive our estimates of the elasticity of productivity with respect to FDI.

Using these elasticities, we analyze the productivity effect by modifying our original welfare calculation to incorporate the lower growth rate of TFP that would arise if no FDI had flowed into countries during 1960–2000. Once we do this, we find that the welfare gain of FDI flows was equivalent to an additional permanent increase in consumption of nearly 2%, on top of the gains generated solely from capital flows. While not as large as pure consumption effect, recall that this analysis is limited to only FDI and based on micro estimates from manufacturing sector that ignores absorptive capacities. If broader measures of foreign capital have other positive externalities then the true welfare gains were likely higher than 2% during this period.

As a final contribution, we consider whether the consumption and productivity effects of foreign capital have been significant in explaining the current distribution of output per capita across developing countries. Our analysis of the consumption effect showed that most countries would not have had significantly different capital stocks under autarky, which leads to our finding that only about 1.1% of the variation in output per capita is attributable to variation in foreign capital flows between countries.

Once we look at the productivity effect, though, we find larger effects of foreign capital on the cross-country distribution of output per capita. The productivity effect of FDI can account for up to 4.5% of the variation in log output per capita. In total, then, we find that foreign capital flows can account for approximately 5.6% of all the variation in log output per capita observed across developing countries. Note that this does not imply anything about causality, but rather indicates the importance of the correlation between foreign capital and output per capita in describing the relative wealth of nations.[6]

The paper proceeds as follows. Section 2 describes the savings model employed and performs the calibration to evaluate the role of foreign capital flows on welfare. Section 3 establishes the role of FDI on productivity and evaluates its welfare consequences. Section 4 performs the development accounting and section 5 concludes.

states that experience a relative increase in TFP are those who receive out-of-state capital on net.

[6]For comparison purposes, previous development accounting has established that educational differences account for approximately 13% of the variation in income per capita (Klenow and Rodriguez-Clare, 1997) and health differences for approximately 15% (Weil, 2007).

2 The Benefits of Foreign Capital Flows

We examine the consumption and welfare effects of foreign capital over the period 1960–2000 for a sample of developing countries. Rather than asking whether there are gains to be had from further financial integration, we calculate the gains that have already been experienced by these countries due to their ability to disconnect savings and investment over this period.

To do so, we use a simple closed economy neoclassical model of optimal savings to ask how each country would have responded if they had been completely autarkic during this period. Given their initial conditions, we can then derive the capital stock in the year 2000 under autarky and compare that to the observed capital stock. In addition, we will be able to compare actual welfare over this period to the welfare that would have been obtained under autarky. Despite the limited capital flows observed in this period, we will find significant gains in welfare from the ability of these developing countries to maintain high consumption while still building their capital stocks.

2.1 Modeling Consumption under Autarky

First, assume utility takes the form

$$V = \sum_{t=0}^{\infty} \beta^t (1+n)^t u(c_t) \tag{1}$$

where $\beta \in (0,1)$ is the time discount factor, n is the growth rate of the population and $u(c_t)$ is the utility of consumption in period t. For our purposes, we will assume that $u(c_t) = c_t^{1-\sigma}/(1-\sigma)$, a constant relative risk aversion utility function with $\sigma > 0$.

Production of output is described by the following Cobb-Douglas function

$$Y_t = K_t^{\alpha} \left(A_t L_t\right)^{1-\alpha} \tag{2}$$

where K_t denotes the stock of domestic capital, L_t is the labor supply, and A_t is a labor-augmenting measure of productivity, assumed for analytical tractability. Labor supply is assumed to grow exogenously at the rate n, so that $L_{t+1} = (1+n)L_t$. Productivity grows at the rate g implying that $A_{t+1} = (1+g)A_t$. Both n and g are assumed to be specific to a country. We do not assume any convergence in the values of n or g over time because we will be interested only in the limited period 1960–2000.

If we denote productivity and population normalized variables with a hat, $\hat{x}_t = x_t/(A_t N_t)$, then we can write the dynamic budget constraint for each economy as

$$\hat{k}_{t+1} = (1 - \delta - n - g)\hat{k}_t + \hat{y}_t - \hat{c}_t \tag{3}$$

where δ is the depreciation rate. Additionally, denote the return on capital as $R_{t+1} = \alpha \hat{k}_{t+1}^{\alpha-1} + 1 - \delta$.

Utility maximization delivers the Euler equation relating consumption over adjacent periods as

$$\hat{c}_{t+1} = \hat{c}_t \frac{(\beta R_{t+1})^{1/\sigma}}{1+g}. \tag{4}$$

At a steady state $\hat{c}_{t+1} = \hat{c}_t$ and thus the steady state return to capital is $R^* = (1+g)^\sigma/\beta$. Hence the steady state value of $\hat{k}^*$ can be written as

$$\hat{k}^* = \left(\frac{\alpha}{R^* + \delta - 1}\right)^{1/1-\alpha}. \tag{5}$$

Steady state consumption, $\hat{c}^*$, can then be found from the dynamic budget constraint in (3).

Starting with an initial capital stock of $\hat{k}_0$ we can derive the optimal capital path from time zero forward, although there is not simple analytical form to this solution. Details on how we obtain the optimal path of $\hat{k}$ are given in the appendix.

Given the optimal path of $\hat{k}$ from 1960–2000 under autarky, using the budget constraint (3) we can find the optimal path of consumption. Denote these optimal autarky consumption values as c_t^{aut} and then utility over this period is

$$V^{aut} = \sum_{t=0}^{41} \beta^t (1+n)^t u(c_t^{aut}). \tag{6}$$

In contrast, the observed utility enjoyed by a country during this period is calculated as

$$V^{obs} = \sum_{t=0}^{41} \beta^t (1+n)^t u(c_t^{obs}) \tag{7}$$

where c_t^{obs} is the actual consumption per person during this period.

The welfare differences between the observed consumption path and the autarky consumption path can be summarized by the equivalent variation, μ, defined as the percentage decrease in a country's consumption that brings observed welfare down to the level that would obtain under autarky.

$$\mu = \left(\frac{V^{aut}}{V^{obs}}\right)^{\frac{1}{1-\sigma}} - 1 \tag{8}$$

where σ is the coefficient of relative risk aversion specified previously.[7]

2.2 Calibration and Results

The value of $\hat{k}_0$ is obtained from the Penn World Tables, with the value of A_0 derived as a residual from the production function in (2) along with a value of $\alpha = 0.33$. The value of σ is set to 2, a value within the range of estimates for risk aversion. Population growth, n, and technological progress, g, are taken to be equal to the growth rate of population and A, respectively, over the period 1960-2000. Population data is from the Penn World Tables and the A series is derived as a residual from the production function in (2). By examining the actual data from 1960–2000, the only change we are introducing into our analysis is to shut down capital flows in the model. Our results are not going to be driven by any assumptions about what long-run technological growth rates are, or whether countries population growth rates or interest rates converge over time. Thus we can be confident that our conclusions relate directly to the welfare effects of capital flows.

The remaining parameter to choose for any given country is the value of β, the discount rate. To obtain a estimate, we utilize the observed consumption behavior over 1960–2000. Consumption per capita in any given year is obtained from the Penn World Tables, and is the PPP adjusted value of total consumption plus total government spending in that year divided by total population.[8] We assume that over this period each country was obeying an Euler equation as in (4). We have data on $\hat{c}_{t+1}$, $\hat{c}_t$. Data on $\hat{k}_t$ allows us to derive the return to capital, R_{t+1}. For each year we can back out the implied value of β from the Euler equation. Denote these implied discount rates as β_t, which allows β to be unique to each year. Our estimated value of β is the simple average of these, so that

$$\tilde{\beta} = \frac{\sum_{t=1961}^{2000} \beta_t}{40}. \tag{9}$$

Once we have $\tilde{beta}$, we use that value to evaluate both observed utility in (7) and autarky utility in

[7] This welfare analysis is the same one used by Gourinchas and Jeanne (2006) in their welfare analysis of financial integration.

[8] We do not distinguish between personal consumption and government consumption in this analysis because we do not have a simple way to model the breakdown between these two components without massively expanding the model.

(6). Observed utility is based, as mentioned above, on per capita consumption and government spending data from the Penn World Tables, while the autarky utility is calculated from consumption series obtained from the neoclassical model presented in the previous section. The two utility values are then combined in equation (8) to find the welfare loss under autarky.

It is instructive to consider a single case, Brazil. Brazil was chosen because it represents a typical developing country experience during this period, running a current account deficit that allowed for investment to outstrip savings. Figure 1 plots savings and investment, as percents of GDP, between 1960–2000 for Brazil. As can be seen, for most of this period investment has been higher than savings and Brazil was receiving flows of capital from abroad. If we consider the counterfactual situation of autarky, then savings and investment must obviously be equal. The predicted value for both begins at approximately 23% and decline slightly over time to the steady state level of just over 22%. This implies higher savings than observed in reality for the period between 1960 and 1968, as well as the period from 1980–2000.

The impact of these higher savings can be seen in figure 2, which plots total real consumption in Brazil as well as the predicted autarky value of per capita consumption. As can be seen, consumption would have been immediately lower, and remained lower throughout the period under consideration. The lower consumption, when adjusted for population and discounted back to 1960, yields lower welfare in Brazil under autarky. In terms of our measure of equivalent variation from (8), this implies welfare was higher by 16% in Brazil during this period because of foreign capital flows.

Table (1) reports the mean and standard deviation of μ by region. As can be seen, in each region the average is negative, indicating that autarky would have been welfare reducing in 1960–2000. The size of this effect varies greatly across regions, though. Sub-saharan Africa gained the most from capital flows during this period, where autarky would have reduced welfare by 16% on average.[9] The Middle East had values nearly as large, while the developed nations (Europe and the Neo-Europes) and Central and South America had similar gains from foreign capital around 9% in welfare. Note that the value for Central and South America is only this high once we exclude Venezuela, an outlier that is discussed further, along with several Asian nations, later in the paper. Asia as a whole shows only slight losses due to autarky, and again, this result will be discussed in more detail below.

Overall, autarky would have lowered welfare by about 10% during this period for the average country.

[9] Note that the main form of capital flows to Africa during the period under consideration was aid flows.

Results for each of the 98 countries can be found in table (2). Displayed are the values of μ, the permanent percentage change in consumption that is equivalent to having experienced 1960–2000 in autarky. In addition, it shows the autarkic capital stock per person, k^{aut} relative to the observed capital stock, k^{obs} for the year 2000. Finally, it also shows the autarky income per capita relative to the observed income per capita, y^{aut}/y^{obs} for the year 2000 as well.

