# The Welfare Gains of Financial Liberalization: Capital Accumulation and Idiosyncratic Risks*

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**Abstract**

Without any individual heterogeneity and under complete markets, the welfare impact of financial openness is quantitatively limited (c.f. Gourinchas and Jeanne, 2006). Not only are inequalities in wealth and in labor productivity a feature of most societies, but financial markets also suffer from many well-known frictions. This article shows that when households face uninsurable idiosyncratic risks on income and borrowing constraints, the welfare implications of financial liberalization are considerable. For instance, the average increase in welfare of a typical emerging market economy that switches from a closed capital market to perfect capital mobility would be equivalent to a permanent increase in average consumption of roughly 5.4 percent. This is about 3.9 times larger than the welfare gains of the same policy under the complete markets environment without any individual heterogeneity. This article shows that individual heterogeneity accounts for 2/3 of this additional increase in the average welfare gain, while market incompleteness accounts for the remaining 1/3. In our calibration, the median household in capital-scarce countries is in favor of international financial integration, but if the pivotal voter is wealthy enough, such reform might not be implemented, since richer households have a vested interest on capital market closeness.

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# 1 Introduction

What are the effects of international financial integration on welfare? The merits and effects of financial globalization have generated a passionate debate among researchers and policy makers. From a simple (theoretical) growth perspective, for a given level and growth rate of total factor productivity (TFP), international financial integration enables capital-scarce countries to raise capital inflows with positive effects on investment and the speed of convergence. It also benefits capital-abundant countries by allocating their savings into more productive investment.[1]

In an influential article, Gourinchas and Jeanne (2006) show in a standard neoclassical growth model that financial openness increases the speed of convergence towards the steady state with a positive effect on domestic welfare. Such benefits, however, seem to be quantitatively limited. The rationality behind this result is the following: For a country that is very close to the steady state consistent with the world interest rate, the gain from financial integration is second order, since the cost of foreign borrowing is very close to the return. Only countries that are far away from their steady state would have significant benefits on opening the capital account, but even for such countries the removal of barriers to capital flows would generate only a temporary increase in capital accumulation relative to autarky. Gourinchas and Jeanne (2006) posit that: "*For the typical non-OECD country, the welfare gain from switching from complete financial autarky to perfect capital mobility is equivalent to a permanent increase in consumption of about 1 percent.*" According to them, international financial integration would lead to important quantitative effects only if it can "import" foreign productivity, or decrease economic distortions (i.e., if it increases TFP), as also pointed out by Obstfeld and Taylor (2004).

In this paper, we also investigate the quantitative welfare implications of international financial integration in a neoclassical growth model. As in Gourinchas and Jeanne (2006), we consider a capital scarce country, that is, a country whose initial capital is below its steady-state detrended level for reasons not explained by the model. We also retain their hypothesis that the economy under study is, except for the level of capital, otherwise identical to the world economy, so that the respective steady-state prices and levels of capital are the same. We investigate whether or not international financial integration of capital markets will be welfare improving.[2]

[1] See Kose, Prasad, Rogoff, and Wei (2006) for a review of the literature on growth and financial openness. See also Henry (2007), Bonfiglioli (2008), Gupta and Yuan (2008), Levchenko, Rancière, and Thoenig (2008), Rancière, Tornell, and Westermann (2008) and Kose, Prasad, and Taylor (2009) for various empirical assessments of financial integration at the micro and aggregate levels.

[2] Caselli and Freyer (2007) argue that the marginal productivity of capital does not vary much across countries. However, Acemoglu (2009) points out that in practice large differences persist

However, we consider a model economy with heterogenous agents and incomplete markets in the same spirit of Aiyagari (1994) and Huggett (1993). In this environment, households face uninsurable idiosyncratic shocks on their labor productivity. We assume that there are endogenous borrowing constraints of the type considered by Kehoe and Levine (1993).[3] There is no aggregate uncertainty. The aggregate production function only depends on the average capital and average labor supply, which is inelastic. In this class of models, agents display a precautionary motive, which means that relatively to a complete markets case, they tend to save more to insure against idiosyncratic labor income fluctuations.

Openness in the financial markets of capital-scarce countries allows for an inflow of foreign capital, which drives up wages and lowers the interest rate. Households increase labor earnings and can borrow and save at the new lower rate. This movement in factor prices tends to reduce consumption inequality and improves the population-weighted average welfare. This effect through changes in factor prices is also present in a version of the growth model with unevenly distributed wealth and labor productivity, but with perfect risk sharing among households. However, when households face non-insurable idiosyncratic shocks in their labor productivity, gains tend to be higher than under complete markets. This is because agents under complete markets are, for the same initial distribution, uniformly better off than agents under incomplete markets, since idiosyncratic risks are fully eliminated. Therefore, under complete markets welfare gains from openness in capital markets are obtained from an already less unequal distribution of consumption. In addition, in incomplete markets financial integration allows poor households to better insure against idiosyncratic risks by reducing borrowing costs and loosening borrowing limits. We, however, show that this insurance effect coming from lower borrowing costs and a slacker borrowing constraint on welfare is relatively small.[4] Our exercises have strong parallels with the effects of tax reforms that change the mix of capital and labor taxes in models with incomplete markets (see, for instance, Domeij and Heathcote, 2004).

once one accounts for quality-adjusted differences in the capital stock across countries.

