On the Benefits of Capital Account Liberalization for Emerging Economies*

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*This paper reflects the views of its authors, not necessarily those of the IMF.

Abstract

Standard theoretical arguments tell us that countries with relatively little capital benefit from financial integration as foreign capital flows in and speeds up the process of convergence. We show in calibrated exercises that conventionally measured welfare gains from this type of convergence appear relatively limited for the typical emerging country. The traditional theory, then, does not seem to provide a sufficient rationale for capital account liberalization. Our approach emphasizes instead that poor countries face a number of distortions that prevent the allocation of production inputs to their most efficient uses. Liberalization of the capital account should then be understood as a means to eliminate or reduce these distortions, and it is this effect of liberalization that may create first order gains. As an illustration of this approach, we present a model in which capital account account liberalization improves domestic allocative efficiency because of its effect on property rights. Our theory has implications for the political economy of financial integration. First, we show that politicians may open the capital account as a way of "locking-in" domestic reform, even when they cannot commit to either decision. Second, traditional trade arguments (e.g. Stolper-Samuelson) would argue that in capital-scarce countries, domestic capitalists would oppose financial integration as it reduces the return to capital, while workers would typically favor it. The political economy of financial integration does not seem to reflect these predictions. Often, domestic capitalists favor integration while workers may or may not oppose it.

1 Introduction

The recent crises have certainly dampened the hope that capital account liberalization provides a smooth road to growth and development for emerging economies. Some economists have advocated a policy reversal. The time seems ripe for a re-examination of the benefits and costs of capital account opening. This paper attempts to take a broad view of the benefits and costs of capital account liberalization for emerging economies, in an attempt to outline what could be a research agenda on these issues. When we look at the range of benefits and costs that economists have attributed to capital account opening, which ones seem potentially large and maybe deserve increased attention from the profession?

In this paper, we distinguish two classes of benefits of capital account opening. The first category includes the benefits in terms *international* allocative efficiency. This includes for example consumption smoothing in response to shocks, or the possibility to accelerate domestic capital accumulation with the help of foreign capital. This category is the one economists understand best, at least in theory, since it is about the welfare benefits of efficient markets. As noted by Eichengreen (2001) "The case for free capital mobility is thus the same as the case for free trade but for the subscripts of the model".

The second class of benefits is a bit more difficult to define, but could be characterized as encompassing the channels by which capital account opening can improve *domestic* allocative efficiency. An open capital account could improve domestic efficiency because of the technological and know-how content of FDI, because the entry of more efficient foreign banks improves the allocation of domestic savings, because an open capital account can generate incentives to reform domestic policies and maintain an investor-friendly domestic environment (the market discipline argument). More broadly it includes the incentives to reform the domestic economic system in a way that reduces unproductive activities (diversion, rent-seeking), or secure better guarantees of property rights—what Hall and Jones (1997) call the "social infrastructure of countries".

The first part of the paper considers the first class of benefits—those in terms of international allocative efficiency. We review the literature and present a new piece of evidence, based of the calibration of a simple neoclassical growth model. This model has increasingly been adopted as the benchmark framework to analyze growth and convergence in an international perspective. As a result, we can rely on the empirical literature on growth and convergence to calibrate the model, and compare the welfare effects of different policies, including capital account opening. We find that while financial openness increases domestic welfare, and while this benefit can be significant for some countries, it is not very large when compared to the benefits of alternative policies that reduce domestic distortions or increase domestic productivity.

This leads us to think that the second category of benefits—in terms of *domestic* allocative efficiency— should perhaps receive relatively more attention than the first. If Hall and Jones (1997) are right that most of the inequality in world income is explained by differences in the "social infrastructure" of countries, then the question of how capital account opening interacts with social infrastructures seems quite relevant. Obviously, this question is as

multifaceted as the concept of social structure itself. The balance of costs and benefits of capital account opening must depend on the domestic political economy, institutions, ideological inclinations, and level of economic development of the country in question. We do not ambition to explore all the aspects of the problem in this paper, and present instead the following "bits" of analysis.

We present a model that focuses on capital account liberalization and the respect of property rights. We consider a country that can commit not to expropriate capital at an horizon that is too short for investment to take place—the standard time-consistency problem in the taxation of capital. As a result, under financial autarky, all the domestic investment goes to the unproductive, informal sector. However the country can commit to leave the capital account open (at the same short horizon). We show that an open capital account provides incentives to maintain an investor-friendly environment, because a failure to do so generates a capital outflow. By this mechanism, opening the capital account can induce a take-off in domestic productivity, which in theory could occur even if there are no capital inflows. In an extension of the model, we also show that if capital becomes illiquid once it is installed in the country, capital account openness retain its benefits if investors are given liquidation rights. These liquidation rights, however, may make the economy vulnerable to self-fulfilling capital account crises.

This is work in progress. This is the first draft of the first paper in a research program on the benefits and costs of capital account liberalization for emerging economies. The goal of this paper is to present the research program, as well as the material that we have at this stage to back it up. We think this material is encouraging, but there are a number of holes. We discuss the directions that our work could take in the conclusion.

2 International Allocative Efficiency

The literature on the gains from capital account liberalization traditionally emphasizes two benefits in terms of allocative efficiency. First, through access to international financial markets, an open economy will be able to stabilize consumption more efficiently against output fluctuations. The welfare gains associated with this consumption smoothing are discussed in Obstfeld (1994) and Cole and Obstfeld (XX). Second, financial integration achieves an efficient allocation of world savings as capital scarce countries—with a correspondingly high marginal product of capital—can borrow from the rest of the world. These capital movements from rich to poor countries accelerate domestic accumulation and convergence.

In this paper, we concentrate on this second class of benefits. First, our focus is on the factors that eventually lead to convergence in output per capita, less on short term fluctuations and the associated business cycle movements. Second, our view is that estimates of the gains from international risk sharing are typically low, except perhaps for very poor countries (see Pallage and Rob (1999)). And third, the evidence suggests that capital flows are procyclical in emerging economies, making it unlikely that international financial integration allow them to smooth consumption in response to shocks.

While the existing literature has investigated extensively the welfare benefits from consumption insurance, little is known about the size of the welfare gains associated with a

faster transition towards the steady state. While there is little conceptual difficulty in this exercise, we will nonetheless reach some surprising conclusions, that will form the preamble for our subsequent analysis.

We begin this section with the simplest possible model: the textbook Ramsey model. In this simple model, calculations of welfare gains from financial opening are straightforward. They are small, very small indeed, for reasonable parameterizations. This results from an unappealing feature of the simplest Ramsey model: the implied theoretical rate of convergence to the steady state is too rapid. Equivalently, countries are not very far from their conditional steady state. As Mankiw Romer and Weil (1992) noted, this is the consequence of too low a capital share. To address this problem, we extend the model to accommodate human capital accumulation. While this ensures slower convergence, the implied welfare gains remain small. Even with human capital, it appears that most countries are not very far from their specific steady state.

Most of the traditional gains from financial integration result from this accelerated conditional convergence. Yet, these gains are trivial, when compared to the gains obtained from either the removal of domestic distortions that distort domestic saving rates, or from the adoption of better technologies. In other words, if financial integration is to be significantly beneficial, it has to improve the efficiency of domestic economies, not simply by providing additional capital at world interest rates.

2.1 The Textbook Ramsey model

We begin by reviewing well-known implications of the standard Ramsey model.

2.1.1 The Model.

Consider then, the problem faced by a small open economy, à la Ramsey-Koopman-Cass. Time is discrete and there is no uncertainty. The representative agent is infinitely lived and has the following preferences, defined over sequences of consumption per effective unit of labor $\{c_t\}$:

$$U_0 = \sum_{t=0}^{\infty} \beta^t \; L_t \; \frac{\left(A_t c_t\right)^{1-\gamma}}{1-\gamma} \tag{1}$$

where $0 < \beta < 1$ represents the discount factor and γ is the coefficient of relative risk aversion. L_t denotes the population size, growing at the exogenous rate $n : L_t = L_0.n^t$, while productivity A_t increases exogenously at rate $g : A_t = A_0.g^t$. We make the normalization $L_0 = 1$.

The economy produces a single tradable good, using capital and labor, according to a Cobb Douglas production function, so output per efficient unit of labor, y_t, follows:

$$y_t = k_t^{\alpha}, \;\; 0 < \alpha < 1 \tag{2}$$

Lastly, the evolution of the capital stock per efficient unit is governed by:

$$k_{t+1} = \frac{1}{ng}\left[\left(1-\delta_k\right)k_t + y_t - c_t\right] \tag{3}$$

where δ_k is the rate of depreciation of physical capital.

Our assumptions imply that k converges towards a steady state value k^*such that:

$$k^* = \left(\frac{s_k}{\delta_k + n.g - 1}\right)^{1/1-\alpha} \tag{4}$$

where $s_k = \alpha.\left(\delta_k + n.g - 1\right) / \left(\delta_k + \beta^{-1} g^{\gamma} - 1\right)$ is the saving rate in the steady state of the closed economy.

We now consider transition path towards this steady state, starting from an initial capital stock $k_0 \neq k^*$ at time $t = 0$, under two scenarios: financial autarky, and financial integration.

Financial Autarky. Under financial autarky, the small country must accumulate capital domestically. Consumption satisfies the usual Euler equation:

$$c_t^{-\gamma} = \beta.g^{-\gamma}.c_{t+1}^{-\gamma}\left[1 - \delta_k + \alpha.k_{t+1}^{\alpha-1}\right] \tag{5}$$

Starting from k_0, the economy evolves along the stable arm of the dynamic system in c and k defined by equations (3) and (5), and converges towards (c^*, k^*) where $c^* = (1 - \delta_k - ng)\, k^* + k^{*\alpha}$ denotes consumption per efficient units. Since capital accumulation competes with current consumption, convergence towards the steady state occurs gradually over time.

Let's denote $U^a(k_0)$ the welfare of the representative agent with initial capital k_0, defined according to equation (1).

Financial Integration. We consider now the case where this small open economy integrates financially with the rest of the world. We assume that the economy is sufficiently small so as not to influence the world interest rate R^*. We further assume that the world real interest rate is consistent with the steady-state marginal return to capital in the small economy. That is, we impose that R^* equals the growth-adjusted discount rate, $\beta^{-1} g^{\gamma}$. This ensures that financial integration does not tilt domestic consumption profiles.[1]

We also assume that there are no impediments to financial flows. This maximizes the welfare benefits from integration, since capital flows will fully and immediately arbitrage away any difference in marginal returns to capital. In this sense, our model is a model where financial integration results in immediate and massive capital flows from a capital abundant rest of the world to a capital scarce domestic economy. The associated neo-classical welfare gains should then be understood as upper bounds on the true welfare gains.[2]

Equating domestic and foreign returns to capital, convergence in output is instantaneous, as is well known:

$$\begin{aligned} k^i &= \left(\frac{\alpha}{R^* + \delta_k - 1}\right)^{1/1-\alpha} = k^*; \\ y^i &= k^{*\alpha} \end{aligned}$$

[1] Equivalently, we assume that the discount factor is common. It is well known that otherwise, there would be no stable cross country distribution of income per capita.

[2] We are also implicitly assuming that the rest of the world has reached its steady state. If this were not the case, world interest rates would be higher and the benefits from integration conparatively lower.

Since the world interest rate equals the growth-adjusted discount rate, consumption also jumps to a constant level, consistent with the intertemporal budget constraint:

$$c^i = c^* - (R^* - gn)(k^* - k_0)$$

Consumption is smaller than the autarky steady state consumption c^* since the domestic country must pay interest on initial foreign capital inflows $k^* - k_0$. We denote $U^i(k_0)$ the welfare of the representative agent under financial integration.