What can be seen immediately is that autarky would have had serious welfare consequences for most countries. Looking further, we see that this does not arise because of any substantial difference in output per capita. The capital stock and output per capita are nearly identical under autarky to their observed values for most countries, as the ratios k^{aut}/k^{obs} and y^{aut}/y^{obs} are very close to one for all countries. The difference, though, is that under autarky countries would have had to finance the capital stock completely from domestic production, lowering the amount of output available for consumption.

An important thing to note is that we are likely understating the welfare loss from autarky. This is because we are imposing two distinct changes on each economy we study. First, we are shutting down capital flows. Secondly, we are enforcing an optimal savings regime. The first assumption will lower welfare, but the second assumption will actually raise welfare in each country. That is, countries are, given their fundamentals, over-saving or under-saving relative to the neoclassical benchmark. So simply imposing the optimal savings regime will improve welfare. Given these countervailing effects at work on welfare, and the fact that we still find such large welfare losses from autarky indicates that foreign capital flows were quite significant in generating utility.

These conflicting effects can be seen in a the set of countries for which autarky would have been predicted to improve welfare; China, Indonesia, South Korea, Malaysia and Venezuela are in this group. Each of these countries maintained an extraordinarily large savings rate throughout 1960–2000. This can be seen clearly in figure 3, which plots the actual savings and investment rates in Indonesia in this period, as well as the predicted rates under autarky. Indonesia is chosen simply as an example of the effect, plots for any of the other countries with positive welfare effects would look broadly similar. As can be seen, savings early in this period was extraordinarily large in Indonesia, and the optimal savings aspect of our autarky regime would have lowered savings rates significantly. Thus consumption, in our counterfactual, is higher under autarky. This does not indicate that foreign integration was bad for welfare, only that the welfare benefits of lower savings rates outweighed the welfare loss associated with autarky.

2.3 The Underlying Mechanism

To understand the source of the welfare gains estimated here we examine the situation in a hypothetical developing country. The benefits of financial integration depends upon the return differential between the country and the rest of the world. The wider the gap, the larger the potential gains.

Consider a country described by the neoclassical model. In line with our observations, we assume this country has the following parameters. The discount rate is $\beta = 0.9$ and the elasticity of intertemporal substitution is $1/\sigma = 1/2$. The depreciation rate is $\delta = 0.06$ and the population growth rate is $n = 0.02$. Technological growth is $g = 0.02$. These parameters are chosen to be representative of a typical developing country, and are quite similar to the actual experience of countries such as India and Pakistan. In autarky, the steady state rate of return in this country would be $R^{aut} = 1.156$. The steady state value of consumption per efficiency unit would be $\hat{c}^{aut} = 1.044$.

To be clear on the source of the welfare gains, for simplicity let us assume that if the country were to operate in autarky it would begin at the steady state immediately. This will highlight that the gains from financial integration are due to differences in domestic returns to capital relative to the world rate. Welfare under autarky, at the steady state, is according to (1) and the Euler equation (4),

$$V^{aut} = \frac{(A_0 \hat{c}^{aut})^{1-\sigma}}{1-\sigma} \sum_{t=0}^{41} \left(\beta(1+n)(1+g)^{\sigma}\right)^t . \tag{10}$$

In contrast, if the country were financially integrated then capital would flow in or out until the return on capital was equal to the world rate, R_w. Given this rate, capital per efficiency unit is given by (5) and from the intertemporal budget constraint in (3) we can find a value for consumption per efficiency unit. Denote this financially integrated value of consumption as $\hat{c}^{int}$. Utility in this situation is given by

$$V^{int} = \frac{(A_0 \hat{c}^{int})^{1-\sigma}}{1-\sigma} \sum_{t=0}^{41} \left(\beta(1+n)(1+g)^{\sigma}\right)^t \tag{11}$$

which is identical to utility under autarky other than the value of $\hat{c}$.

Comparing the utility under autarky with the utility under integration, the equivalent variation as described by (8) reduces to

$$\mu = \frac{\hat{c}^{aut}}{\hat{c}^{int}} - 1. \tag{12}$$

This measures the percent gain (or loss) in permanent consumption that is equivalent to living under autarky versus living under integration. The value of $\hat{c}^{aut}$ was, given our parameter choices, equal to 1.044. The value of $\hat{c}^{int}$ depends crucially on the value of R_w. If R_w were exactly equal to R^{aut}, then μ would be equal to zero, as our hypothetical country would have no gains from trade in capital goods available. However, once $R_w \neq R^{aut}$ then integration may be better or worse than autarky.

The value of μ is graphed in figure 4 against various values of R_w.[10] At very low levels of world returns, there is little scope for improvement over autarky as individuals would not be able to earn any return on their investments. However, as R_w increases, the value of μ declines, indicating that autarky extracts an increasingly severe cost on countries. As world rates approach about 1.04 the welfare cost of autarky is equivalent to nearly a 14% permanent loss of consumption. Once the world rate approaches the autarky rate, the welfare cost of autarky falls to zero as there are now no gains to be obtained from capital flows. Once the world rate actually exceeds the autarky rate, there is actually a welfare gain from autarky in this set-up. The lower welfare under openness arises because the high world rate of return lowers consumption and utility in early periods by more than it raises utility later in time.

Large welfare gains from capital flows, such as we have found, suggest that countries operate near the minimum point of the curve plotted in figure 4. This means that there are continued net inflows of foreign capital. Theoretically, this implies two things. First, that the world rate of return is below the domestic rate of return, and second, that there is little or no convergence of the domestic rate of return to the world rate over time. In other words, there must be *some* reason why foreign capital continues to flow into countries over time, and in our neoclassical setting this reason must be differentials in rates of return.

Over time, we would expect that all rates of return would converge. If not, one country would acquire infinite assets relative to the rest of the world. However, within our limited time period of 1960–2000 the continued net inflow of foreign capital into countries suggests that there is some persistence to the differences in returns across countries. Looking to the future, the continued benefits of financial integration will depend in large part on the continued persistence of these differentials.

[10] $R = 1 + r$, where r varies from 0% to 20%.

2.4 Robustness

This analysis uses an optimal savings model to describe the behavior of nations under autarky. The parameters of this model are chosen, when possible, to match the actual experience of the country in question. However, the elasticity of intertemporal substitution is assumed to be $\sigma = 2$. One concern may be whether this choice is driving the results.

Table 1 reports in the final two columns the average value of μ, be region, under different assumptions regarding σ. When $\sigma = 1$, we have log utility (as in Gourinchas and Jeanne (20007)), and as can be seen the averages do not change much from our baseline scenario. A slightly bigger change occurs when we increase σ to 4. In this case the absolute size of μ goes up an in all regions other than the richest: Europe, Japan, and the neo-Europes.

The increase in σ implies a lower elasticity of inter-temporal substitution. Under autarky consumption growth in developing countries will tend to be high, and the lower elasticities imply lower welfare from this autarky consumption path. However, the higher σ also induces households to accumulate less capital, meaning their autarky consumption is higher. It is not analytically clear which of these effects should dominate. From the results, it appears that for all the developing world, an increase in σ does not raise consumption by enough to overcome the welfare loss from enduring fast consumption growth. On the other hand, the rich nations appear to gain more utility from their increased consumption when σ is large than they lose in utility from having consumption grow over time. This seems to make sense given that consumption growth in autarky is just given by g, the growth rate of TFP. On average, in developing countries this growth rate is higher than in rich countries, and therefore there is less of a welfare cost from this consumption growth in rich countries.

Regardless of the choice of σ, the results do not change substantially. The welfare loss that would have been associated with autarky between 1960–2000, on average, is always in the range of 10-14%.

2.5 Comparison to Previous Literature

We find welfare gains from foreign capital to be quite large relative to previous estimates that are found elsewhere. In particular, GJ suggest that the welfare gains of financial integration are equivalent to a 1% increase in permanent consumption, averaged over their sample, while our estimate suggests welfare gains an order of magnitude greater. The difference in outcomes can be attributed mainly to the different approaches we take in examining how rates of return to capital evolve over time.

GJ ask what the welfare gain would be if a country were to fully financially integrate. In the neoclassical framework, this is identical to asking what the welfare gain would be of jumping instantly to the steady state, rather than converging over time. In their paper they derive a simple approximation of the welfare gain, μ, to capture the intuition behind their result. They find that the this equivalent variation can be written as follows

$$\mu \approx \beta(\hat{r} - r^*)\frac{dc}{c} \tag{13}$$

where β is the discount rate, r^* is the world rate of return, and dc/c is the percent increase in consumption gained from an inflow of foreign capital. The value $\hat{r}$ is the permanent value of domestic interest rates, and is defined as $\hat{r} \equiv (1-\beta)\sum_0^\infty \beta^t r_{t+1}$. The idea behind (13) is that the marginal gain to utility from foreign capital depends on how fast domestic rates of return are converging to world rates. If rates converge quickly, then $\hat{r}$ will be close to r^* and there will be only limited welfare gains. However, if domestic rates of return persistently diverge from world rates, then $\hat{r} - r^*$ will be large and so will the associated welfare gains.

As an example, consider again the case of Brazil. Figure 5 plots several series of rates of return over this period. Using the parameters and calibration from GJ the world return r^* is equal to 5.42%. Beginning in 1960, their predicted path of the rate of return in Brazil would be as shown, converging rapidly towards the world rate. Discounting this predicted rate back to 1960, the permanent value of the predicted return, $\hat{r}$, does not differ much from the world rate. Thus the welfare gain from integration in their model, as described in (13), finds only a small gain in welfare.

What our approach does, in comparison, is to look at how r_t actually evolved over time, rather than making assumptions about its convergence. The data on the calculated rate of return is plotted in figure 5 as well, and while it does fall appreciably over this period of time, it does not necessarily converge to the implied world rate of GJ. Because of this, the permanent value of the rate of return, $\hat{r}$, remains high even after discounting, and the welfare gains implied by (13) are large as well.[11]

Once we observe the actual experience of nations with financial integration, it becomes more clear that

[11] GJ discuss that their results are driven by the rate of convergence of the rate of return towards the world rate. They examine several alternative models— such as Barro et al. (1995)—in an attempt to slow down convergence and generate larger welfare gains, but they do not find any appreciable differences. One implication of our findings is that the convergence of rates of return is in fact much slower than even more sophisticated models of integration would predict.

autarky during 1960-2000 would have been disastrous for welfare. Despite significant barriers to capital flows during this period and small actual flows of capital up until the 1990's, most countries benefitted significantly. In terms of the original question we posed, we do find that the actual experience of financial integration has been a positive one for most nations.