[3]Although Kehoe and Levine (1993) introduced participation constraints in a complete markets framework, we use it in an incomplete markets environment. Zhang (1997) uses the same approach in an economy without capital, and Ábrahám and Cárceles-Poveda (2010) in an economy with capital. We also investigate the case of the Aiyagari (1994) natural borrowing limit but results are less conservative and therefore we only report results with the endogenous borrowing constraint. In fact, our quantitative results are robust to any form of borrowing constraint, including the *ad-hoc* fixed restriction.

[4]Notice that with capital market openness the price of the riskless asset (capital) goes down, while the price of the risk factor (labor) goes up. This price change therefore increases the problem of insurance in an incomplete markets environment.

Quantitatively, for an economy with the average capital to output ratio of a large sample of non-OECD economies, aggregate welfare increases by at least a factor of 3.9 when compared to the complete markets economy without any initial individual heterogeneity.[5] In addition, heavy savers lose while households at the bottom of the wealth distribution have large welfare gains from international financial integration. In the benchmark case, at the top quintile of the wealth distribution households have an average welfare loss of about 0.6 percent of consumption equivalent relative to the baseline level, while households at the lower quintile of the wealth distribution have an average welfare gain of 8.5 percent. By solving a model with the same individual heterogeneity as in the incomplete markets, but allowing households to fully insure against idiosyncratic shocks, we can decompose the overall welfare effects of international financial integration into two components: individual heterogeneity and market incompleteness. The average population-weighted welfare gain in terms of consumption equivalent to the baseline under complete markets, but with individual heterogeneity is below that of the incomplete markets case (4.1 percent against 5.4 percent), but substantially larger than the value under complete markets and a representative agent model (roughly 1.4 percent). We also show that even in the case in which the rate of return on capital is similar across countries, capital market openness might have a sizeable effect on welfare when countries implement reforms that boost productivity growth, as observed in the data.

Finally, we show that in capital-scarce countries the median household is in favor of a reform that integrates a close financial economy to the international capital market. Consequently, if political power depends on the vote of the median household, then countries would implement such a reform. However, if political power is unequal and its concentration depends positively on wealth (as argued by Engerman and Sokoloff, 2005, and others), then financial integration might not occur and will be less likely the closer the economy is to its long-run equilibrium. Therefore, we provide a political argument to explain why aggregate unexploited gains might exist from international financial integration.[6]

There is a large literature on the welfare implications of financial integration. Most of this literature focuses on how financial integration might improve risk shar-

[5]Hoxha, Kalemli-Ozcan, and Vollrath (2009) also find large welfare gains of financial liberalization using an Arrow-Debreu environment. In their model, countries are different in their fundamentals (e.g., rate of technical change and subjective discount factor) and not only on the level of capital scarcity.

[6]Wright (2005) also provides a reason for the existence of large unexploited gains from international financial integration. He shows that market incompleteness can lead to a coordination problem, such that investors (foreign and domestic) might disagree on how a firm should be operated. In another vein, Gourinchas and Jeanne (2005) model how international capital mobility affects the incentives for countries to adopt reforms that can enhance productivity.

ing among countries.[7] Recently, Townsend and Ueda (2009) have analyzed how capital market openness can affect financial deepening by reducing transaction costs, in a similar way to Greenwood and Jovanovic (1990) and Acemoglu and Zilibotti (1997), and have encountered large welfare effects. We emphasize different mechanisms on how financial integration might affect welfare.

Quantitatively, both individual heterogeneity and incompleteness of markets are relevant in our welfare analysis. The hypothesis of incomplete markets is relevant for two different reasons: firstly, as shown by Cordoba (2008) and Krueger and Perri (2006), market incompleteness is a key friction in explaining wealth inequality in the United States;[8] and it is also important in the context of a developing economy, which is likely to show a much lower level of financial sophistication than, say, the US economy. There are alternative informal arrangements in which households insure against idiosyncratic income shocks (see Jacoby and Skoufias, 1997, Townsend, 1994), but recent empirical evidence has pointed out that informal insurance mechanisms are often weak.[9] We see our exercises as complementary to those implemented by Gourinchas and Jeanne (2006). In fact, they emphasize in their concluding remarks the importance to depart from the Arrow-Debreu environment to evaluate the effects of international financial integration.[10]

We are not the first to analyze the welfare effects of international financial integration in an incomplete markets framework. Mendoza, Quadrini, and Ríos-Rull (2007) (see also Mendoza, Quadrini, and Ríos-Rull, 2009) use an incomplete markets environment in line with our model in order to study the welfare consequences of capital markets liberalization. There is, however, one important difference. While Mendoza, Quadrini, and Ríos-Rull (2007) consider the welfare consequences of capital markets integration between countries that are heterogenous in financial markets conditions, our paper studies the case with countries that are heterogenous in the scarcity of capital. In their exercises, financial globalization hurts the poor in countries with less developed financial markets. In countries with depressed financial markets, liberalization will increase borrowing costs and therefore produce distribu-

[7]See, for instance, Athanasoulis and van Wincoop (2000), Lewis (2000) and Obstfeld (1994). Interestingly, Athanasoulis and van Wincoop (2000) find large benefits from risk sharing. The gain for a 35-year horizon, corresponding to a welfare equivalent permanent increase in consumption, is 6.6 percent when based on a set of 49 countries.