To compare welfare under the two scenarios, we define the compensating variation $\mu^i(k_0)$ as the percentage drop in consumption that makes the agent in the integrated economy indifferent between the two convergence paths. That is, $\mu^i(k_0)$ satisfies:

$$\left(1 - \mu^i(k_0)\right)^{1-\gamma} U^i(k_0) = U^a(k_0)$$

or equivalently:[3]

$$\mu^i(k_0) = 1 - \left(\frac{U^a(k_0)}{U^i(k_0)}\right)^{1/1-\gamma} \tag{6}$$

Similarly, we can define the $\mu^a(k_0)$ as the equivalent variation, that is, the percentage increase in consumption that brings the welfare of the representative agent under autarky up to its level under integration:[4]

$$\begin{aligned} \mu^a(k_0) &= \left(\frac{U^i(k_0)}{U^a(k_0)}\right)^{1/1-\gamma} - 1 \\ &= \frac{\mu^i(k_0)}{1 - \mu^i(k_0)} \end{aligned}$$

2.1.2 Specification and results

A natural question is whether the welfare gains, as measured by $\mu^i(k_0)$ or $\mu^a(k_0)$ are large or small. To answer this question, we need to make a number of additional assumptions. First, we assume that the growth rate of productivity, g, and the depreciation rate for physical capital δ_k are common across countries. g reflects the advancement of knowledge. Our assumption implies that there is a common technological frontier expanding at the same pace in all countries. This is a common assumption in the growth literature (see Hall and Jones (1999) and Parente and Prescott (2000)). There is also little reason to assume that depreciation rates differ systematically across countries. Accordingly, we set $g = 1.012$, in line with long run multifactor productivity growth in the U.S., and $\delta_k = 6\%$. We further assume that the discount factor β is equal to 0.96, while the capital share α is 0.3.[5]

If all countries share the same preferences, technology and population growth, they would all converge towards the same steady state and standards of living. This *unconditional* convergence is strongly at odds with the data (see Barro and Sala-i-Martin (1995)). Accordingly, we introduce three elements that allow for different steady states across countries. First, we

[3] With log preferences, the condition becomes: $\mu^i(k_0) = 1 - e^{(1-\beta n)\left(U^a(k_0) - U^i(k_0)\right)}$.

[4] Similarly, with log preferences: $\mu^a(k_0) = e^{(1-\beta n)\left(U^i(k_0) - U^a(k_0)\right)} - 1$.

[5] With these assumptions, the world real interest rate is equal to $R^* = 1.0542$.

will allow different population growth rate n. Second, countries may also differ in their level of productivity A_0. As Mankiw et al mention, 'A_0 reflects not just technology but resource endowments, climate, institutions, and so on' (Mankiw et al, p.411). Hall and Jones (1999) ascribe these differences in productivity to differences in institutions and government policies, which they call social infrastructure.

The variation in population growth rates does not account for the observed variation in national saving rates and the corresponding variation in levels of steady state capital k^*. To do so, we assume that domestic returns to capital are implicitly distorted at a rate τ that is country specific. We refer to τ as the *capital wedge*. τ is a shorthand for all the distortions that potentially affect the return to domestic capital: credit market imperfections, taxation, expropriation, bureaucracy, bribery and corruption... Different models would have different implications for the implicit rents generated by the distortion, τRk. For simplicity, we assume that these are rebated in a lump-sum fashion to the representative agent. In this manner, we focus exclusively on the distortive aspects of the capital wedge. Under this modification, the steady state saving rate is a decreasing function of τ:

$$s_k(\tau) = \alpha . \frac{\delta_k + n.g - 1}{\delta_k + R^*/(1-\tau) - 1}. \tag{7}$$

The steady state marginal product of capital $R^*/(1-\tau)$ exceeds the world interest rate when $\tau > 0$.

We use data from the Summers-Heston Penn World Tables (PWT), version 6.0 to construct the saving rate s_k , current capital per capita k_0 and the growth rate of the population n. PWT version 6.0 extends data through 1998 for most variables in the Penn World Tables. As in Mankiw et al, we measure n as the average growth rate of the working age population (ages 15 to 64), using data on the fraction of the population of working age from the World Bank's World Development Indicators. The steady state saving rate $s_k(\tau)$ is defined as the average share of gross investment in GDP from 1985 to 1995. This call for two remarks. First, to the extent that countries are open, we are under/overstating the true saving rate if countries are running a current account surplus/deficit. Second, steady state saving rates may differ from current ones if countries are far from steady state.

PWT version 6.0 does not contain estimates of the stock of capital. Instead, we follow Bernanke and Gurkaynat (2001)'s methodology and construct capital stocks using their perpetual inventory method.[6] Our final sample includes between 67 and 76 countries.

Using equation (4) and data on initial capital and output per capita, we construct a measure of the capital gap $\ln k^*/k_0$ in 1960 and 1995 according to:[7]

$$\ln k^* - \ln k_0 = \frac{1}{1-\alpha}\left[\ln\left(\frac{s_k}{\delta_k + ng - 1}\right) - \ln\left(\frac{k_0}{y_0}\right)\right]$$

This decomposition follows Klenow and Rodriguez-Clare (1997) and Hall and Jones (1999) in writing the capital gap in terms of the capital-output ratio rather than the capital-labor ratio. We do this since the capital-labor ratio would increase with an exogenous increase in

[6] We refer the reader to their paper for more details and thank them for making the data available.

[7] Note that the capital gap is independent of the country specific capital gap A_0.

Capital Gap	OECD					non-OECD				
year	mean	min	max	s.d.	Obs.	mean	min	max	s.d.	Obs.
1960	0.59	0.02	0.86	0.20	21	0.60	0.02	0.97	0.26	55
1995	0.45	0.11	0.73	0.14	20	0.35	0.01	0.93	0.19	47

Table 1: Capital Gap Summary, as a fraction of the Steady State Capital Stock, 1960 and 1995

Capital Wedge	OECD					non-OECD				
year	mean	min	max	s.d.	Obs.	mean	min	max	s.d.	Obs.
1960-1970	0.00	-0.06	0.12	0.04	21	0.27	-0.02	0.75	0.19	56
1985-1995	0.01	-0.04	0.07	0.03	21	0.19	-0.06	0.57	0.14	48

Table 2: Capital Wedge Summary, 1960 and 1995

productivity. Instead, along a balanced growth path, the capital-output ratio is related to the saving rate.

Table 1 reports summary statistics for the capital gap of OECD and non OECD countries, measured as $1 - k_0/k^*$.[8]

The table indicates that the average gap has declined somewhat between 1960 and 1995. Surprisingly, the decline is more pronounced for non-OECD countries, indicating that these countries may have moved closer to their conditional steady state. We also observe significant heterogeneity, with some countries exhibiting a capital gap close in excess of 90%.[9] For our purpose, the relevant number is a capital gap of 35 and 45% for non-OECD and OECD countries respectively.

Our calibrated model requires also an estimate of the capital wedge τ. We can invert equation (7) to construct an average estimate of the wedge from average saving rates s_k and labor force growth rates n. We calculate the capital wedge at the beginning of the sample, using average population growth rates and saving rates from 1960 to 1970. We also calculate the capital wedge consistent with the average saving rate and population growth rate from 1985 to 1995. The results are reported in table 2.

The capital wedge is very large for non-OECD countries, with an average of 19% in 1995. This average masks substantial heterogeneity, as the wedge goes from -6% for some countries, implying a capital subsidy, to a prohibitive 57%.[10] The wedge is strongly correlated with

[8] We limit the sample to countries with positive capital gaps. For some countries, our measured saving rate is so low that current capital exceeds steady state capital. We do not view these cases as particularly relevant. Including them would decrease average capital gaps.

[9] Countries with capital gap in excess of 90% include Paraguay in 1995 and 1960, and, Indonesia, Singapore and Bostwana in 1960.

[10] Korea, Singapore and Thailand for non OECD countries, and Austria, Finland, France, Japan, Norway and Switzerland for OECD exhibit negative capital wedges. Madagascar, Mozambique and Uganda have wedges in excess of 50%.

percent	OECD					non-OECD				
year	mean	min	max	s.d.	Obs.	mean	min	max	s.d.	Obs.
1960	1.27	0.24	2.99	0.91	21	1.67	0.00	10.62	1.63	55
1995	0.69	0.06	1.86	0.53	20	0.65	0.01	4.06	0.64	47

Table 3: Compensating Variation, 1960 and 1995

output per capita, reflecting the correlation between standards of living and saving rates predicted by the standard Ramsey and Solow models (see Mankiw et al).

We also observe that the wedge has decreased somewhat for non-OECD countries, from 27% to 19%. Our simulations use values of τ betwen 0 and 0.7.

Figure 1 reports the welfare gains, measured by μ^i, as functions of the capital gap $k_0/k^*(\tau)$ for various values of τ.[11] The results indicate that the welfare gains are minuscule, except for very low initial values of the capital stock relative to steady state. For the typical non-OECD country, with an average capital gap of 35%, and a capital wedge of 20%, the welfare gains are only 0.96% per year! For OECD countries, with an average capital gap of 45%, and no capital wedge on average, the welfare gains are similar, at 0.72% per year.

For each country in our sample, given an initial capital stock k_0, population growth n, capital wedge τ and productivity A_0, we compute the welfare under autarky U^a and under integration U^i.[12] The results are reported in Table 3. The gains represent about 0.65% of steady state consumption for the typical non-OECD country as of 1995. This represents merely twice the welfare cost of business cycles, as calculated by Lucas! In fact, the gains are slightly larger for OECD countries. As of 1960, our estimates indicate larger gains, between 1.27 and 1.67%.[13]

Why are the welfare gains so small? The main answer is that physical capital in non-OECD economies is not very far from its steady state level. Following Hall and Jones (1999), the calibration of our model attributes most of the cross-country inequality in output per capita to cross-country differences in productivity, not capital endowments.[14] The difference between less developed countries and developed countries, in other words, is *not* that the former start with a large capital deficit that can be filled by capital outflows but rather that

[11] The values for μ^a are very comparable. Since μ^i is small, so is μ^a.

[12] We perform this calculations by first computing the capital gap and capital wedge for each country and calculating $U^a(k_0/k^*;\tau)$ and $U^i(k_0/k^*;\tau)$.

[13] The country with the largest gains then is Zimbabwe: 10.62% of steady state consumption.

[14] Young (1995) argues that the role of capital accumulation in the development of newly industrialized countries has been underestimated, because of measurement problems. For example, he finds that in a country like Singapore, the growth in output per capita is entirely explained by factor accumulation, not productivity growth. Hsieh (2002) points to an anomaly in the implications of Young's findings for factor prices: the return to capital in Singapore did not fall by the very large amount that would be predicted by the Young model. Although this problem deserves more scrutiny, we would also argue that cross-country differences in TFP seem important to explain the pattern of capital flows between developed and less developed economies. Our finding that the capital gap is roughly similar in OECD and non-OECD countries could account for the fact that capital does not flow from rich countries to poor countries (Lucas, 1990).

they are converging towards a much lower steady state. Although capital account opening can accelerate this convergence, the welfare benefit is not very large when compared to the long-run inequality resulting from cross-country differences in TFP.

Another reason why the welfare gains from capital account opening are so small could lie in the specification of the model. It is well known that the speed of convergence of the Ramsey model around the steady state is equal to $(\delta_k + n.g - 1)(1 - \alpha)$. With α equal to 0.3 and an average population growth rate equal of 2.2%, the theoretical speed of convergence would be equal to 6.59%. At this speed, the half life is only 10.5 years. It is perhaps not so surprising that financial integration does not provide substantial benefits if the convergence speed is so high.[15]

Presumably, more realistic results would obtain, with possibly larger gains associated welfare gains, if countries were further away from their conditional steady state. This can be achived, mechanically, if the capital share is higher. The next subsection looks at the introduction of human capital, alongside physical capital.

2.2 An Extended Ramsey Model with Human Capital

Growth economists have long emphasized the importance of human capital. Here we follow Mankiw et al (1992) Mankiw, Barro and Sala-i-Martin (1995) and introduce human capital in an otherwise standard Ramsey growth model. Our objective here is to derive the implications of the model for the transition path under both autarky and financial integration.