3 Productivity and FDI

Beyond the consumption effect, it is possible that the foreign capital may influence welfare through productivity by introducing new technologies or increasing competition in a country. To examine this effect we look at foreign direct investment (FDI), as this has the best identified productivity effects among the types of foreign capital flows in the micro literature.

To incorporate the possibility of productivity gains arising through foreign direct investment we will modify the structure of the TFP term in our original production function. Using (2), output, in per capita terms is

$$y = A^{1-\alpha} k^{\alpha} \tag{14}$$

where k is stock of capital per capita and A is again the residual measure of total factor productivity. We split TFP into two separate terms

$$A^{1-\alpha} = B \left(\frac{k^F}{k} \right)^{\gamma} \tag{15}$$

where k^F/k is the stock of FDI relative to the domestic capital stock, and B is a measure of residual productivity. This formulation allows us to deal with the issue that much of FDI does not involve actual capital accumulation, but simply the acquisition of existing capital by a foreign owner. In this case, k^F/k would increase, but total k would remain fixed. γ measures the elasticity of TFP with respect to FDI per capita, and will be the central parameter of interest in our analysis.[12]

With the formulation in (15), growth in A can be written as

$$g = \frac{1}{1-\alpha} \left(\frac{\dot{B}}{B} + \gamma \frac{\dot{k^F}}{k^F} - \gamma \frac{\dot{k}}{k} \right). \tag{16}$$

[12] This specification has the unrealistic prediction that TFP would equal zero if there were no foreign capital present in the economy. Altering the specification to incorporate a fixed term for productivity that solves this issue raises analytical issues without changing the basic nature of our results.

Part of the growth in A over any period is derived from growth in FDI per capita relative to growth in the total capital stock. The larger γ is, the more relevant this growth in FDI becomes.

To begin naively, consider figure 6, which plots the log of residual total factor productivity against the log of FDI per capita in 1995. The positive relationship is clear, but the usefulness of such data is limited. Foreign capital may flow to those countries that already have high productivity, and therefore the elasticity of TFP with respect to FDI (the slope of the regression line in figure 6) is biased upward. A simple cross-country analysis such as this, though, does give us an idea of the upper bound on this elasticity, approximately 0.177. To pursue a more relevant value of γ we examine the micro literature on firm level effects of FDI in the following section.

3.1 Foreign Capital and Productivity

There are several channels by which foreign capital may enhance total factor productivity within domestic economies: 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, 2005), and facilitating risk sharing and hence investment in riskier and high yielding projects (Obstfeld, 1994; Kalemli-Ozcan, Sorensen, and Yosha, 2003).[13]

Starting with Caves (1974), researchers originally focused on country case studies and industry level cross sectional studies. 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.[14] 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.

A more promising approach is to investigate the change in firm productivity and the change in FDI,

[13]Note that this is a selective list of references and the reader must see the extensive survey of Kose, Prasad, Rogoff, and Wei (2006) and Henry (2007) for a full list.

[14]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.

where the unobserved time-invariant industry and region factors that affect firm productivity are removed. The standard regression of this approach is as follows:

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

where y_{it} is some measure of firm level productivity and X_{it} represents firm specific controls. A positive estimate of λ 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.[15] Positive spillover effects are found only for developed countries.[16] Moran (2005) argues that the original industry and case studies underline the importance of competitive environment and this might explain why studies find negative results in studies about countries who pursued inward oriented policies, such as Venezuela (Aitken and Harrison, 1999).[17] In addition, 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.

Given these issues, we focus on several recent studies from the literature that have dealt carefully with the endogeneity issues and have produced well-identified estimates on the causal role of FDI on productivity at the firm level. Our next set of development accounting is based on these estimates, which can be divided into two broad categories: direct productivity effects and spillover productivity effects.

3.1.1 Direct Productivity Effects

To be useful in our development accounting exercise, estimates of the effect of foreign ownership on productivity must overcome several issues. The first is that acquired plants are not randomly selected from the population, biasing estimates if this simultaneity is not accounted for. Essentially, do firms become more

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

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

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

productive because they receive FDI, or does FDI "cherry pick" the most productive firms in a developing economy? The second issue is that the estimates must be for firm total factor productivity, not partial measures such as output per worker. Finally, the actual measure of total factor productivity should be estimated correctly, accounting for the simultaneous nature of productivity and input decisions.

Of the variety of studies of foreign ownership and firm level productivity, we identify three that fit our criteria: Benfratello and Sembenelli (2002), Evenett and Voicu (2003), and Arnold and Javorcik (2005).[18] Benfratello and Sembenelli study Italian firms and find no positive effect of foreign ownership on productivity levels. This result, though, is for a developed economy, and as such is less relevant to our current focus on developing nations.

Arnold and Javorcik (2005) study Indonesian firms during the period 1984–1994 and use a propensity score matching method to identify the effect of foreign acquisition on firms total factor productivity. The propensity matching yields a sample of acquired firms matched with statistically identical non-acquired firms.[19] The authors then use difference-in-differences to estimate the effect of acquisition on the "treated" group, the acquired firms. Their estimates show a 34% increase in productivity from foreign acquisition in their preferred specification using 185 matched pairs of firms (one acquired by foreigners and one not).

The specifications from Arnold and Javorcik assume that log TFP is a linear function of foreign ownership, so that productivity takes the functional form of

$$\ln TFP = \theta \frac{k^F}{k} \tag{17}$$

where k represents the total capital stock, k^F is the capital stock owned by foreigners, and θ is the estimated effect of foreign ownership on productivity. The preferred estimates of Arnold and Javorcik show θ equal to 0.293. For use in our accounting, it will be useful to translate θ into an elasticity of TFP with respect to the foreign capital share. To do this, consider that we can write (17) as $\ln TFP = \theta exp\left(\ln \frac{k^F}{k}\right)$ and take the

[18]Other studies that study productivity and foreign ownership, but suffer from one of the potential biases listed previously are Aitken and Harrison (1999), Djankov and Hoekman (2000), Doms and Jensen (1998), Griffith (1999) and Harris (2002).

[19]This technique is used to create a control group of firms that are statistically identical to the acquired firms. The technique depends on the sample of acquired firms looking very similar to the non-acquired firms in the first place. If the acquired firms are distinctly different from non-acquired firms in all the observable variables, then the technique will not be valid. Arnold and Javorcik document that their acquired and non-acquired firms are nearly identical on all the variables they have data for.

derivative of ln TFP with respect to the natural log of k^F/k,

$$\frac{\partial \ln TFP}{\partial \ln k^F/k} = \theta \frac{k^F}{k} \equiv \gamma \tag{18}$$

The elasticity (denoted γ as it now matches the elasticity proposed in equation (15)) thus depends on k^F/k, and for this we take the cutoff value used by Arnold and Javorcik. That is, in their paper they measure k^F/k as a binary variable, taking a value of 1 if a firm has foreign ownership greater than or equal to 20%, and a value of zero otherwise. The value of γ is thus 0.293 x 0.200 = 0.059.

The study of Evenett and Voicu (2003) looks at a sample of Czech firms in the period 1995–1998. They find that when they account for sample attrition and selection problems, there are substantial productivity benefits to firms that received FDI. Their empirical specifications are similar to Arnold and Javorcik (2005) and their estimated value of θ is 0.358, from a sample of 205 firms. Applying a similar conversion to that used previously, and noting that Evenett and Voicu's cutoff level of FDI is 10%, we have that γ_1 is equal to 0.036.

The values of γ are distinctly lower than the cross-country value of γ, 0.177. The fact that these micro-estimates lie below the cross-country value lends confidence. We previously discussed that the cross-country value is biased upwards due to reverse causality between productivity and foreign capital, so we expect the true value to lie below 0.177.

3.1.2 Spillover Effects

In Javorcik (2004), significant effects of FDI are found when firms act as suppliers to foreign-owned firms, even if they are not foreign-owned themselves. 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 m according to the national input-output tables. The foreign share in sector m is based on a measure of horizontal FDI in that sector. The combined measure is written as

$$DownFDI_j = \sum_m \alpha_{jm} \sum_{i \in j} \frac{(k_i^F/k_i)Y_i}{\sum_{i \in j} Y_i}. \tag{19}$$

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

The productivity effects of this downstream FDI as specified by Javorcik imply a productivity function nearly identical to that in (17)

$$\ln TFP = \theta DownFDI_j \tag{20}$$

where θ now measures the effect of FDI spillovers on productivity. From Javorcik we obtain several estimates of θ that lie between 0.035 and 0.041.[20] As the $DownFDI_j$ measure is continuous (i.e. does not use a cutoff value as the direct productivity studies did), we translate the value of θ directly to an elasticity γ.[21]

3.2 Calibration and Results

From the direct productivity literature we find that estimates of γ lie between 0.036 and 0.059, while the spillover literature suggests a γ between 0.035 and 0.041. Now one could easily argue that these effects should be added together to reflect the overall impact of FDI on the economy. To be conservative we will use 0.036 as our estimate of γ.

Recall that equation (16) showed that TFP growth is a combination of three things: growth in FDI per capita, growth in the aggregate capital stock, and growth in B, the residual productivity term. To evaluate the welfare effects of FDI flows, we consider the following counterfactual. What if each country had been in autarky, and had not received any new flows of FDI during our period of study? To evaluate this effect, we perform our calibration exercise again, except now using the following as our estimate of TFP growth

$$\hat{g} = g - \left(\gamma \frac{\dot{k^F}}{k^F} - \gamma \frac{\dot{k}}{k} \right). \tag{21}$$

Without growth in FDI, $\hat{g} < g$, and welfare under autarky should be even lower than previously estimated.

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

[21] In addition to Javorcik (2004), recent research by Blalock and Gertler (2005) has shown significant effects of foreign ownership on productivity, both directly and in spillovers to other firms. However their spillover 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. Their evidence on the direct productivity effects is convincing in that they use the "natural experiment" of Indonesia's currency crisis to identify the effect of foreign ownership on output, capital accumulation, and employment across Indonesian firms. However, they focus only on exporting firms and so we do not utilize their estimates for our purpose.

We use data from Lane and Milesi-Ferretti (2006) on foreign asset positions. The growth of FDI per capita is calculated using their series on "FDI Liabilities" between the years 1970 and 2000, and we assume that this growth rate would approximate the growth rate of FDI between 1960 and 2000.[22] Population growth is taken from the Penn World Tables 6.2, and the combination of data allows us to calculate the growth rate of FDI per capita. Growth in the aggregate capital stock per capita is taken from the Penn World Tables, calculated using a perpetual inventory method similar to that found in Bernanke and Gurkaynak (2001).