2.2.1 The Model

We extend the production function as in Hall and Jones (1999), by assuming that output per capita follows:

$$y_t = k_t^{\alpha}.h_t^{1-\alpha} \tag{8}$$

h_t denotes the amount of human-capital augmented labor used in production -measured in efficiency unit $(H_t/(A_t.L_t))$ and satisfies:

$$h_t = (1 - u_t)\, .e^{\phi.S_t}.$$

u_t represents the fraction of time devoted to human capital accumulation, so that $(1 - u_t)$ L_t the represents total amount of labor involved in production, while $\exp(\phi S_t)$ denotes the efficiency of a unit of labor. We follow Hall and Jones (1999) and Bils and Klenow (2000), and interpret S_t as educational attainment, i.e. the average years of schooling of the working age population. With this interpretation, the coefficient ϕ represents the return to schooling estimated in a Mincerian wage equation. We assume further that $0 \leq u < \bar{u} < 1$. In particular, it is not possible to allocate all the time to human capital accumulation.

In addition to the capital accumulation equation, human capital accumulates according to:

$$S_{t+1} = u_t + (1 - \delta_h)\, S_t \tag{9}$$

where δ_h represents the depreciation rate of human capital.

[15] We nonetheless observe that our theoretical speed of convergence of 6.6% is well within existing estimates (see for instance Caselli, Esquivel and Lefort (1996) who find a convergence speed of 10%).

Under our assumptions, k and S converge towards steady state values characterized by:

$$\begin{aligned} k^* &= \left(\frac{s_k(\tau)}{\delta_k + g.n - 1}\right)^{1/1-\alpha} h^* \\ h^* &= (1 - \delta_h S^*) . \exp(\phi S^*) \\ S^* &= \frac{1 - \delta_h + \phi - \beta^{-1} g^{\gamma-1} n^{-1}}{\phi\ \delta_h} \end{aligned} \tag{10}$$

where the saving rate for physical capital s_k is as before.[16]

Under our assumptions, the steady state level of human capital accumulation does not depend upon the capital wedge τ. The reason is that the capital wedge affects identically the return to education and the return on labor.

We now consider the transition paths under financial autarky and financial integration

Financial Autarky. Starting from k_0 and S_0 the economy evolves along the stable arm of the dynamic system in (c, u, k, S) and converges towards (c^*, u^*, k^*, S^*).

We denote $U^a(k_0, S_0)$ the welfare of the representative agent with initial capital k_0 and human capital S_0.

Financial Integration. As before, financial integration implies that the return to physical capital is equalized across countries:

$$1 - \delta_k + \alpha (k_t/h_t)^{\alpha-1} = R^*/(1 - \tau)$$

This pins down the ratio of physical to human capital:

$$\begin{aligned} k_t &= \left(\frac{s_k(\tau)}{\delta_k + g.n - 1}\right)^{1/1-\alpha} h_t \\ &\equiv z^*(\tau)\ h_t \end{aligned}$$

Convergence is not instantaneous, however, since human capital needs to be accumulated domestically. We show in the appendix that the optimal education policy is very simple:

$$\begin{cases} u_t = \bar{u} & S_t < S^* \\ u_t = u^* & \text{if } S_t = S^* \\ u_t = 0 & S_t > S^* \end{cases}$$

It is optimal to accumulate human capital at the maximum possible rate, u^*, as long as convergence is not achieved, i.e $S_t < S^*$. Conversely, if there is too much human capital to start with, no investment will occur. Convergence to the steady state occurs in finite time, at the maximum possible speed.

Since the world interest rate equals the growth adjusted discount factor, consumption is flat and constant, at a level consistent with the intertemporal budget constraint. Unlike the

[16] We assume that the restriction $-\phi \leq 1 - \delta_h - \beta^{-1} g^{\gamma-1} n^{-1} < \phi(\bar{u} - 1)$ is satisfied, so that $0 \leq u^* = \delta_h S^* < \bar{u}$.

Human Capital Gap	OECD					non-OECD				
year	mean	min	max	s.d.	Obs.	mean	min	max	s.d.	Obs.
1960	0.47	0.28	0.82	0.15	22	0.67	0.40	0.98	0.15	44
1995	0.26	0.10	0.59	0.12	22	0.28	0.05	0.57	0.14	48

Table 4: Human Capital Gap Summary, as a fraction of Steady State Human Capital , 1960 and 1995

previous case, in this world, the domestic agent borrows, both to increase the capital-output ratio to its steady state value, and also to ensure a flat consumption profile despite a growing income profile. As before, we denote $U^i(k_0, S_0)$ the welfare of the representative agent under financial integration, and $\mu^i(k_0, S_0)$ (resp. $\mu^a(k_0, S_0)$) the consumption equivalent from the integrated (resp. autarkic) equilibrium.

2.2.2 Specification and results

To implement the model, we need to construct estimates of the stock of human capital S_t, and its steady state value S^* for the countries in our sample. We describe in details in the appendix our methodology, which follows closely Jones (1997) and Barro and Lee (1993). Briefly, we construct a measure of total educational attainment for people over age 25 using equation (9) and data on durations of primary, secondary and higher schooling and educational, as well as data on educational attainment rates for people in the corresponding educational cells. This provides a stock measure S_t, every five years from 1960 to 2000. To construct a measure of S^*, we use the fact that $S^* = u^*/\delta_h$. We measure u^*as the investment rate in education in the last measured year (2000 in most cases).[17] As Table 4 reports, the data indicate that most countries, including OECD countries, are substantially below their steady state human capital stock. The gap decreases from 47% to 28% in OECD countries and from 67% to 28% in non-OECD countries.

Combining equations (10) and data on the capital output ratio and initial capital stock, we obtain an expression for the initial capital gap:

$$\ln k^* - \ln k_0 = \frac{1}{1-\alpha}\left[\ln\left(\frac{s_k}{\delta+n+g}\right) - \ln\left(\frac{k_0}{y_0}\right)\right] + [\ln\ h^* - \ln h_0] \tag{11}$$

The initial capital gap now depends upon two terms. As before, the first term reflects the gap between the steady state and current capital output ratio. The second term adds the gap between current and steady state output contributions of human capital. Given the definition of h_0, the only bit missing is the flow of human capital investment, u_0, compared to its steady state value, u^*. We approximate u_0 by noting that $u_t = S_{t+1} - (1-\delta_h)S_t$, and construct u_{1960} using data on educational attainment between 1960 and 1965, and u_{1995} using data on educational attainment between 1995 and 2000. The resulting capital output gaps are reported in table 5.

Capital Gap	OECD					non-OECD				
year	mean	min	max	s.d.	Obs.	mean	min	max	s.d.	Obs.
1960	0.60	0.04	0.89	0.22	21	0.61	0.03	0.97	0.26	35
1995	0.50	0.15	0.78	0.15	20	0.42	0.01	0.93	0.19	36

Table 5: Physical Capital Gap Summary, when we include Human Capital, as a fraction of Steady State Human Capital , 1960 and 1995

percent	OECD					non-OECD				
year	mean	min	max	s.d.	Obs.	mean	min	max	s.d.	Obs.
1960	1.71	0.31	4.36	1.17	21	2.04	0.12	5.22	1.46	55
1995	0.91	0.09	2.67	0.66	20	0.91	0.04	4.03	0.69	41

Table 6: Compensating Variation, 1960 and 1995

Thile the average capital gaps are similar as of 1960 between OECD and non OECD countries. On average, 50% of the gap remains in 1995 for OECD countries, and 42% for non-OECD. Lastly, since the formula for the saving rate in steady state is unchanged, our estimates for the capital wedge are also unchanged.

The results for the equivalent variation are presented in figure 2.[18] We can see from the figure that the welfare gains drop sharply as physical capital increase, just as before, while they remain mostly flat as S_0 varies.

The welfare gains for each country in the sample are reported in Table 6. As before, we find moderate gains, ranging from 0.91 in 1995 -or three times the gains from the elimination of the business cycles- to 2.04% in 1960 for non OECD countries. The maximum gain of 5.22% is reported for Korea in 1960 and 4.03% in 1995 for Paraguay.

Figure 3 plots the welfare gains under financial integration. The horizontal axis measures U^a, the welfare under autarky. The vertical axis reports U^i, welfare under integration, for each country in our sample. By the first welfare theorem, all the points must lise above the 45 degree line. How much above the 45 degree line indicates how much financial liberalization improves welfare. As we can see from the figure, for many countries, the gains are hardly discernible at all. Figure 4 reports the associated compensating variation for each country.

To get a comparison that is perhaps more meaningful, we compare these gains to the gains obtained from the elimination of the capital wedge, the only source of distortion in our economy, as well as an increase in A_0, bringing countries closer to the world technological frontier.

[17] Hence our construction of steady state human capital mirrors our construction of steady state physical capital stocks.

[18] Our simulations assume common values for ϕ and δ_h, g, β and n. This would imply a common steady state educational attainment S^* across countries (see equation (10). To match our empirical estimates, we measure welfare from relative positions in physical capital k_0/k^* and human capital S_0/S^*.

2.3 Alternative Welfare Experiments

To start with, let's consider the output per capita in each country in our sample, $A_0 y_0$, as of 1995. We can think of the process of development as a process that brings standards of living in emerging countries to their levels in the developed world. Accordingly, we can define a evelopment gap as the gap between current standards of living and the standard of living of the frontier economy, the U.S. However, we have to take into account the fact that the US itself, according to our definition, is not yet at its steady state. So we define instead a development gap as the gap between domestic output per capita and steady state output per capita in the US, $A_{us} y^*_{us}$.

A key question for economic development consists in identifying the sources of this development gap. Do they reflect lack of domestic saving, possibly caused by a high capital wedge? Do they reflect the fact that emerging countries are far away from their steady state? Or do they reflect low domestic productivity. It turns out that we can decompose the development gap into these three components since:

$$\ln A_0 y_0 - \ln A_{us} y^*_{us} = (\ln y_0 - \ln y^*) + (\ln y^* - \ln y^*_{us}) + (\ln A_0 - \ln A_{us}) \tag{12}$$

The first term reflects the domestic gap in output per efficient unit of labor. According to equations (8) and (10), it is equal to:

$$\ln y_0 - \ln y^* = \frac{\alpha}{1-\alpha}\left[\ln\left(\frac{k_0}{y_0}\right) - \ln\left(\frac{s_k}{\delta + n + g}\right)\right] + \left[\ln h_0 - \ln\, h^*\right].$$

This is the term that is eliminated or greatly reduced by financial integration. We refer to this term as the convergence gap.

The second term reflects the gap in terms of steady state output per efficient unit of labor. Using equation (10), we can rewrite this term as:

$$\begin{aligned} \ln y^* - \ln y^*_{us} \;=\; & \frac{1}{1-\alpha}\left[\ln\left(\frac{s_k(\tau)}{\delta_k + g.n - 1}\right) - \ln\left(\frac{s_k(\tau_{us})}{\delta_k + g.n_{us} - 1}\right)\right] \\ & + (\ln h^* - \ln h^*_{us}) \end{aligned}$$

It includes two components. The first one reflects differences in the capital wedge and saving patterns, while the second reflects differences in steady state human capital accumulation.

The third term in equation (12) reflects differences in productivity between the domestic country and the US, in 1995.

Figure 9 reports the decomposition for all 67 countries in our sample. The first column, labeled convergence, reports the contribution from the domestic output gap. The second column, labeled steady state, reports the contribution in of physical and human capital accumulation in steady state. The third term, labeled productivity, reports the contribution of the productivity gap.

First, we note that the development gap is important, with the average country achieving only 26% of the U.S. steady state standards of living, with OECD countries at 54% and non-OECD countries at 14% only.[19]

Second, we observe that the convergence gap accounts only for a small fraction of the development gap. On average countries are at 80% of their domestic steady state (75% for OECD countries, 81% for non OECD ones). For two of the poorest countries in our sample, Zambia and Niger, the convergence gap exceeds one, indicating that these countries are *above* steady state.

Third, the contribution of physical and human capital accumulation is very different across OECD and non OECD countries. For OECD countries, it systematically exceeds one (with an average of 1.18), implying that all OECD countries have higher rates of accumulation of human and physical capital than the U.S. in the long run. For non-OECD countries, it averages 79%, with substantial heterogeneity, from a low of 37% (Mozambique) and a high of 1.42 (South Korea).

However, it is apparent from the table that most of the development gap arises from the productivity component. The correlation between the development gap and the productivity gap is 95%. It is 82% with the steady state component and -0.21 with the convergence gap. For instance, according to our calculations, Togo's steady state output per capita is only 3% of the the U.S. steady state. This reflects mostly a much lower productivity (6% of US) and a much higher capital wedge (6.6 times as high as the U.S.). On the other hand, Togo is only about 5% away from its steady state. Financial integration only brings Togo much faster to a very much impoverished steady state.

We now verify this claim directly with two additional welfare experiments. First, we imagine that for each country, the domestic capital wedge moves halfway towards the US.

Figure 5 reports the welfare under the new environment against the autarkic welfare. We can see from the graph that many countries improve their welfare substantially, especially lower income countries, with lower welfare under autarky. It is clear that significant changes in domestic distortions to the accumulation of capital can have substantial effect on domestic welfare, an order of magnitude larger than the benefits from financial liberalization.

The compensating variation (reported on Figure 6) indicates that the gains can be as high as 22% of steady state consumption for a country like Mozambique. The average gain for non-OECD countries is 6% of steady state consumption (or 7% of current consumption).

Second, we imagine that for each country, domestic productivity moves halfway towards the US. Figure 7 is similar to Figure 5 for this experiment. We can immediately see that the welfare effects are very large. Figure 8 reports the compensating variation. The gains are impressive: 80% of steady state consumption for the lowest welfare country in our sample, Zambia, or equivalently 4.5 times its current consumption. The average compensating variation for non-OECD countries is now 50% of steady state consumption, or 1.21 times current consumption!

[19] Note that since convergence is far from complete for the U.S., standards of living in 1995 represent only 77% of steady state standard of living in that country, according to our estimates.

3 Domestic Allocative Efficiency

The evidence in the preceding section indicate an interesting—and new to our knowledge—perspective on financial liberalization: emerging economies do not benefit greatly from international financial integration if the latter does not increase their productivities at the same time that it reallocates capital internationally. Hence, capital account liberalization can significantly contribute to economic development and convergence to the extent that it accompanies—perhaps triggers—a reduction in domestic distortion (the capital wedge) and more importantly, leads to a more efficient domestic allocation of capital.

Where should we go from here? Several paths seem to open themselves, and we start this section by providing a broad overview of those that seem the most promising to us. We then illustrate our general approach by presenting a model that focuses on the nexus between capital account liberalization, property rights and economic development.

3.1 Capital Account Liberalization and Economic Development: A Brief Overview

If the inequality between nations resulted from the international allocation of capital, capital account openness would eliminate all differences in output per capita. However, the evidence suggests that we do not live in such a world. Most of the inequality between nations seems to be due to differences in TFPs, not to differences in factor endowments. Hence, capital account openness can reduce the international inequality in output per capita only to the extent it significantly reduces the differences in TFPs.

Can capital liberalization, in combination with other policies, induce an economic take-off (a large increase in TFP) in less developed countries? If one views capital account liberalization as a significant component in the policy package required for economic development—as some argue—the answer must be yes. Hence we would define our research program on capital account liberalization in two steps: first, exploring the channels by which capital account liberalization can improve domestic allocative efficiency, and second, assessing the relevance of these channels in light of the empirical evidence. This paper reports the progress we have made so far in thinking about the first, theoretical, question—the conclusion will present brief remarks on the second one.

One natural channel by which international financial integration could increase the productivity of less developed economies is by allowing inflows of Foreign Direct Investment (FDI) in industries where foreign firms enjoy a productivity advantage.[20] The entry of foreign capital could then increase the productivity of domestic labor both directly, and indirectly by encouraging productivity gains in the domestic firms that compete with the new entrants. One industry that deserves special emphasis and separate consideration in this regard, is the banking sector. In this case, the superior efficiency of foreign banks in allocating domestic saving could spill over by producing efficiency gains in the whole economy.

[20] See Borensztein et al (1998) and Carkovic and Levine (2002) for evidence on the impact of FDI on growth.

One central question, if one follows this line of thought, is why some countries close their capital account to FDI. This is reminiscent of a question that some economists see as key in understanding economic development (or the lack thereof): why some countries *choose* not to adopt the most efficient technologies available to them. According to Parente and Prescott (2000), the answer (and the fundamental reason for the low TFP in less developed economies) has to do with the domestic political economy. Some groups benefit from the continued use of inefficient technologies, because they own production inputs that are specific to these technologies and would become less valuable if production switched to more efficient alternatives. These groups promote barriers to the adoption of the more efficient technologies, what Parente and Prescott call "barrier to riches".[21]

How does this analysis relate to capital account opening? First, if the more efficient technology is foreign and must be imported through FDI, then the domestic groups that are opposed to its introduction in the domestic productive sector—typically, owners of capital and labor that are specific to the less efficient domestic technology—can achieve their objectives by closing the economy to FDI. Second, if the more efficient technology can be operated by some domestic entrepreneurs, then the same groups can impede its development by domestic financial repression (Rajan and Zingales, 2002). Capital account restrictions, in this case, can be viewed as the external component of financial repression.

Another benefit often attributed to capital account liberalization is the market discipline on domestic policies. In a recent review of the benefits and costs of financial globalization, for example, Obstfeld (1998) states that the "main potential positive role of international capital markets is to discipline policymakers who might be tempted to exploit a captive domestic capital market".[22]

From our perspective, the "good policies" induced by capital account openness must be policies that significantly increase domestic productivity (or do not decrease it). There are several reasons, in our view, to focus on one important aspect of domestic policies, which is how respectful they are of private property rights. First, economists and political scientists have increasingly emphasized the importance of secure property rights for economic development. Second, there is a sense in which capital account openness deepens and extends the property rights of private agents, since it gives them the freedom to move their property abroad (Quinn, 2000). Finally, there is considerable anecdotal evidence that in the countries that have historically been subject to periodic bouts of populism, private agents are attached to capital account openness precisely for the reason that it offers them a protection against expropriation.[23]

There is no formal model—to our knowledge—of the nexus between capital account liberalization, the respect of property rights, and economic development. We present such a model below. This model presents the traditional "discipline argument" in favor of free capital mobility, applied to an aspect of domestic policies that is widely acknowledged as

[21] See also Krusell and Rios-Rull (1996); Bridgman *et al* (2001).

[22] See also Stiglitz (2000).

[23] For example, Maxfield (1997) explains the commitment of Mexico to currency convertibility since the 1920s exactly in this way. When this commitment was violated in 1982 "the president of an autonomous Mexican business association ...declared that the right to exchange pesos into dollars and to export them, ' a form of protection and defense of savings', had been violated" (Maxfield, 1997, pp. 100-101).

crucial for economic development, the respect of property rights.

3.2 Capital Account Liberalization, Property Rights, and Economic Development

The main features of our model are as follows. We consider an emerging economy in which investors have the choice between two sectors, the formal sector and the informal sector. Capital is more productive in the formal sector, but it can be taxed, or expropriated.[24] By contrast, capital cannot be taxed or expropriated in the informal sector. Under financial autarky, it may be the case that there is no investment in the formal sector because of the traditional time consistency problem in the taxation of capital. Opening the capital account, by allowing investors to escape expropriation, ensures that investment flows to its most efficient use in the formal sector.

The argument may seem straightforward, and the idea that international financial integration can help to solve the time consistency problem in the taxation of capital is not new (see e.g. Kehoe, 1989, and Quadrini, 2001). We think, however, that our model innovates relative to the existing literature in three ways. First, it clarifies the fact that the argument does not require the assumption—implicitly made in the previous literature—that the government can commit to an open capital account even though it cannot commit to future taxation. As we show, a country can commit to non-expropriatory policies at a long horizon even if it can commit to an open capital account only for a relatively short time, through a "political lock-in" effect. Second, we show that an open capital account can induce not only lower taxation but also higher productivity, an important property of the model in view of the evidence we have presented in the preceding section. Finally, in an extension of the model, we show that the argument does not require physical capital to be liquid or mobile. The logic of the argument requires investors to have *liquidation rights*, which is possible even if physical capital itself is illiquid.

3.2.1 Main assumptions

We consider a small open economy in a world with one homogeneous good. The model has three period $t = 0, 1, 2$. The country has access to two technologies: an efficient technology and an inefficient technology. Both technologies combine capital and labor to produce the consumption good at periods $t = 1, 2$. The production functions are Cobb-Douglas:

$$y = A_e k^{\alpha} l^{1-\alpha} \tag{13}$$

$$y = A_i k^{\alpha} l^{1-\alpha}. \tag{14}$$

The level of TFP is higher in the efficient technology ($A_e > A_i$). The two technologies have the same factor elasticities, so that the efficient technology dominates the inefficient one irrespective of the factor prices. The reason why the inefficient technology may nevertheless

[24] For simplicity, our model identifies the non-respect of property rights with the taxation of capital. What we have in mind here is less the formal taxation of capital income as it exists in developed economies than the risk of expropriation as it exists in less developed economies.

be used in equilibrium is related to taxation. Capital income can be taxed in the efficient sector, not in the inefficient sector. One may think of the inefficient sector as an informal sector with small scale projects in which the productive capital is operated by its owner. This sector is "informal" in the sense that productive capital is not easily observable—and so cannot easily be taxed—by the government.

By contrast, the efficient technology requires capital to be invested in large scale projects. Capitalists become investors holding financial assets, instead of small entrepreneurs operating physical assets. The scale of production makes capital easier to locate and tax than in the inefficient sector. The modern sector, as a result, is not only more efficient; it is also more "formal" in the sense that it gives the sovereign more scope in taxing capital income.

The country is populated by two classes of agents: capitalists and workers. Capitalists are endowed with some capital, which they choose to specialize into the efficient or the inefficient technology at period 0. This choice cannot be reversed in the following periods. Each unit of capital is productive in periods 1 and 2 (capital lasts two periods). We assume that the capital used to produce in period t must be installed in the country in period $t-1$.

Workers are identical, and each of them is endowed with one unit of labor in periods 1 and 2, the two periods in which production takes place. The labor market is perfectly competitive and labor is perfectly mobile between the formal and informal sectors. The aggregate quantities of domestic capital and domestic labor are respectively denoted by K and L.

We consider two policy areas. The first one is related to domestic redistribution. The domestic government taxes capital income in periods 1 and 2 and redistributes the proceeds to workers. The other policy area has to do with the capital account. The capital account can be open or closed in periods $t = 0, 1$, the periods in which capital is installed for production in the following period. If the capital account is open, capital can freely flow in and out of the country, and can be rented abroad tax-free, at the world price R^*. By contrast, if the capital account is closed, capital cannot cross the borders. We assume that capital can move internationally only if it has been specialized in the efficient technology—capital is by nature immobile in the inefficient sector.

We assume that the domestic government determines its policies so as to maximize the utility of the representative worker—for example, because the country is a democracy and workers are the majority. The nature of the equilibrium depends, of course, on the government's ability to commit to a policy course, and we compare different assumptions in the following section. The utility of capitalists and workers is equal to their expected undiscounted consumption in periods 1 and 2

$$U_t = E_t(C_1 + C_2) \tag{15}$$

It is Pareto optimal for domestic investment to be in the efficient technology. Whether this is the case in equilibrium, however, depends on the government's ability to commit, as well as the capital account policy—as we shall see below. The analysis now proceeds in three steps. First, we analyze the equilibrium under different assumptions on the government's horizon of commitment, conditional on financial autarky (subsection 3.2). We then show how a commitment to capital account mobility at a short horizon can buttress a commitment to low taxation at a longer horizon (3.3). Third, we present an extension of the model in which

capital account mobility generates the risk of self-fulfilling capital account crises (3.4).

3.2.2 Financial autarky

We assume in this section that the capital account is closed in periods 0 and 1. Hence, the efficiency of the domestic productive sector depends completely on the choice of technology made by domestic capitalists in period 0. Let us denote by K_e and K_i the aggregate quantities of capital respectively committed to the efficient and inefficient sectors ($K_e + K_i = K$).