The other parameters of the savings model are set to be the same as before, and the existing data on population growth and the discount rate are derived as previously explained. In the end, we compute the equivalent variation, or the percent decrease in permanent consumption associated with autarky, just as in equation (8). Since we include the effect of FDI, we denote this welfare measure as μ^{FDI}.

The results of this are found in table (2). We perform the calculation only for developing countries, on the presumption that developed nations are not likely to gain in productivity from the inflow of FDI.[23]

For those countries that remain, it can be seen that μ^{FDI} is always smaller than μ, indicating that welfare under autarky would be even worse if the productivity gains from FDI are removed. However, the decrease in welfare is not of the same scale as that found when we simply closed the country to capital flows. Looking at the average values for this "FDI Sample", we see that permanent consumption would have been 9.8% lower under autarky when we incorporate FDI flows. This compares to a value of 8.2% when we only consider the capital flows themselves. So the productivity effect of FDI raised welfare by about 1.6% relative to autarky.

4 Accounting for Foreign Capital and Output

To further explore the importance of foreign capital on the observed performance of nations, we use development accounting techniques similar to those found in Klenow and Rodriguez-Clare (1997) and Weil (2007). The idea is to decompose output per capita into its component parts: capital stocks and total factor productivity. With this decomposition we can address which factor is relatively most important in determining why output per capita varies across countries. Note that this method neither assumes nor assigns causality

[22] In the neoclassical model the net and gross flows are equal since there is one asset flowing. Due to the data limitations on outflows for developing countries we are only focusing on inflows.

[23] In addition, data limitations mean that several developing countries are unavailable in this exercise.

between any factor and output per capita, but simply accounts for the role of each. In other words, whatever are the fundamental causes of output per capita, these fundamentals must operate through either capital stocks or TFP, and the accounting will indicate which of these two avenues is the more likely path. [24]

Given (15), we write the production function in (14) as

$$y = B\left(\frac{k^F}{k}\right)^{\gamma} k^{\alpha}. \tag{22}$$

In this form we would be required to measure the fraction k^F/k, and this presents a problem. k^F is specifically the stock of FDI liabilities from Lane and Milesi-Ferreti (2006), which is reported in millions of current US dollars. The value of k can be obtained from the Penn World Tables and measured at PPP. To calculate k^F/k correctly would require converting one of these values into the units of the other.

To avoid the errors inherent in such a conversion, we re-write the production function as follows

$$y = B(k^F)^{\gamma} k^{\alpha-\gamma}. \tag{23}$$

and now we can examine the impact of FDI per capita (k^F) on output per capita. From this formulation, an increase in k^F, holding constant k, increases productivity. In other words, if FDI becomes a larger share of all capital, productivity increases. So this production function allows for similar inferences, while eliminating the need to convert between different measures of capital stocks. The value of this method is that the differences in units between k^F (measured in millions of current U.S. dollars by Lane and Milesi-Ferreti) and k (measured at PPP in the Penn World Tables) are swept up in the residual term B. We thus do not need to make any assumptions about how to convert one value into the other.

To incorporate the effect of foreign capital flows on the aggregate capital stock, we rewrite (23) as follows

$$y = B(k^F)^{\gamma} \left(\frac{k}{k^{aut}}\right)^{\alpha-\gamma} (k^{aut})^{\alpha-\gamma} \tag{24}$$

where the fraction k/k^{aut} is the ratio of the actual capital stock to the stock of capital predicted in autarky in our calibration. Output per capita and capital per person are obtained from the Penn World Tables. B

[24] Note that we also could have included health or education as a third factor as in Klenow and Rodriguez-Clare (1997) or Weil (2007). The number of factors that are included will not effect our results. Whatever additional human capital factor that is not accounted for will be counted as part of the residual productivity term.

can be found as the residual once the other terms are known. The value of α is assumed to be one-third, as is typical in the literature. The value of γ used is 0.036, the figure drawn from the firm level evidence reviewed previously.

To begin with, we examine the size of each term in (24) relative to the value for a reference country. Typically, this reference country would be the U.S., but in this analysis we focus on developing countries, so we choose instead to use Ireland as our reference. Ireland has been the recipient of vast flows of FDI, and is an example of a highly open and successful developing country. We exclude developed nations from this analysis because it seems unlikely that the productivity effects of FDI are relevant for these countries, and additionally their inclusion obscures our ability to see the differences within developing nations. The exclusion of the rich countries leaves us with a sample of 59 developing countries.

Table 3 shows the value of each component of output per capita relative to the value from Ireland, and all data is from the year 2000. As can be seen, Ireland is quite rich relative to the rest of the sample, with the average country having $y_i/y_{Ireland}$ of 20%. Residual productivity, B, is certainly a strong source of differences. The average relative to Ireland is only 0.394, and values range as low as 7% for Tanzania and 11% for Zambia. What these numbers mean is that output per capita in Tanzania would be only 7% of that in Ireland, even if Tanzania were identical to Ireland in every respect except residual productivity.

The relative value of $(k^F)^\gamma$ is 66% for the sample, indicating that productivity in the average developing country is only two-thirds of productivity in Ireland due to the differences in FDI stocks between countries. If we examine a country like India, we see that their productivity is only 53% as high as Ireland's because of the fact that FDI per capita in India is so much lower.

The final two columns of the table show how important aggregate physical capital and foreign capital flows are to output per capita differences across this sample. Comparing the value of k^{aut} of a country to Ireland, we see that if every country had been in autarky, output per capita would have been only 61% as large as in Ireland.

In contrast the final column shows values of nearly 99% for every country. This column compares the ratio k/k^{aut} to a similar ratio for Ireland. k/k^{aut} measures the size of the actual capital stock relative to the predicted autarky capital stock, and as was seen in table 2, this number is close to one for nearly all countries. In other words, in autarky most countries would have had close to their observed capital stocks in 2000 - however this would have come at the cost of greatly decreased welfare, as established earlier in the paper. So what the results of table 3 show is that the productivity effects of FDI are quite important in accounting for cross-country output differences, while the consumption effects (i.e. the effect of financial integration on capital accumulation) are relatively insignificant.

To establish this in more detail, we perform a more complete variance decomposition of output per capita in (24). Specifically, take logs of (24) and then the variance. Variation in log output per capita is then the sum of the variance in each individual term in (24) plus all the covariances between individual terms. Table 4 shows the exact values of the variances and covariances for our sample of 59 developing countries in 2000.

These raw statistics do not necessarily illustrate the role of each component clearly, so as a summary we provide the share of each component in the total variation of log output per capita. To be more explicit, for the residual productivity term, B, the share is calculated as

$$Share(B) = \frac{Var(\ln B) + Cov(\ln B, \ln(k^F)^\gamma) + Cov(\ln B, \ln(k^{aut})^{\alpha-\gamma}) + Cov(\ln B, \ln(k/k^{aut})^{\alpha-\gamma})}{Var(\ln y)} \quad (25)$$

and the other shares are calculated in a similar manner. This type of breakdown is essentially identical to that used in Klenow and Rodriguez-Clare (1997) in their development accounting exercise.

What our results show is that TFP still accounts for over half of the variation we observe in output per capita. While not nearly as large, the variation in FDI per capita, k^F, does account for 4.5% of all variation. What this implies is that if we want to explain why output per capita differs across countries, somewhere around 4.5% of our final story will have to involve why FDI per capita varies across countries. This does not mean that FDI flows *cause* output per capita to go up, but rather that whatever causes FDI flows to vary will also cause output per capita to vary.

Moving to other columns in table 4, we see that variation in the autarkic capital stocks, k^{aut}, accounts for about 38% of all variation in output per capita. Comparatively, variation in the ratio k/k^{aut} is a relatively small factor, accounting for only 1.1%. Combined, these two terms just tell us that aggregate capital accounts for about 39% of all variation in output per capita. So capital flows between countries did not significantly change the overall capital stocks per capita that countries worked with in 2000, even though they were highly significant in allowing countries to increase welfare over the period 1960–2000.

If we want to consider the overall impact of foreign capital flows on output per capita, we could combine shares accounted for by k^F and k/k^{aut}. By itself, variation in FDI per capita accounts for 4.5% of the variation in output per capita across countries, and combined with the 1.1% accounted for by k/k^{aut}, this tells us that about 5.6% of the variation in 2000 among developing countries can be accounted for through differences in foreign capital flows.

To appreciate the size of these effects, consider that in most studies, variation in human capital is found to account for between 10-15% of all variation in income per capita when using a metric similar to ours. Weil (2007) found that differences in health across countries could account for up to 13% of cross country income differences, also using a similar methodology. So while foreign capital flows are not quite as large in their effects as human capital, considering the many restrictions and small flows of capital to these developing countries over the last fifty years, perhaps this is not terribly surprising. Over the next fifty years, as foreign capital flows presumably increase, the share attributable to foreign capital may increase dramatically.

Interestingly, our initial welfare calculations showed that the consumption effect of foreign capital was much more important than the productivity effect in determining the value of financial integration. When we change our focus and examine the effect of financial integration on variation in output per capita then we find that the productivity effect is more relevant. Regardless of the viewpoint one takes, there is evidence that financial integration has had a significant impact on output and welfare across nations in the last forty years.

5 Conclusion

Existing research on financial integration has often been concerned with the extent of integration and the effects of integration on growth rates of poor countries. Our paper has focused on a different question: did the capital flows we observed between 1960–2000 actually have a material impact on output and welfare?

Using a calibrated neoclassical model of savings, we computed the path of consumption for each country in a sample of 98 as if they had been in autarky the entire period. Comparing welfare in this counter-factual to the welfare of the actual consumption stream, we found a gain, on average, equivalent to a 10% permanent gain in consumption due to foreign capital flows.

The sizable welfare gains we find arise because we do not make any assumptions regarding the convergence of countries to a worldwide interest rate. From 1960–2000, it does not appear that foreign capital flows slowed down simply because countries were approaching a hypothetical world rate of return. Thus the gains from capital flows continued to accrue during this period, allowing for large welfare effects.

Aside from this pure consumption effect of foreign capital, many countries also achieved gains in productivity due to the inflows of FDI. Incorporating this into our analysis suggests that the productivity effect added, on average, another 2% welfare gain to our original estimates.

When we examined output per capita in the year 2000, our development accounting exercise finds that 5.6% of all the variation in log output per capita in a sample of 59 developing countries can be attributed to variation in foreign capital flows. While not implying causality, this does suggest that foreign capital flows have had some significant impact on divergent outcomes across the developing world.

Taken together, the welfare and accounting results suggest that the actual experience of financial integration between 1960–2000 was widely beneficial to the world. By transferring technology to other countries and allowing nations to disconnect investment from savings foreign capital provided higher consumption and greater productivity. This holds despite the fact that most economists would consider the flow of capital into many countries to be "too small" within our standard models. An important implication is that as further flows of capital occur, the welfare and productivity gains may only increase.

A Solving for the Optimal Consumption and Capital Paths

The problem we have is to solve for the optimal path of consumption and capital, given the initial capital stock of k_0, the following constraints,

$$\begin{aligned}\hat{c}_{t+1} &= \hat{c}_t \frac{(\beta R_{t+1})^{1/\sigma}}{1+g} \\ \hat{k}_{t+1} &= (1-\delta-n-g)\hat{k}_t + \hat{y}_t - \hat{c}_t\end{aligned}$$

and the steady state value of capital per effective unit of

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

As there is no simple analytical solution to this problem, we have to find the optimal paths by other means. One option is to solve the problem numerically, which we have done and found to be nearly identical to the second option, linearization.

Linearizing this system is tedious but straightforward. For a full exposition, see Barro and Sala-i-Martin (1995). First-order Taylor expansions of the Euler equation and the inter-temporal budget constraint are solved together to arrive at a solution for the optimal path of the capital stock per efficiency of

$$\hat{k}_{t+1} = (1-p)\hat{k}^* + p\hat{k}_t \tag{26}$$

where

$$p = \frac{\phi}{2} - \left(\frac{\phi^2}{4} - \frac{1}{\beta}\right)^{1/2} \tag{27}$$

and

$$\phi = 1 + \frac{1}{\beta} - \frac{\beta(1+g)^{1-\sigma}\alpha(\alpha-1)\hat{k}^{*(\alpha-1)}\hat{c}^*}{\hat{k}^*\sigma}. \tag{28}$$

Equation (26) says that next periods capital stock is essentially a weighted average of the steady state capital stock and the current capital stock. The weight, p, is ultimately a function of the basic parameters of the model, the steady state capital stock, and the steady state value of consumption per efficiency unit, $\hat{c}^*$. Steady state consumption is found by solving the inter-temporal budget constraint at the steady state level of capital per efficiency unit,

$$\hat{c}^* = \left(\hat{k}^*\right)^\alpha - (\delta+n+g)\hat{k}^*. \tag{29}$$

Similarly, optimal consumption in any given period t is found from the budget constraint along with the optimal values of k_t and k_{t+1} obtained from the linearization.

B Data Descriptions and Sources

B.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,[25] 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, $FDIL_t = FDIL_{t-1}\frac{rerus_t}{rerus_{t-1}} + \Delta FDIL_t$.

B.2 Sub-samples of Countries

Central and South America: Argentina, Bolivia, Brazil, Barbados, Chile, Colombia, Costa Rica, Dominican Republic, Ecuador, Guatemala, Honduras, Jamaica, Mexico, Nicaragua, Panama, Peru, Paraguay, El Salvador, Trinidad and Tobago, Uruguay, Venezuela

Sub-Saharan Africa: Burundi, Benin, Burkina Faso, Cote d'Ivoire, Cameroon, Rep. of Congo, Cape Verde, Ethiopia, Gabon, Ghana, Guinea, The Gambia, Guinea-Bissau, Equatorial Guinea, Kenya, Lesotho, Madagascar, Mali, Mozambique, Mauritius, Malawi, Niger, Nigeria, Rwanda, Senegal, Chad, Togo, Tanzania, Uganda, South Africa, Zambia, Zimbabwe

Middle East and North Africa: Algeria, Egypt, Iran, Israel, Jordan, Morocco, Syria, Turkey

Asia: Bangladesh, China, Comoros, Indonesia, India, South Korea, Sri Lanka, Pakistan, Philippines, Seychelles, Thailand, Hong Kong, Malaysia, Nepal

Europe and Neo-Europes: Australia, Austria, Belgium, Canada, Switzerland, Denmark, Spain, Finland, France, Great Britain, Greece, Ireland, Iceland, Italy, Japan, Luxembourg, Netherlands, Norway, New Zealand, Portugal, Romania, Sweden, United States

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

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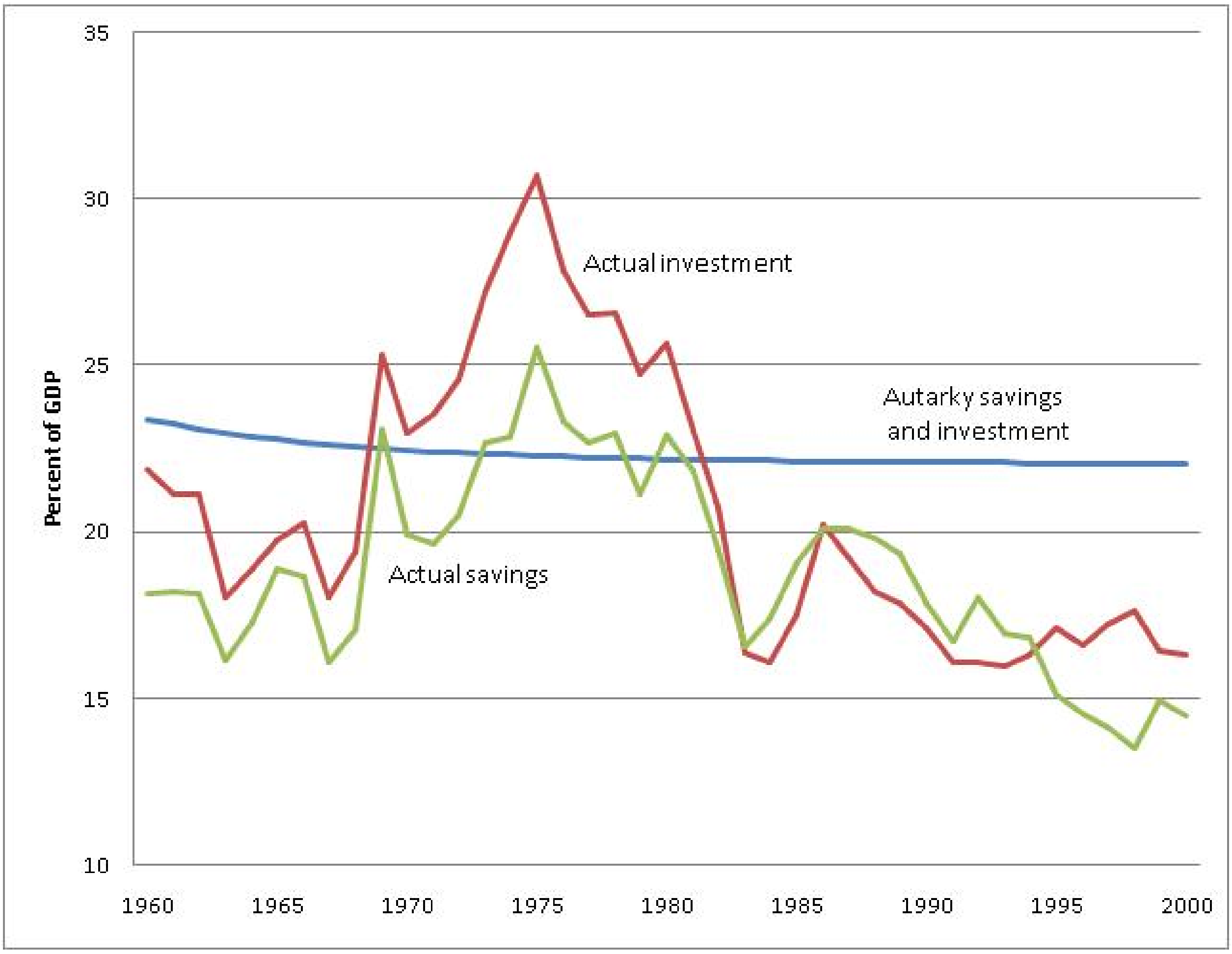

Figure 1: Actual and Predicted Autarky Savings and Investment in Brazil, 1960-2000

Notes: Actual data on savings and investment are taken from the Penn World Tables, Mark 6.1. Predicted savings and investment under autarky are identical by construction, and are derived from the optimal savings model described in the text.

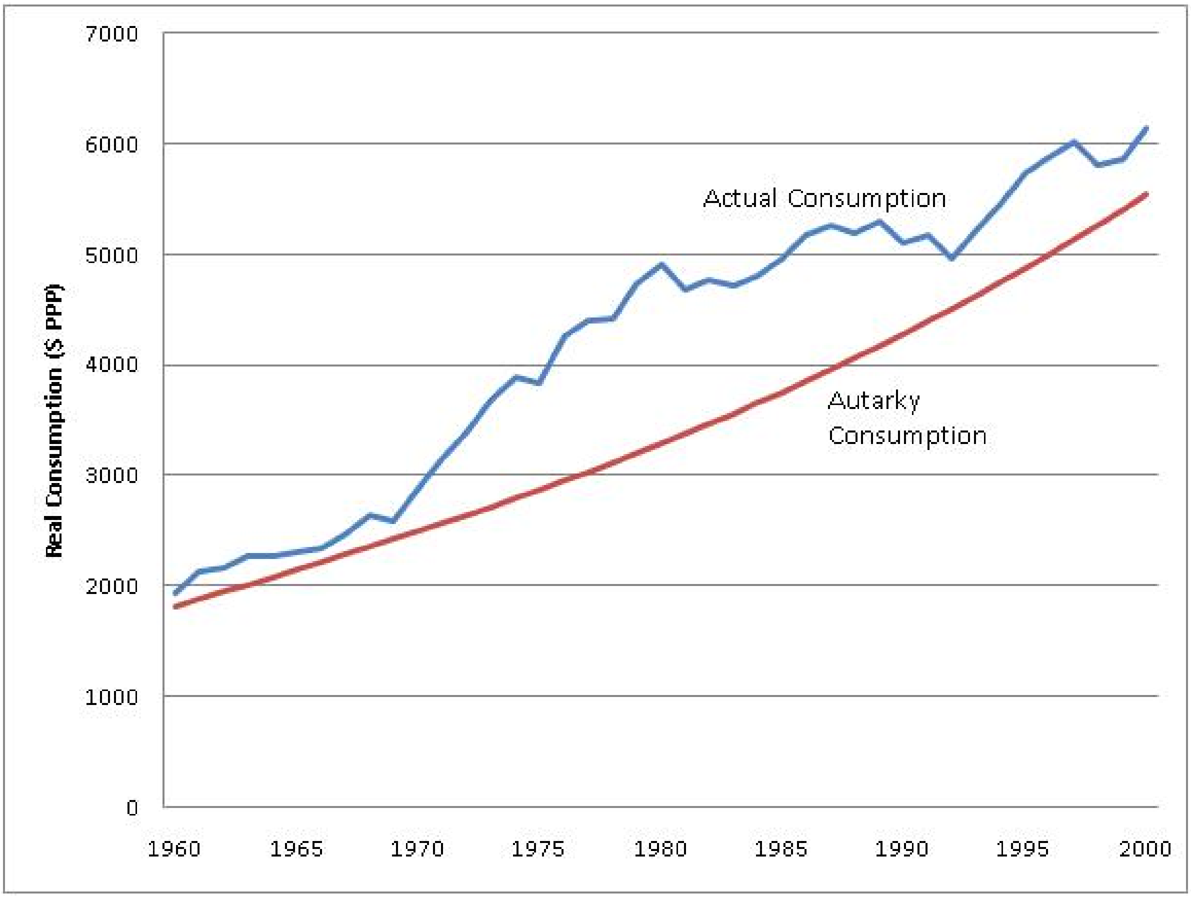

Figure 2: Actual and Predicted Autarky Consumption in Brazil, 1960-2000

Notes: Actual data on consumption is taken from the Penn World Tables, Mark 6.1. Predicted consumption under autarky is derived from the optimal savings model described in the text.