In periods $t = 1, 2$, the real wage w is equal to the marginal productivity of labor in the efficient and inefficient sectors. As a result, labor demand is given by $L_e = ((1-\alpha)A_e/w)^{1/\alpha} K_e$ in the efficient sector, and by $L_i = ((1-\alpha)A_i/w)^{1/\alpha} K_i$ in the inefficient sector. The equation for the equilibrium in the labor market, $L_e + L_i = L$, then implies the following expression for the real wage

$$w = (1-\alpha)L^{-\alpha}\left(A_e^{1/\alpha}K_e + A_i^{1/\alpha}K_i\right)^{\alpha}. \tag{16}$$

The return per unit of capital in sector $s = e, i$ is given by

$$\max_l (A_s k^\alpha l^{1-\alpha} - wl) = \kappa A_s^{1/\alpha} w^{-\frac{1-\alpha}{\alpha}} k, \quad s = e, i, \tag{17}$$

where $\kappa \equiv \alpha(1-\alpha)^{(1-\alpha)/\alpha}$. Hence, in equilibrium the gross rental price of capital in sector s must be

$$R_s = \kappa A_s^{1/\alpha} w^{-\frac{1-\alpha}{\alpha}}, \quad s = e, i. \tag{18}$$

Let τ_t denote the tax rate on capital income in the efficient sector at time $t = 1, 2$. By investing one unit of his initial capital into the formal sector a capitalist secures $(1-\tau_1)R_e$ in period 1 and $(1-\tau_2)R_e$ in period 2. This must be compared with a net return of R_i in both periods if the same unit of capital is invested in the informal sector. Investment goes to the most efficient sector if $(1-\tau_1)R_e + (1-\tau_2)R_e \geq 2R_i$, or, denoting by $\tau \equiv (\tau_1 + \tau_2)/2$ the average tax rate over the lifetime of capital,

$$\tau \leq \overline{\tau} \equiv 1 - \left(\frac{A_i}{A_e}\right)^{1/\alpha} \tag{19}$$

This is an incentive condition.[25] The average tax rate over the lifetime of capital must be lower than a threshold, above which capitalists prefer to escape taxation by investing in the informal sector. Note that if the productivity gap between the informal and the formal sectors widens (A_e/A_i increases), it takes a higher tax rate to discourage capitalists from investing in the formal sector.

Let us come to redistributive policies in equilibrium. A key assumption, in this regard, is the horizon at which the domestic government can commit to future policy. We compare

[25] The inequality is not strict because we assume that capitalists opt for the most efficient technology if they are indifferent between the two.

three assumptions: (i) full-commitment: the government can commit to τ_1 and τ_2 in period 0; (ii) partial-commitment: the government can commit one period ahead, i.e., to τ_1 in period 0 and to τ_2 in period 1; and (iii) zero-commitment: the government sets τ_t in period t.

Although we do not wish to specialize the model too much with assumptions on the domestic political institutions, our assumptions on commitment can easily be interpreted in a simple model of political delegation. For example, one could assume that the representative worker elects the policymaker, and that policymakers are automata who implement the program on which they have been elected. The horizon of commitment, then, is simply the length of the term for which policymakers are elected.

The extreme cases of full commitment and zero commitment are simple. Let us start with full commitment—the government sets τ_1 and τ_2 at time 0. Then in order to maximize the representative worker's utility the government will maximize redistribution subject to the constraint of not discouraging capitalists from investing in the formal sector. That is, it will set the average tax rate to the threshold $\overline{\tau}$ defined in equation (19). All the surplus generated by the use of the efficient technology is captured by workers.

At the other extreme, let us assume that the government cannot commit at all. That is, workers effectively decide τ_1 in period 1 and τ_2 in period 2. Then, we obtain the classical time consistency problem in the taxation of capital. The government expropriates capitalists once their capital is irreversibly committed to the formal sector by setting $\tau_1 = \tau_2 = 1$. Anticipating this, capitalists do not invest in the formal sector.

These results are not new. Where this paper innovates is by focusing on the intermediate case where some degree (but not full) commitment is possible. We do not view the zero commitment assumption as very realistic. Countries have institutional and other ways to commit over their future policies at some horizon. To the extent that a time consistency problem remains, it is because the political horizon at which the country commits to non-expropriatory policies is shorter than the economic horizon at which investors have to commit their capital. This idea is captureed, in the model, by the partial commitment assumption that the sovereign can set its policy one period ahead: that is, it can commit to τ_t at period $t-1$ ($t = 1, 2$).

The equilibrium is then as follows. Like in the no-commitment case, and for the same reason, the government expropriates capitalists in the formal sector in the last period ($\tau_2 = 1$). Because capital is expropriated in the second half of its life, the *average* tax rate will necessarily be larger than one 1/2. The difference with the zero commitment case is that now, the government can commit in period 0 not to expropriate in period 1. By increasing τ_1 from zero to 1, the government can achieve any *average* tax rate τ between 1/2 and 1. If an average tax rate of 50 percent does not discourage capitalists from investing in the formal sector, then the government achieves the same rate of taxation as under full commitment by setting $\tau_1 = 2\overline{\tau} - 1$. On the other hand, if the threshold $\overline{\tau}$ is lower than 50 percent, the equilibrium is the same as under the absence of commitment.

Our results so far are summarized in the following proposition.

Proposition 1 . *Assume that the capital account is closed in periods 0 and 1 (financial autarky). Then the equilibrium depends on the horizon of commitment of the government in the following way.*

(i) (Zero commitment) If the government cannot commit, capitalists invest all their capital in the informal sector, and there is no redistribution in equilibrium.

(ii) (Full commitment) If the government can commit until period 2, capitalists invest all their capital in the formal sector and the government sets the average tax rate at the maximum level consistent with the existence of the formal sector, $\overline{\tau} \equiv 1 - \left(\frac{A_i}{A_e}\right)^{1/\alpha}$.

(iii) (Intermediate commitment) If the government can commit one period ahead, the equilibrium is the same as under zero commitment if $\overline{\tau} < 1/2$ *and the same as under full commitment if* $\overline{\tau} \geq 1/2$.

Under partial commitment, the horizon of political commitment by workers is shorter than the horizon of economic commitment by capitalists. As a result, workers can promise capitalists only a fraction of total returns, and this fraction may be too small for the efficient, formal sector to develop. The equilibrium in which all the investment goes to the informal sector is Pareto-inefficient. Both workers and capitalists are worse off than in the full-commitment equilibrium (the workers strictly so, since they receive a lower wage and there is no redistribution; the capitalists are indifferent). We show in the following section how this problem can be solved by opening the capital account.

3.2.3 Capital account mobility and political lock-in

Exactly in the same way as it commits to a low tax rate, the government could commit at period 0 to keep the capital account open in period 1. For example, workers can elect in period 0 a policymaker who is ideologically committed to free capital movements. Although workers cannot commit to re-elect this policymaker in period 1, the capital account will be open when the first policymaker is replaced. We now analyze how the results derived under autarky in the preceding section are changed if the capital account is open in period 1. For the sake of the analysis, we keep the capital account closed in period 0. This assumption will be relaxed. Capital account openness plays rather different roles in periods 0 and 1, and it is preferable to analyze them separately.

Like before, the choice of the second period tax rate, τ_2, is made in period 1. The difference is that now the stock of capital in the formal sector is no longer pre-determined by the domestic capitalists' period 0 choices. It is determined by an arbitrage between domestic and foreign investment that is made in period 1, the period in which the government sets the tax rate. Because investment decisions are made at the same time as fiscal policy, the stock of domestic capital is now elastic to the tax rate. Capitalists can "vote with their feet" (Tiebout, 1956).

In equilibrium the net return on capital must be equal to the international rental price R^*. Using equation (18) this implies

$$(1 - \tau_2)R_2 = R^*, \tag{20}$$

where $R_2 = \kappa A_e^{1/\alpha} w_2^{-\frac{1-\alpha}{\alpha}}$ is the period 2 gross return of capital in the formal sector (see equation (18); we drop the index e to alleviate notations). Assuming that domestic capitalists do not invest in the informal sector (which is true in equilibrium), the period 2 real wage can be written

$$w_2 = (1-\alpha) A_e \left(\frac{K_2}{L}\right)^{\alpha} \tag{21}$$

where K_2 denotes the level of capital in the domestic formal sector in period 2.

The domestic government sets the tax rate τ_2 so as to maximize the last period consumption of the representative worker, which is equal to the real wage plus the proceed of the tax per capita $C_2^w = w_2 + \tau_2 R_2 \frac{K_2}{L}$. Simple manipulations then show

$$C_2^w = \frac{A_e K_2^{\alpha} L^{1-\alpha} - R^* K_2}{L} \tag{22}$$

This expression is maximized when there is no distorsion relative to the laissez-faire ($\tau_2 = 0$). That is, when the capital account is open the representative worker maximizes his utility by not taxing domestic capital.

Opening the capital account in period 1 allows the representative worker to commit to zero taxation in the last period. Once the capital account is open, the worker will elect a policymaker that does not tax capital, knowing that the gain from redistribution will be more than offset by the depressing impact of the capital outflow on the real wage.

If the capital account is closed in period 0, the domestic worker can nevertheless tax capital in period 1, like before. Since the capitalist now receives a return R^* per unit of capital in period 2, the incentive condition to invest in the formal sector becomes $(1-\tau_1)R_e + R^* \geq 2R_i$, which can be written in terms of the average tax rate as

$$\tau \leq \overline{\tau} + \frac{R^* - R_e}{2R_e}. \tag{23}$$

If the country is capital scarce ($R^* < R_e$), the maximum tax rate is lower than under financial autarky because opennes reduces the return on capital below the autarkic level.

If financial autarky prevents the domestic efficient sector from developing ($\overline{\tau} < 1/2$), then opening the capital account in period 1 is Pareto-efficient. Workers strictly benefit since they receive a higher wage plus some transfers. The welfare of capitalists remains at the autarkic level, since the surplus associated with the use of the efficient technology is captured by workers.

Proposition 2 . *Assume the capital account is closed at period 0, but the government commits to open it in period 1, then all domestic capitalists invest their capital in the efficient, formal sector in period 0. The government taxes capital income at rate* $\tau_1 = 2\overline{\tau} + (R^* - R_e)/R_e$ *in period 1 and at rate* $\tau_2 = 0$ *in period 2. If the domestic formal sector does not develop under financial autarky* ($\overline{\tau} < 1/2$)*, then opening the capital account in period 1 strictly increases the welfare of domestic workers and leaves that of domestic capitalists unchanged.*

Two points are worth making.

- The benefit of capital account liberalization highlighted in the proposition is very different from the more traditional benefits in terms of allocative inefficiency. *In particular, it could arise even if there is no capital flow in equilibrium.* Assume that the country is neither capital scarce nor capital abundant ($R_e = R^*$). Then opening the capital account might seem irrelevant since in equilibrium there is no capital inflow or outflow in period 1. However, that capital *can* move in and out is crucial for the development of the formal, efficient sector (the economic take-off).

- Our results are reminiscent of the classical idea that an open capital account reduces the equilibrium level of taxation on capital by making it more mobile. Furthermore, the point that an open capital account is a way to solve the time consistency problem in the taxation of capital has been developed elsewhere (Quadrini, 2000). One issue with this line of thought, however, is that it assumes that the government can commit to an open capital account even though it cannot commit to low taxation. Our model does not have this problem, since it does not assume any asymmetry in the way the country can commit: the horizon of commitment is the same for the redistributive policy and the capital account policy. We show that committing to an open capital account and low taxation even for a limited horizon has a "lock-in" effect: these policies tend to be maintained once they have been introduced.

The assumption that the capital account is closed in period 0 may seem unappealing. Under partial commitment, the capital account regime is inherited from the past. If the game we are modelling were repeated, then the country would start with an open capital account. How are the results changed if the capital account is initially open?

First, it is easy to see that the government's problem being the same in period 0 as in period 1, the tax rate τ_1 is also set at zero. Hence, there is no redistribution in equilibrium once the economy is locked in the regime with an open capital account. As a result, capitalists receive a share of the surplus generated by the use of the efficient technology. However, it remains true that both classes benefit from capital account openness if closure prevents the domestic efficient sector from developing. Capitalists receive a higher return (if $R^* > R_i$) and workers a higher wage. The absence of redistribution does not hurt workers since there is no redistribution in the autarkic equilibrium. Note the contrast with the standard Stolper-Samuelson model, in which it is always the case that one of the two classes (the one with the scarce factor) suffers from financial integration with the rest of the world.