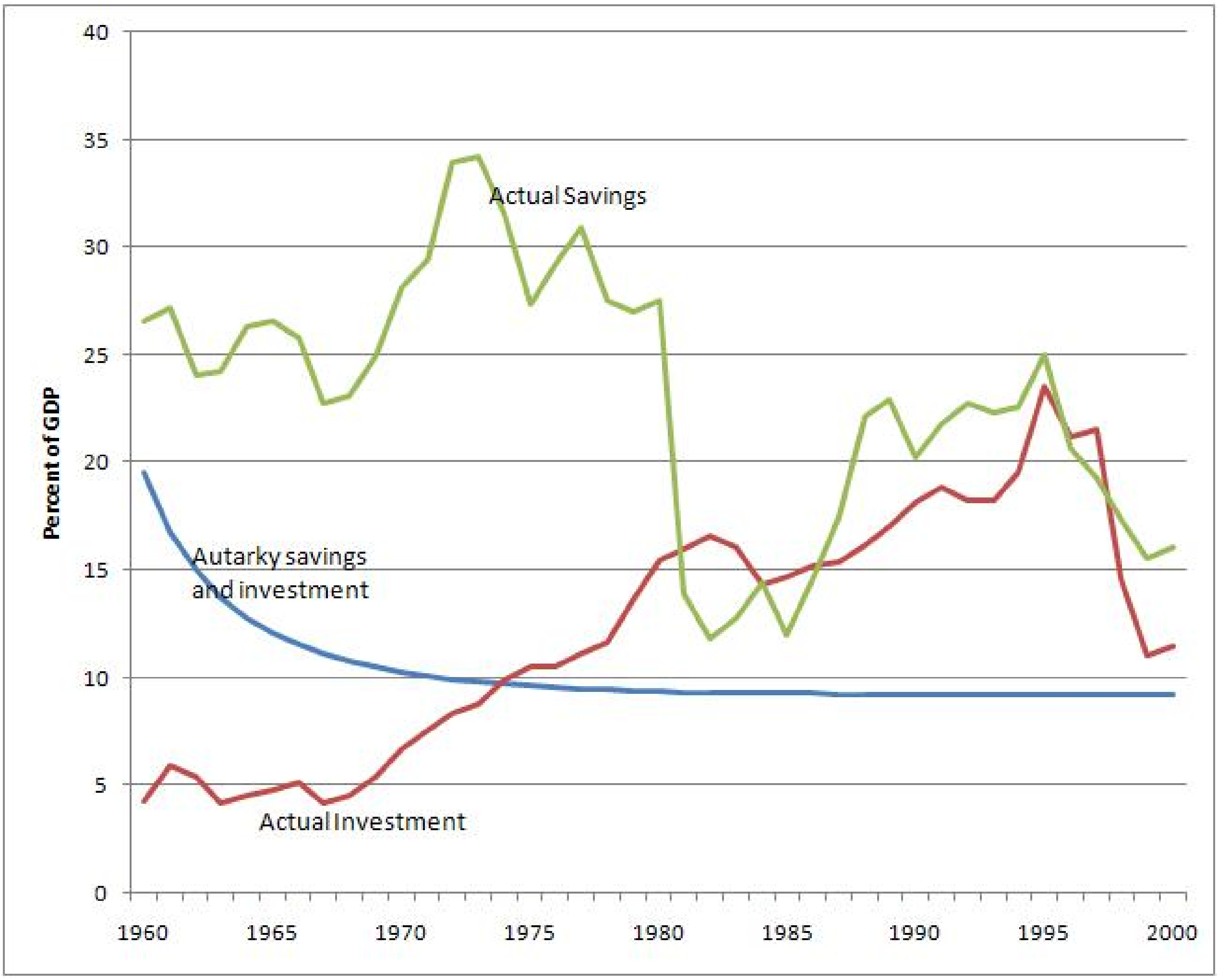

Figure 3: Actual and Predicted Autarky Savings and Investment in Indonesia, 1960-2000

Notes: Actual data on savings and investment are taken from the Penn World Tables, Mark 6.1. Predicted savings and investment under autarky are identical by construction, and are derived from the optimal savings model described in the text.

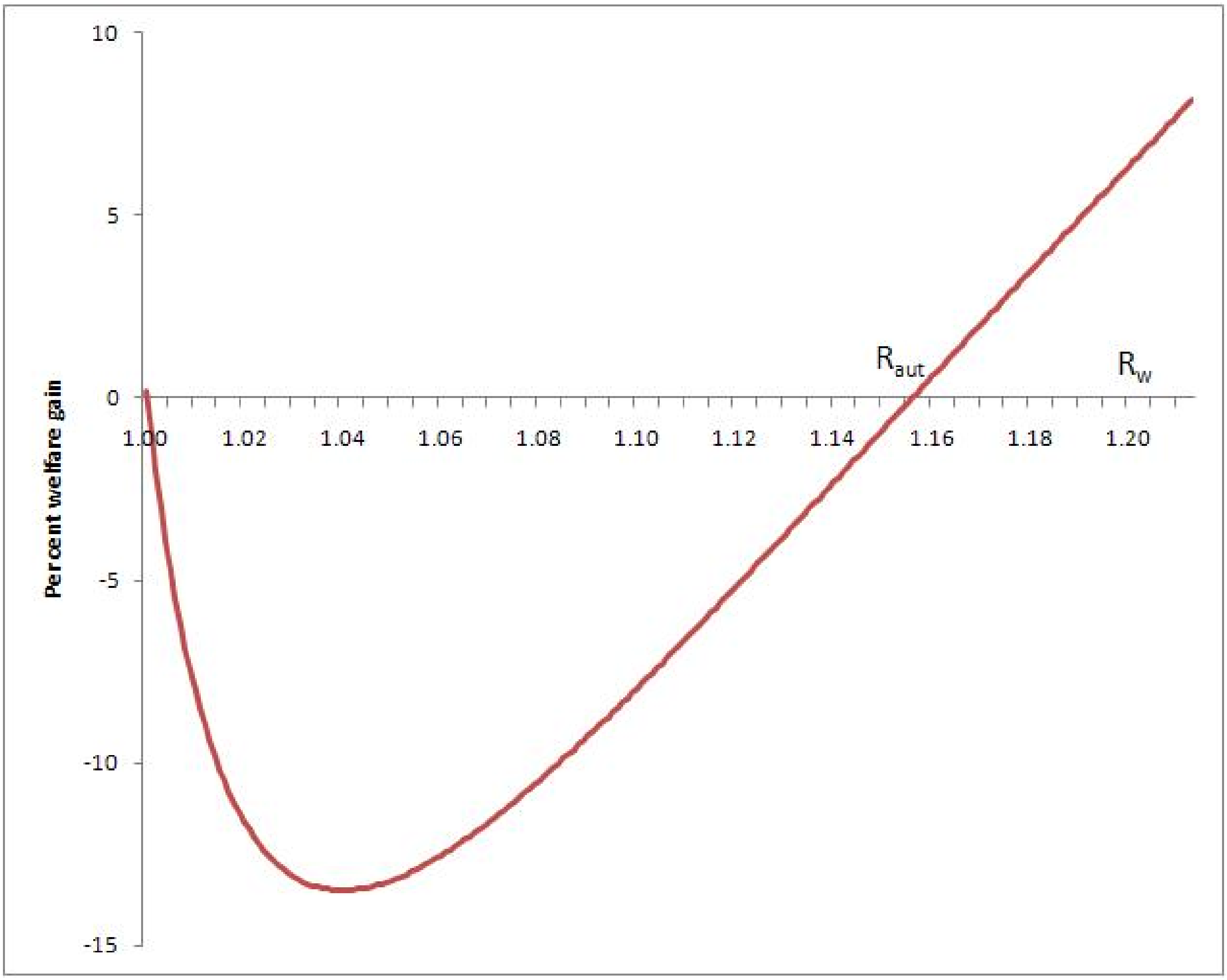

Figure 4: Welfare Gain from Autarky at Different Levels of the World Rate of Return, R_w

Notes: The graph plots the value of μ, the percent permanent gain (or loss) in consumption that is equivalent to operating under autarky. The value R^* is the steady state rate of return in autarky. This value is calculated, as described in the text, from a neoclassical savings model with a discount rate of $\beta = 0.9$, an intertemporal elasticity of substitution of $1/\sigma = 1/2$, a depreciation rate of $\delta = 0.06$, a population growth rate of $n = 0.02$ and a technological growth rate of $g = 0.02$.

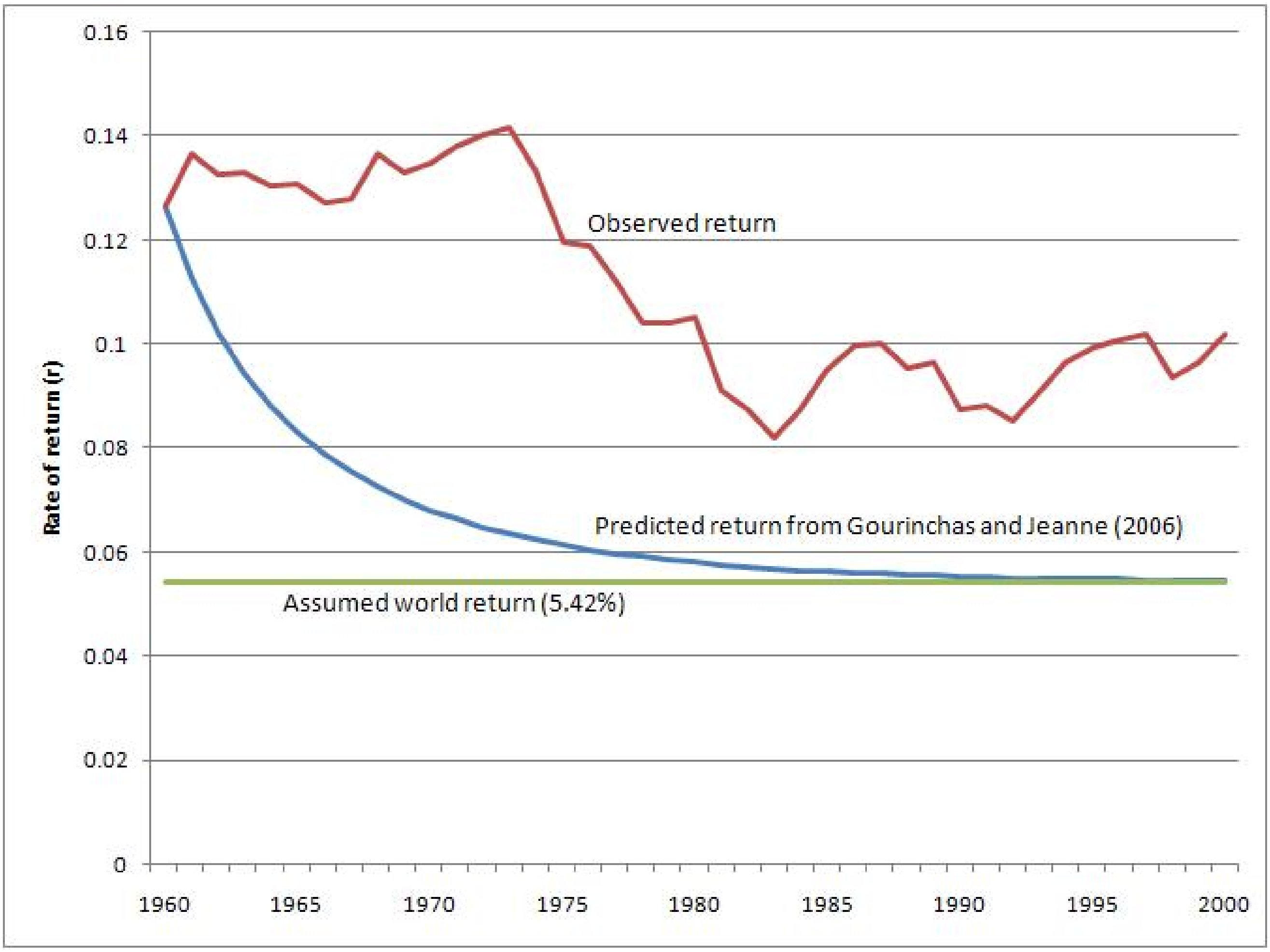

Figure 5: Actual and Predicted Rates of Return in Brazil, 1960-2000

Notes: Actual data on rate of return is calculated as the marginal product of capital minus depreciation of 6%, where the marginal product is $\alpha\hat{k}^{\alpha-1}$. Data on the actual capital stock per efficiency unit, $\hat{k}$, is from the Penn World Tables, Mark 6.1, as described in the text. The predicted rate of return is derived from a neoclassical model of savings with a discount rate of $\beta = 0.96$, technological growth of 1.2% per annum, population growth of 0.74% per annum, an intertemporal elasticity of substitution of one, and an elasticity of output with respect to capital of 0.33. The values match those used in Gourinchas and Jeanne (2006) in their calculation of the welfare gains from financial integration.

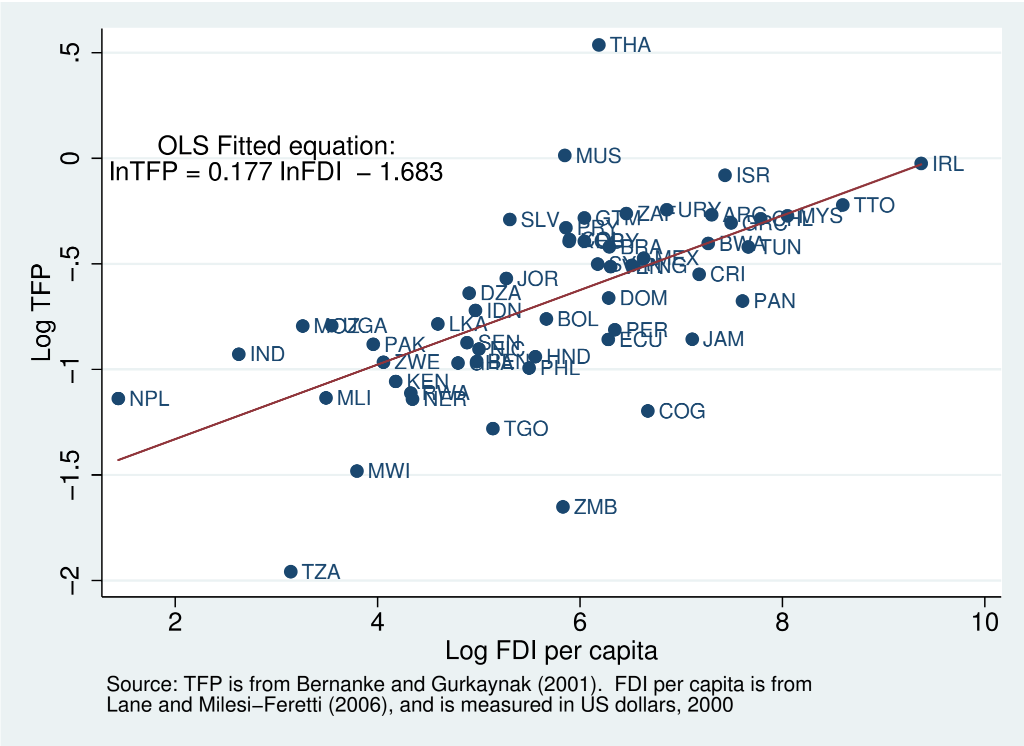

Figure 6: Cross-country Relationship of TFP and FDI

Table 1: Welfare Effects of Autarky, by Region, 1960–2000

				Robustness:	
		Baseline: $\sigma = 2$		$\sigma = 1$	$\sigma = 4$
Region	N	Mean μ	SD μ	Mean μ	Mean μ
Central and South Amer.	21	-5.10	23.33	-5.11	-15.21
ex. Venezuela	20	-9.24	13.94	-12.89	-9.56
Sub-Saharan Africa	32	-16.16	19.19	-15.93	-19.32
Asia	13	-5.13	13.61	-4.94	-5.72
Middle East and N. Africa	8	-11.54	15.11	-11.98	-13.41
Europe and Neo-Europes	23	-7.72	10.24	-7.43	-6.73
All	98	-10.10	18.10	-9.97	-13.57
ex. Venezuela	97	-11.06	15.67	-10.99	-13.04

Notes: The table reports the mean and standard deviation of the value μ, which is the percent permanent decrease in consumption that is equivalent to being in autarky 1960–2000. See text for details of it's construction. N is the number of observations in each group, and the countries comprising each group are listed in the appendix. The baseline results are calculated using a coefficient of relative risk aversion of $\sigma = 2$, while the robustness considers the mean values of μ using values of $\sigma = 1$ and $\sigma = 4$, respectively. The results excluding Venezuela are shown as it is an outlier in the results.

Table 2: Outcomes Under Autarky

	Relative Values:		Welfare Effects:	
Country	k^{aut}/k^{obs}	y^{aut}/y^{obs}	μ	μ^{FDI}
Argentina	1.23	1.07	-1.44	-5.36
Australia	1.03	1.01	-4.39	
Austria	0.92	0.97	-9.59	
Burundi	0.38	0.73	-6.16	
Belgium	0.92	0.97	-6.81	
Benin	0.75	0.91	-9.43	-9.87
Burkina Faso	0.56	0.83	4.25	
Bangladesh	1.02	1.01	4.69	
Bolivia	1.11	1.04	-10.68	-12.21
Brazil	0.99	1.00	-16.39	-19.44
Barbados	1.54	1.15	-52.52	
Canada	0.72	0.90	-3.42	
Switzerland	1.00	1.00	-0.15	
Chile	0.92	0.97	-2.34	-4.70
China	0.78	0.92	11.52	
Cote d'Ivoire	1.13	1.04	-15.23	-15.58
Cameroon	0.77	0.92	-0.27	-0.49
Rep. of Congo	1.32	1.10	-55.89	-58.29
Colombia	0.82	0.93	-1.73	-2.70
Comoros	0.68	0.88	-30.90	
Cape Verde	1.20	1.06	-26.09	
Costa Rica	0.73	0.90	-6.91	-8.23
Denmark	0.97	0.99	-4.27	
Dominican Rep.	0.95	0.98	-0.21	-1.33
Algeria	1.19	1.06	-12.52	-13.39
Ecuador	0.93	0.98	-20.62	-23.41
Egypt	1.01	1.00	-12.54	-13.43
Spain	0.87	0.95	-14.02	
Ethiopia	1.14	1.04	-8.25	-8.72
Finland	1.10	1.03	-4.58	
France	0.87	0.96	-10.80	
Gabon	1.25	1.08	-21.44	-20.74
Great Britain	0.98	1.00	-0.01	
Ghana	1.54	1.15	-48.62	-48.85
Guinea	1.62	1.17	-5.44	
The Gambia	0.32	0.69	-35.80	
Guinea-Bissau	1.68	1.19	-52.47	
Eq. Guinea	0.32	0.69	25.36	
Greece	1.11	1.03	-21.13	-25.92
Guatemala	0.91	0.97	-13.50	-13.98
Hong Kong	0.74	0.90	-18.85	
Honduras	0.59	0.84	-3.70	-4.25
Indonesia	0.42	0.75	41.01	39.74