3.2.4 Capital account crises

So far we have assumed that capital was liquid in period 1. Conditional on openness, capital was as mobile in period 1 as in period 0. We now consider an extension of the model in which physical capital is illiquid. This reduces the commitment value of an open capital account, since capital is not as responsive to the tax rate as before. We show that the benefits of capital account openness can be preserved if the capital account policy is augmented by a financial arrangement that gives capitalists *liquidation rights*. This arrangement, however, has a negative side effect: it also gives rise to self-fulfilling capital account crises.

Assume that capital invested in the domestic formal sector is virtually immobile in period

1 (it is "bolted down", to take a metaphore often used for FDI). Productive capital can be liquidated in period 1 but (almost) all the investment is lost in the process. The proceed of liquidation is ϵ per unit of capital, where ϵ is assumed to be very small. Then (20) is replaced by

$$(1-\tau_2)R_2 \geq \epsilon R^* \tag{24}$$

As long as the net return $(1-\tau_2)R_2$ is strictly higher than ϵR^*, capital does not flow out. In period 1, the government increases τ_2 until $(1-\tau_2)R_2$ is equal to ϵR^* since for this range of tax rates domestic capital is inelastic. ϵ being very small, the tax rate τ_2 is very close to 1, and capitalists do not invest in the formal sector in period 0. Hence it looks like the illiquidity of capital destroys the benefit of capital account liberalization: if capital cannot move out of the country because of its intrinsic illiquidity, then opening the capital account serves no purpose. Opening the capital account in period 1 will not suffice to solve the time consistency problem in the taxation of capital.

We modify the model as follows. Assume for simplicity that the formal sector involves one public firm, and that this firm can enter the following type of contracts with investors: repay ρ_1 in period 1 and ρ_2 in period 2. Since the firm is public, ρ_1 and ρ_2 are effectively determined by the representative worker.

The condition for capitalists to invest in the formal sector is $\rho_1 + \rho_2 \geq 2R_i$, where the first-period payment has to be lower than the first period output per unit of capital ($\rho_1 \leq A_e(L/K)^{1-\alpha}$). Under partial commitment, the government decides ρ_2 at time 1. The second period payment ρ_2 is set to (almost) zero once capital is "bolted down" in the country. We assume $A_e(L/K)^{1-\alpha} < 2R_i$ so that in equilibrium, capitalists do not invest in the formal sector under partial commitment.

Let us now assume that the financial contract gives capitalists *liquidation rights*, i.e., the right to ask for an early repayment $\tilde{\rho}$ at the end of period 1, after ρ_1 has been paid. This payment is made by liquidating capital, and capitalists are served sequentially, like in the Diamond-Dybvig model. We define an open capital account as a commitment by the domestic government to enforce capitalists' liquidation rights and to allow them to take the proceeds in a tax haven outside the country.

We assume that capitalists are atomistic, so that a small number of them can receive $\tilde{\rho}$ if they ask for it (because $\epsilon > 0$). If $R^*\tilde{\rho} > \rho_2$ all capitalists demand an early repayment since, if others rollover their claims, an individual capitalist is better off receiving $\tilde{\rho}$ and invest it abroad. Hence there is a run, and the formal sector is liquidated. To avoid liquidation the domestic government minimizes ρ_2 under the constraint $\rho_2 \geq R^*\tilde{\rho}$, and sets

$$\rho_2 = R^*\tilde{\rho} \tag{25}$$

Hence by choosing $\tilde{\rho}$ appropriately the government can commit itself to any level of ρ_2. The logic is the same as in Jeanne (2002): the liquidation rights discipline the government to implement the commitment-first-best policy.[26] The insight here is that for capital account liberalization to have a commitment value, it is not necessary for capital to be liquid; it is sufficient for capitalists to have *liquidation rights*.

[26] See also Diamond and Rajan (2001).

However, like in Diamond and Dybvig, giving investors liquidation rights on illiquid capital raises the risk of a self-fulfilling crisis. Even if the government sets ρ_2 at the level implied by equation (25), there is an equilibrium in which investors simultaneously ask for repayment. Those that get repaid take the proceeds out of the country, so that the run can also be described as a capital account crisis. The crisis could be determined by a sunspot event. Let us denote by μ the exogenous probability of a self-fulfilling crisis. How does the decision to open the capital account depend on μ?

The aggregate utility of workers is equal to total expected output minus the level of utility that must be guaranteed to capitalists in order to induce them to invest in the formal sector, $2\alpha A_i K^\alpha L^{1-\alpha}$. Total expected output is equal to $2A_e K^\alpha L^{1-\alpha} - \mu(A_e K^\alpha L^{1-\alpha} - \epsilon K R^*)$, the level of output if there is no crisis minus the probability of a crisis times the associated output loss. Workers vote in favor of capital account liberalization if this increases their utility above the autarky level, $2(1-\alpha)A_i K^\alpha L^{1-\alpha}$. Taking the limit $\epsilon = 0$, we find that the capital account is opened if the probability of crisis is not too large

$$\mu \leq 2\left(1 - \frac{A_i}{A_e}\right). \tag{26}$$

4 Conclusion

The main contribution of this paper, at the present stage of its development, is that it suggests to look at the question of the benefits of capital account liberalization for developing economies from a new angle. Capital account liberalization will not induce a significant catch-up in the development of less developed economies if its only effect is to re-allocate capital internationally, since the international allocation of capital is not the main factor behind the inequality across nations. However, capital account liberalization could, in combination with other policies, play a significant role in the economic take-off of less developed economies, and to the extent that it does, it would have large benefits. This suggests to us that the question of the benefits of capital account liberalization should be not considered as a simple application of the first welfare theorem, but rather as a central question in the field of development economics.

We have illustrated the linkage between capital account openness and economic development in a model that focuses on property rights. We also briefly discussed other possible approaches to this question, in particular the political economy of financial repression. Developing models of the nexus between domestic financial repression, financial openness and economic development is an important item in our research agenda.

Finally, the question arises of how these theories can be validated empirically. One approach would be based on case studies: looking at the capital account regimes and capital flows in cases of successful economic take-offs. On the basis of our data, the non-OECD countries that knew the largest increase in productivity relative to the US are: Hong Kong, Singapore, Thailand, Israel, Korea, Mauritius, Indonesia, Brazil and Tunisia. The heterogeneity of this group of countries suggests that any conclusion on the benefits of capital account liberalization must be dependent on the country and its circumstances. Clearly, capital

account liberalization cannot be a universal pre-requisite for growth, since some countries, such as Korea, grew a lot with relatively closed capital accounts. However, comparative case studies could show that *some form* of capital account openness can play a key role in *some* strategies of development that were successful in *some* countries. It could suggest how (and which kind of) capital account liberalization can complement other growth-inducing policies.

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5 Appendix

5.1 Constructing Human capital stocks (in progress)

The methodology here follows Jones (1997) quite closely, building upon Barro and Lee (1993).

The concept of human capital measured here is average educational attainment for people over age 25, i.e. the average number of years of schooling in the population>25. This is a stock measure, as needed for the theory. The stocks are constructed from two different sources. First, using censuses data for benchmark years, Barro and Lee measure educational attainment for people over 25 in three different educational categories: primary, secondary and higher. Average schooling years is constructed as:

$$\begin{aligned} S &= d_p \left[\frac{1}{2}h_{ip} + h_{cp}\right] + (d_p + d_{is})\, h_{is} + (d_p + d_s)\, h_{cs} \\ &\quad + \left(d_p + d_s + \frac{1}{2}d_h\right) h_{ih} + (d_p + d_s + d_h)\, h_{ch} \end{aligned}$$

where d_j is the (country specific) duration in primary (p), incomplete secondary (is), secondary (s) and higher (h); h_j are the educational attainment rates for the corresponding cells, for people over age 25. They complete their observations using data on enrollment rates and duration and a perpetual inventory method.

The data is coming from the UNESCO. The Barro and Lee (2000) data provides educational attainment data until 2000 for roughly 100 countries. These correspond to S_{2000}. We need to construct S^* to obtain an estimate of the long run educational attainment. To do so, we follow Jones (1997) and use the perpetual inventory method to obtain these long-run estimates.

For instance, Barro and Lee formula to update the primary educational rates use enrollment rates and population growth as follows:

$$h_{p,t} = \left(1 - \frac{l_{25,t}}{l_t}\right) h_{p,t-5} + \frac{l_{25,t}}{l_t}\left(PRI_{t-15} - SEC_{t-10}\right)$$

where l_t is the population age 25 and over in year t, $l_{25,t}$ is the population of age 25-29 at age t (i.e. entering the sample over the last 5 years), PRI_{t-15} is the primary enrollment rate at $t-15$, and SEC_{t-10} is the secondary enrollment rate in $t-10$. The first term represents the previous stock minus a 'depreciation', due to death -assumed to be random across educational attainments- while the second term reflects accumulation due to the new cohort who got primary education (and did not go on to secondary education). What interests us is the value of $h_{p,t}$ in steady state. If we assume that the enrollment rates will stay at their current value (measured in 1996 in practice, or the latest available observation when not available), and that the ratio of the entering cohorts to the total population over 25 l_{25}/l will remain constant, then we have:[27]

$$h_p^* = (PRI - SEC)$$

[27] This last assumption implies no demographic transition in countries. This is of course an overstatement. As countries age, we can expect smaller younger cohorts relative to the size of the country. This would tend to reduce the estimates of education attainment. Our estimates constitute an upper bound.

Similar calculations for secondary and higher education yield:

$$\begin{aligned} h_s^* &= (SEC - HIGH) \\ h_h^* &= HIGH \end{aligned}$$

The last thing to do is to allocate the educational attainment between complete and incomplete cycles. I do this using data from Barro and Lee on the percentage of complete versus incomplete schooling in each cell. Denoting π_j the ratio of completed to total for cell j, the contribution of primary education to total average schooling is:

$$d_p \left[\frac{1}{2} (1 - \pi_p) + \pi_p \right] h^*$$

and we have similar contributions for secondary and higher. Summing gives S^*. An estimate of $\ln h^* = \ln (H/L)^* = \phi S^*$.

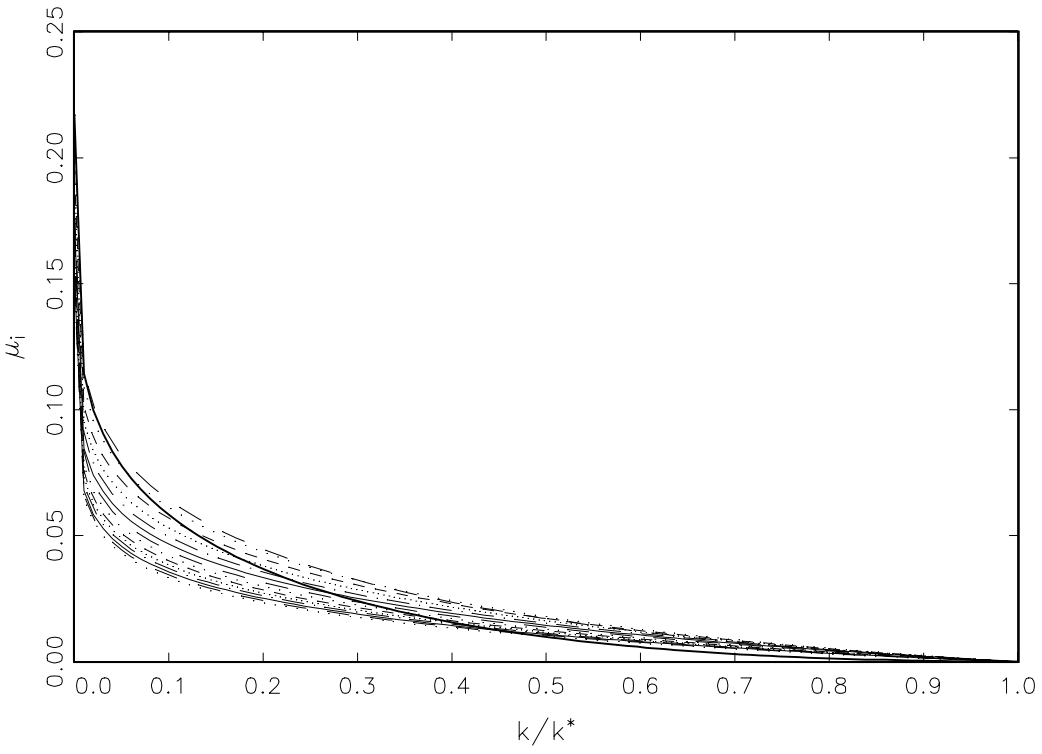

Figure 1: Equivalent Variation $\mu_i(\tau)$ for various values of the capital wedge (τ) between 0 and 0.7.