Table 2: Outcomes Under Autarky

	Relative Values:		Welfare Effects:	
Country	k^{aut}/k^{obs}	y^{aut}/y^{obs}	μ	μ^{FDI}
India	0.97	0.99	-2.40	-3.25
Ireland	0.86	0.95	-1.39	-5.39
Iran	1.11	1.03	20.24	16.07
Iceland	1.24	1.07	-13.08	
Israel	1.02	1.01	-27.41	-32.50
Italy	1.06	1.02	-11.72	
Jamaica	1.31	1.09	-0.59	-1.99
Jordan	0.66	0.87	-21.23	-22.48
Japan	0.64	0.86	-21.51	
Kenya	1.37	1.11	-14.48	-14.88
Rep. of Korea	0.44	0.76	7.66	2.39
Sri Lanka	0.58	0.84	-4.97	-5.61
Lesotho	0.11	0.48	-18.98	
Luxembourg	1.09	1.03	13.03	
Morocco	0.80	0.93	-19.08	-20.24
Madagascar	1.03	1.01	-23.17	-20.21
Mexico	0.83	0.94	-12.15	-15.10
Mali	1.20	1.06	5.65	4.60
Mozambique	0.64	0.86	-28.75	
Mauritius	1.19	1.06	-11.75	-14.97
Malawi	1.71	1.19	-28.46	-29.19
Malaysia	0.54	0.82	6.65	3.96
Niger	1.66	1.18	-1.16	-1.66
Nigeria	0.33	0.69	9.30	8.89
Nicauragua	0.60	0.85	-24.09	
Netherlands	1.03	1.01	-3.00	
Norway	0.96	0.99	-9.75	
Nepal	0.45	0.77	1.16	
New Zealand	0.92	0.97	-2.18	
Pakistan	1.00	1.00	-31.52	-32.09
Panama	0.71	0.89	-14.60	-15.51
Peru	1.22	1.07	-18.54	-21.60
Philippines	0.88	0.96	-4.57	-6.32
Portugal	0.76	0.91	-13.81	
Paraguay	0.65	0.87	14.95	13.74
Romania	1.18	1.06	-34.65	
Rwanda	0.57	0.83	9.45	9.25
Senegal	1.16	1.05	-9.51	-9.74
El Salvador	0.80	0.93	-6.43	-7.07
Sweden	0.98	0.99	-7.50	
Seychelles	0.50	0.80	16.58	
Syria	1.27	1.08	-14.10	
Chad	2.07	1.27	-16.89	-20.46

Table 2: Outcomes Under Autarky

	Relative Values:		Welfare Effects:	
Country	k^{aut}/k^{obs}	y^{aut}/y^{obs}	μ	μ^{FDI}
Togo	0.43	0.76	-17.48	-17.71
Thailand	0.63	0.86	-6.32	-12.11
Trinidad and Tobago	1.00	1.00	2.50	1.52
Turkey	0.58	0.84	-7.65	-9.40
Tanzania	1.45	1.13	-29.72	-32.63
Uganda	0.50	0.80	1.64	1.55
Uruguay	1.17	1.05	4.84	2.50
United States	0.75	0.91	-5.12	
Venezuela	1.45	1.13	82.95	79.37
South Africa	1.33	1.10	3.13	2.24
Zambia	1.31	1.09	-43.15	-46.16
Zimbabwe	1.22	1.07	-35.65	-36.80
Average	0.95	0.97	-10.10	
Standard Dev.	0.35	0.13	18.10	
FDI Sample Average			-8.19	-9.83
FDI Sample Average			-9.83	-8.19

Notes: The value of k^{aut}/k^{obs} and y^{aut}/y^{obs} measure the predicted size of the capital stock and income per capita, respectively, under autarky relative to their observed values. Both the predicted and observed values of capital and output are for the year 2000. See text for precise definitions of these values. The value of μ measures the permanent percent change in consumption equivalent to being under autarky 1960–2000; negative numbers indicate that autarky would have lowered welfare, while positive numbers indicate that autarky would have improved welfare. μ^{FDI} measures the welfare impact, in similar terms, when we incorporate the lower growth rate in TFP that would have obtained without inflows of FDI over 1960–2000. The parameters of the neo-classical model used to calculate the autarky values are a depreciation rate of $\delta = 0.06$, a production function parameter of $\alpha = 0.33$, and a coefficient of relative risk aversion of $\sigma = 2$. Population growth and technological growth are obtained from country data, as explained in the text.

Table 3: Sources of Variation in Income per Capita

	Relative value of:				
Country	y	B	$(k^F)^\gamma$	$(k^{aut})^{\alpha-\gamma}$	$(k/k^{aut})^{\alpha-\gamma}$
Argentina	0.417	0.622	0.792	0.925	0.916
Benin	0.046	0.197	0.603	0.374	1.034
Bolivia	0.103	0.276	0.710	0.560	0.940
Brazil	0.273	0.497	0.715	0.795	0.965
Chile	0.376	0.573	0.813	0.821	0.984
Cote d'Ivoire	0.071	0.263	0.621	0.463	0.936
Cameroon	0.077	0.287	0.597	0.440	1.028
Rep. of Congo	0.069	0.204	0.711	0.525	0.901
Colombia	0.204	0.483	0.658	0.633	1.014
Costa Rica	0.223	0.429	0.755	0.660	1.042
Dominican Rep.	0.200	0.449	0.719	0.634	0.976
Algeria	0.186	0.439	0.623	0.735	0.923
Ecuador	0.131	0.288	0.703	0.662	0.981
Egypt	0.159	0.479	0.666	0.517	0.962
Ethiopia	0.024	0.159	0.515	0.314	0.934
Gabon	0.318	0.711	0.641	0.766	0.912
Ghana	0.051	0.213	0.604	0.458	0.866
Greece	0.554	0.754	0.750	1.042	0.940
Guatemala	0.148	0.418	0.664	0.542	0.987
Honduras	0.078	0.219	0.656	0.490	1.100
Indonesia	0.138	0.396	0.566	0.517	1.192
India	0.094	0.351	0.528	0.522	0.970
Ireland	1.000	1.000	1.000	1.000	1.000
Iran	0.227	0.560	0.573	0.753	0.940
Israel	0.643	0.769	0.826	1.055	0.960
Jamaica	0.140	0.267	0.764	0.760	0.901
Jordan	0.148	0.354	0.686	0.570	1.068
Kenya	0.047	0.204	0.555	0.467	0.892
Rep. of Korea	0.602	0.824	0.716	0.865	1.179
Sri Lanka	0.125	0.365	0.608	0.512	1.101
Morocco	0.141	0.361	0.655	0.585	1.019
Madagascar	0.032	0.203	0.530	0.308	0.957
Mexico	0.332	0.553	0.748	0.794	1.010
Mali	0.037	0.181	0.551	0.401	0.921
Mauritius	0.528	0.972	0.697	0.845	0.923
Malawi	0.030	0.148	0.552	0.430	0.845
Malaysia	0.376	0.573	0.782	0.747	1.123
Niger	0.033	0.172	0.554	0.409	0.851
Nigeria	0.027	0.106	0.635	0.314	1.270
Pakistan	0.076	0.286	0.555	0.496	0.964
Panama	0.230	0.378	0.796	0.728	1.050
Peru	0.174	0.349	0.706	0.768	0.918

Table 3: Sources of Variation in Income per Capita

			Relative value of:		
Country	y	B	$(k^F)^\gamma$	$(k^{aut})^{\alpha-\gamma}$	$(k/k^{aut})^{\alpha-\gamma}$
Philippines	0.130	0.337	0.636	0.607	0.996
Paraguay	0.178	0.429	0.661	0.585	1.071
Rwanda	0.034	0.192	0.549	0.290	1.109
Senegal	0.061	0.241	0.611	0.448	0.930
El Salvador	0.168	0.447	0.676	0.546	1.019
Chad	0.034	0.150	0.591	0.481	0.806
Togo	0.033	0.136	0.612	0.335	1.187
Thailand	0.260	0.446	0.700	0.772	1.080
Trinidad and Tobago	0.424	0.656	0.865	0.774	0.964
Turkey	0.259	0.545	0.636	0.677	1.103
Tanzania	0.018	0.080	0.575	0.454	0.880
Uganda	0.036	0.226	0.559	0.247	1.143
Uruguay	0.365	0.667	0.721	0.817	0.928
Venezuela	0.243	0.431	0.758	0.847	0.880
South Africa	0.286	0.567	0.744	0.753	0.899
Zambia	0.034	0.117	0.652	0.489	0.902
Zimbabwe	0.094	0.274	0.599	0.627	0.917
Average	0.196	0.394	0.665	0.609	0.987
Standard Dev.	0.188	0.214	0.095	0.195	0.096

Notes: The values are the size of each variable relative to the same variable in Ireland. Ireland is chosen as the reference country because it is relatively rich and is generally considered one of the most integrated small economies in the world. All data is from 2000. y is output per capita, B is residual TFP, (k^F) is the direct productivity effect of foreign capital, k^{aut} is the calibrated aggregate capital stock per capita in autarky, and k/k^{aut} is the observed aggregate capital stock relative to the calibrated autarky capital stock. The value of γ used is 0.035, as discussed in the text, and the values of α is 0.33.

Table 4: Variance Decomposition of Log Output per Capita, 2000

	$\ln y$	$\ln B$	$\ln (k^F)^\gamma$	$\ln (k^{aut})^{\alpha-\gamma}$	$\ln (k/k^{aut})^{\alpha-\gamma}$
$\ln y$	0.954				
$\ln B$	0.538	0.322			
$\ln (k^F)^\gamma$	0.043	0.022	0.003		
$\ln (k^{aut})^{\alpha-\gamma}$	0.361	0.188	0.018	0.164	
$\ln (k/k^{aut})^{\alpha-\gamma}$	0.012	0.006	0.001	-0.008	0.013
Share of $Var(\ln y)$	1.000	0.563	0.045	0.378	0.011

Notes: The table reports the variance and covariances of the various components of output per capita, where output per capita is described by $y = B(k^F)^\gamma \left(k/k^{aut}\right)^{\alpha-\gamma} (k^{aut})^{\alpha-\gamma}$. Output y and aggregate capital stocks k are from the Penn World Tables. k^F is the stock of FDI liabilities per person, from Lane and Milesi-Feretti (2006). k^{aut} is the predicted autarky capital stock from the calibration described in the text. The parameter α is set to 0.33. The parameter γ is the elasticity of productivity with respect to FDI, and is taken to be 0.036, following our review of the firm level literature, see text. The "Share of $Var(\ln y)$" is calculated as the variance of each individual term, plus the covariance of the term with all other components, divided by the variance of $\ln y$.