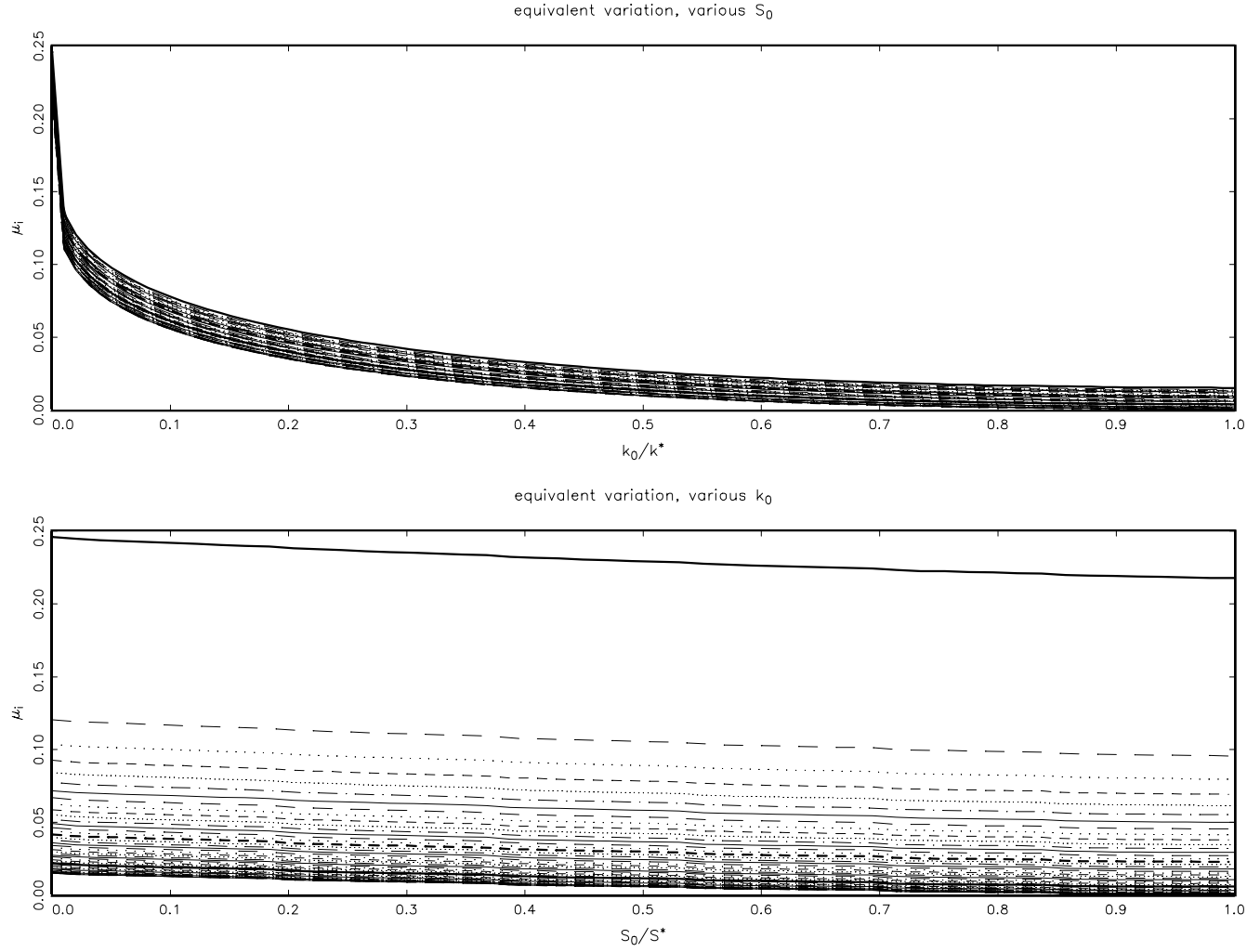

Figure 2: Equivalent Variation, various values of S_0 and k_0, for $\tau = 0$.

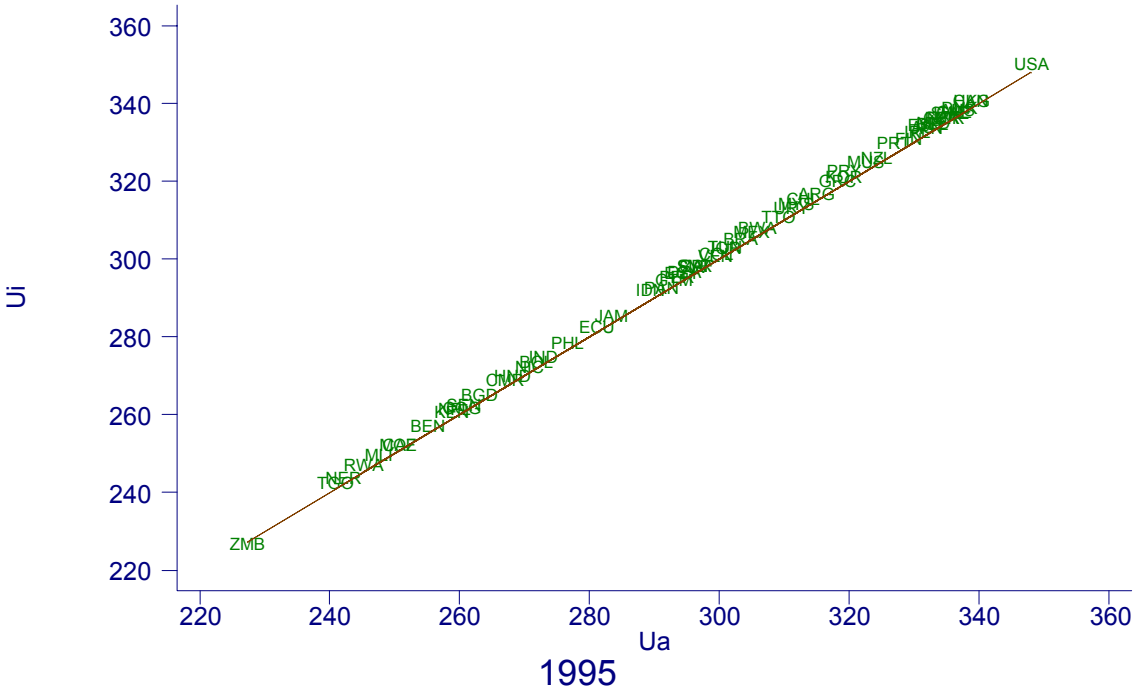

Figure 3: Welfare Gains under Financial Integration, 1995

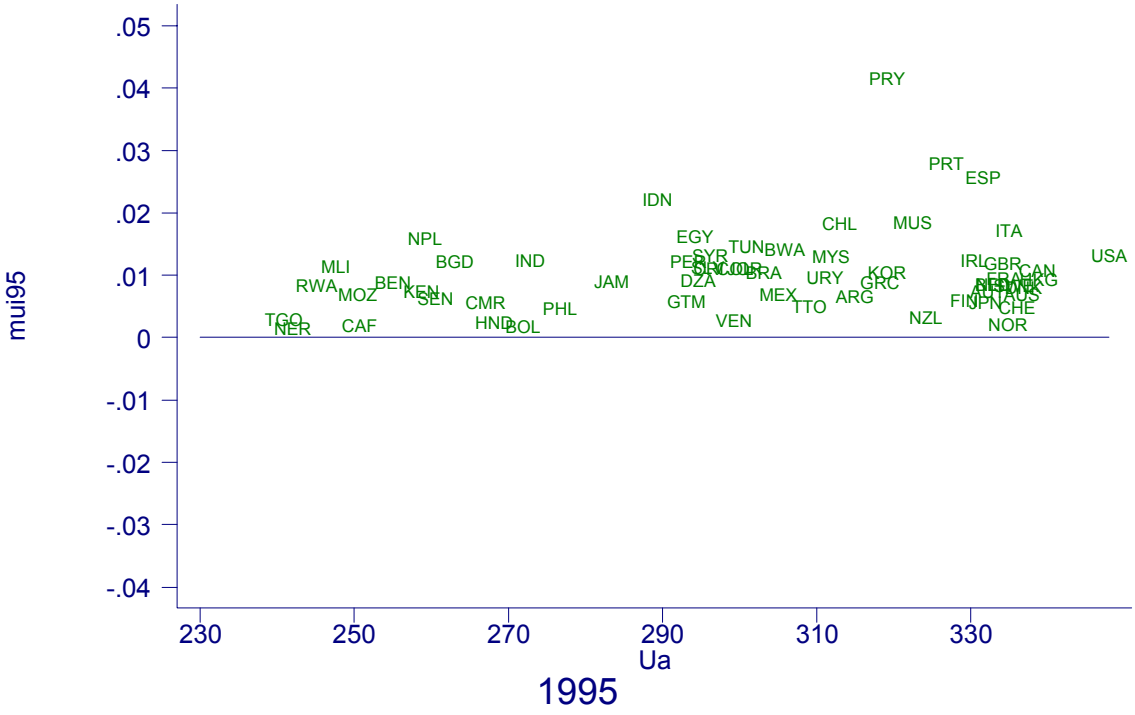

Figure 4: Compensating variation from financial integration, 1995.

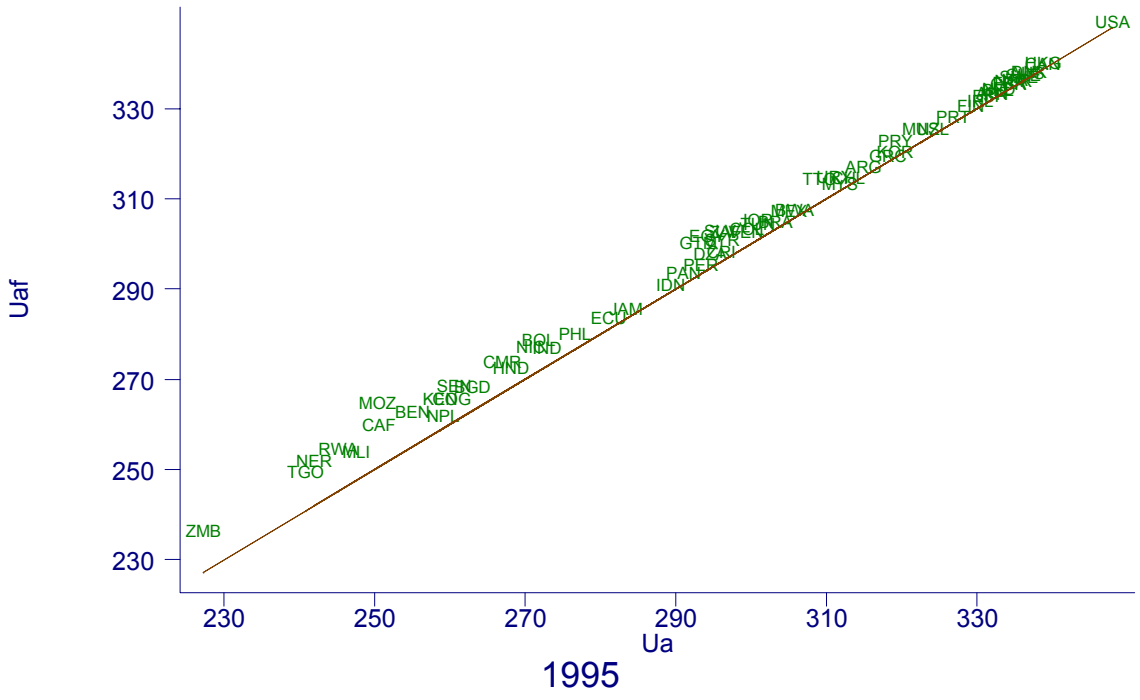

Figure 5: Welfare gains for a 50% reduction of the capital wedge with the U.S., 1995.

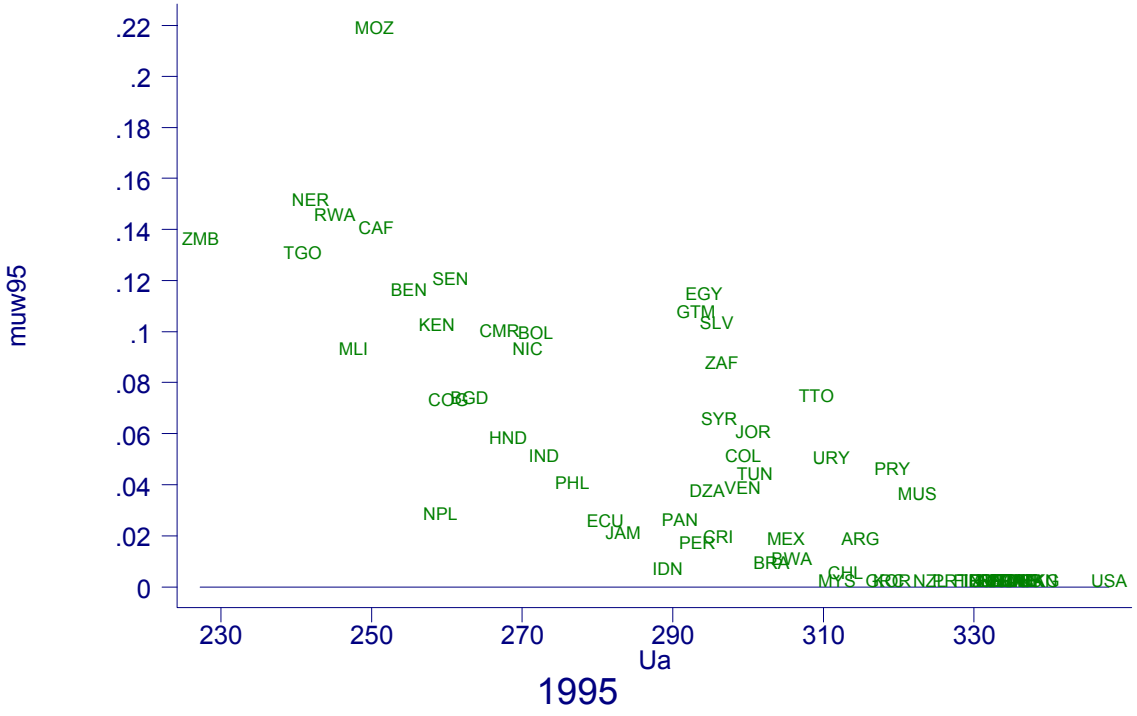

Figure 6: Compensating variation from a 50% reduction of the capital wedge with the U.S., 1995.

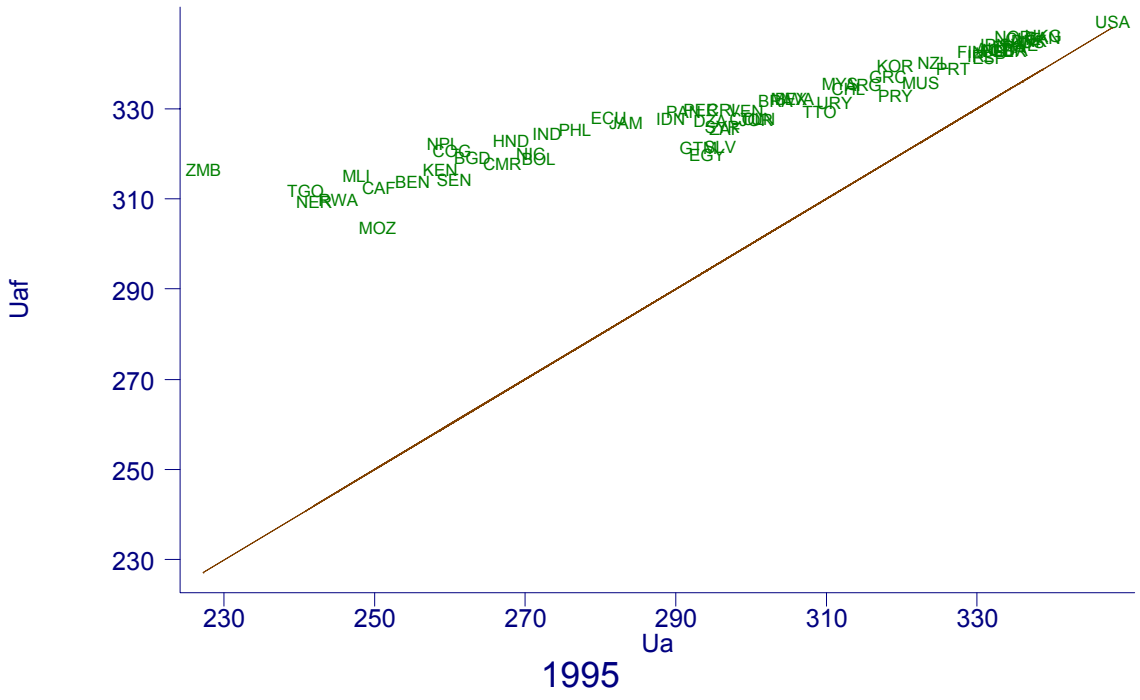

Figure 7: Welfare gains from 50% reduction of productivity gap with the U.S.

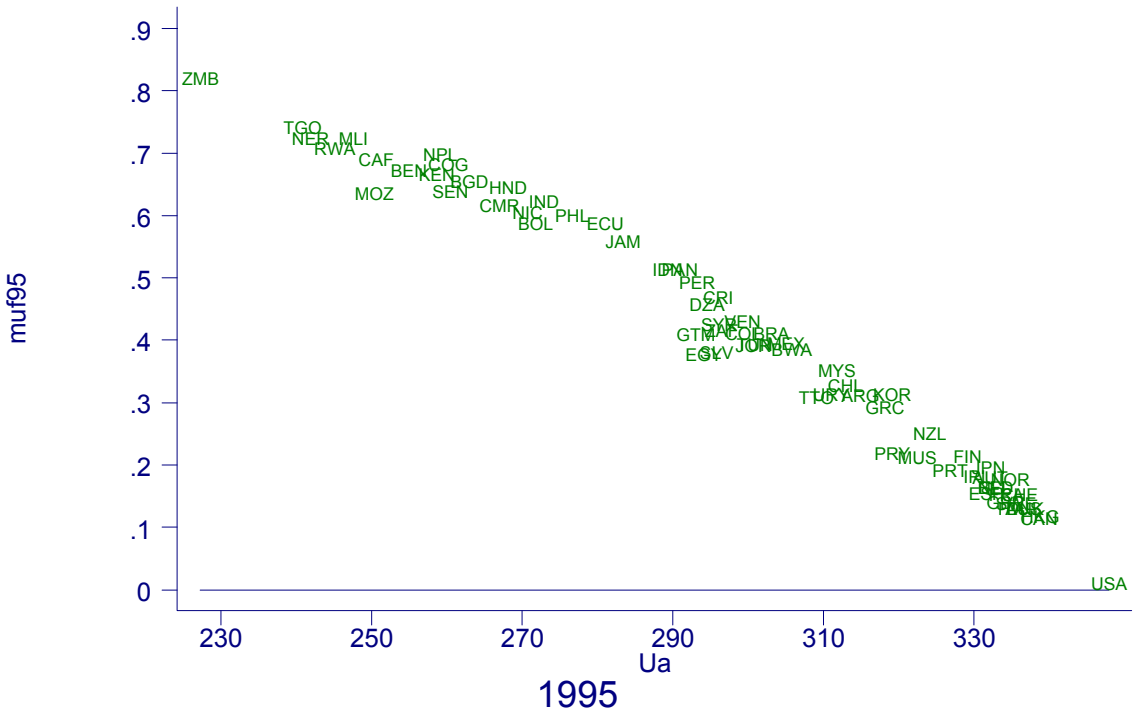

Figure 8: Compensating variation for a 50% reduction in productivity gap with the U.S., 1995.

country	convergence	steady state	productivity	output per capita
ZAMBIA	1.73	0.58	0.03	0.03
RWANDA	0.82	0.50	0.07	0.03
TOGO	0.95	0.55	0.06	0.03
NIGER	1.04	0.45	0.07	0.03
MALI	0.84	0.57	0.07	0.03
MOZAMBIQUE	0.86	0.37	0.11	0.04
CENTRAL AFR. R.	0.97	0.49	0.08	0.04
BENIN	0.83	0.55	0.09	0.04
NEPAL	0.72	0.81	0.08	0.04
KENYA	0.78	0.62	0.09	0.05
SENEGAL	0.87	0.54	0.11	0.05
BANGLADESH	0.78	0.67	0.10	0.05
CONGO	0.95	0.71	0.08	0.06
INDIA	0.71	0.74	0.11	0.06
CAMEROON	0.85	0.62	0.12	0.06
HONDURAS	0.94	0.76	0.10	0.07
NICARAGUA	0.93	0.65	0.12	0.08
BOLIVIA	0.92	0.69	0.14	0.09
PHILIPPINES	0.87	0.89	0.13	0.10
INDONESIA	0.56	1.00	0.18	0.10
ECUADOR	0.95	0.91	0.13	0.11
JAMAICA	0.79	0.97	0.15	0.12
EGYPT	0.59	0.64	0.31	0.12
SYRIA	0.68	0.76	0.26	0.13
PERU	0.71	0.96	0.20	0.14
GUATEMALA	0.85	0.59	0.27	0.14
EL SALVADOR	0.72	0.65	0.30	0.14
ALGERIA	0.71	0.89	0.23	0.14
JORDAN	0.63	0.79	0.29	0.14
COSTA RICA	0.78	0.94	0.22	0.16
PANAMA	0.96	0.95	0.18	0.16
COLOMBIA	0.75	0.81	0.27	0.16
TUNISIA	0.67	0.86	0.29	0.17
PARAGUAY	0.43	0.81	0.52	0.18
BOTSWANA	0.65	0.96	0.29	0.18
BRAZIL	0.75	0.97	0.26	0.19
VENEZUELA	0.91	0.88	0.25	0.20
S.AFRICA	1.10	0.74	0.26	0.21
MEXICO	0.81	0.96	0.28	0.22
CHILE	0.64	1.05	0.36	0.24
TRINIDAD&TOBAGO	0.81	0.77	0.38	0.24
URUGUAY	0.76	0.87	0.38	0.25
MALAYSIA	0.70	1.14	0.32	0.26
ARGENTINA	0.80	0.99	0.37	0.30
MAURITIUS	0.68	0.87	0.52	0.31
GREECE	0.75	1.12	0.39	0.33
KOREA, REP.	0.65	1.42	0.37	0.34
PORTUGAL	0.54	1.22	0.55	0.36
SPAIN	0.53	1.21	0.62	0.39
NEW ZEALAND	0.92	1.06	0.45	0.44
IRELAND	0.72	1.16	0.57	0.47
FINLAND	0.81	1.24	0.51	0.51
ITALY	0.63	1.22	0.67	0.51
UNITEDKINGDOM	0.74	1.10	0.65	0.53
AUSTRIA	0.74	1.28	0.57	0.54
NETHERLANDS	0.77	1.18	0.60	0.54
FRANCE	0.72	1.24	0.62	0.55
BELGIUM	0.80	1.18	0.60	0.57
JAPAN	0.77	1.41	0.53	0.58
SWEDEN	0.81	1.11	0.65	0.59
CANADA	0.73	1.15	0.71	0.60
AUSTRALIA	0.86	1.04	0.67	0.60
DENMARK	0.78	1.19	0.67	0.62
SWITZERLAND	0.80	1.28	0.62	0.63
HONG KONG	0.75	1.23	0.70	0.64
NORWAY	0.93	1.29	0.57	0.68
UNITEDSTATES	0.77	1.00	1.00	0.77
mean	0.80	0.91	0.34	0.26
s.e.	0.17	0.26	0.22	0.21
min	0.43	0.37	0.03	0.03
max	1.73	1.42	1.00	0.77

Figure 9: Country Decomposition