[8]Borrowing constraints are also important to account for the inequality in the lower tail of the wealth distribution. We also consider an endogenous borrowing limit.

[9]In particular, poor households in developing countries have substantial difficulties insuring against idiosyncratic risks (see Morduch, 1999, Ravallion and Chaudhuri, 1997).

[10]Marcet and Marimon (1992) also investigate the welfare effects of capital market openness in a non Arrow-Debreu environment under enforcement, informational, and commitment problems. Depending on the friction considered, financial openness can also lead to large aggregate welfare implications.

tional effects in opposite direction to ours. In a recent article, Angeletos and Panousi (2010) also analyze the effects of international financial integration with an incomplete markets model, but considering that agents face uninsurable idiosyncratic risk in their capital (or entrepreneurial) income, instead of in their labor income. Interestingly, their long-run welfare implications of international financial integration are consistent with our results.

The paper proceeds as follows. Section 2 describes the model economy and defines the competitive equilibrium. Section 3 describes the model calibration and contains policy experiments designed to evaluate the welfare effects of international financial integration. It also analyzes the political economy of capital market openness. Section 4 concludes.

# 2 The model

The model economy is characterized by a standard neoclassical growth model based on Aiyagari (1994), with infinite-lived households who are *ex-ante* identical. Households face idiosyncratic shocks on their labor productivity but there is no aggregate uncertainty. This allows us to study the effects of financial integration on welfare in a world where individuals use financial assets to smooth consumption not only over time, but also across different states. The production sector is represented by a technology that exhibits constant returns to scale. The produced good can be used for consumption or investment. Below we describe the environment in detail.

## 2.1 The production sector

At any time period $t$ there is a production technology that converts capital, $K_t$, and efficient units of labor, $A_t L_t$, into output $Y_t$ according to:

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

Parameter $\alpha \in (0,1)$ corresponds to the capital income share. Capital depreciates at rate $\delta \in (0,1)$, and labor productivity, $A_t$, grows at constant rate $1+g = \frac{A_{t+1}}{A_t}$, with $A_0 = 1$. Households competitively rent units of efficient labor and capital to firms. Input rental prices are given by their marginal productivity:

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

$$r_t^K = \alpha K_t^{\alpha-1}(A_t L_t)^{1-\alpha}. \tag{3}$$

Profits are zero in equilibrium and we can assume a representative firm.

## 2.2 The household sector

The economy is inhabited by a continuum of infinitely lived and *ex-ante* identical households with measure one. The household size, $N_t$, grows at exogenous rate $1 + n = \frac{N_{t+1}}{N_t}$. We normalize the initial population to one. Each household supplies inelastically $N_t$ units of labor per period, and faces idiosyncratic shocks on labor productivity. A household with shock $z_t$ receives labor income $w_t N_t z_t$. We assume that $z_t$ follows a finite state Markov process with support $\mathcal{Z}$ and a transition probability matrix $\mathcal{P}(z, z') = \Pr(z_{t+1} = z' | z_t = z)$. The Markov chain generating $z_t$ has just one ergodic set, no transient states and no cyclically moving subsets. Each household has preferences defined over stochastic processes for consumption per household member, $c_t$, given by the following utility function:

$$\mathrm{E}_0 \left[ \sum_{t=0}^{\infty} \beta^t N_t u(c_t) \right] , \quad \beta \in (0, 1) . \tag{4}$$

The one-period utility function is represented by

$$u(c) = \frac{c^{1-\sigma}}{1-\sigma} , \quad \sigma > 0 .$$

Households do not have access to state-contingent contracts but can sell and buy financial assets in the form of a debt contract. At each period $t$, households are distinguished by their labor productivity shock, $z_t$, and asset holdings, $a_t$. A household's one-period budget constraint is given by:

$$N_t c_t + a_{t+1} \leq (1 + r_t) a_t + w_t N_t z_t , \tag{5}$$

where $r_t = r_t^K - \delta$ is the interest rate net of depreciation.

For computational purposes, we transform variables in order to make the economic system a stationary one. The transformations are standard: aggregate variables, $Y$ and $K$, are divided by $AN$, and per capita variables and factor prices that grow over time in the balanced growth path at the rate $g$ are divided by the technology level, $A$. Therefore, we define:

$$\hat{Y} = \frac{Y}{AN}; \quad \hat{K} = \frac{K}{AN}; \quad \hat{c} = \frac{c}{A}; \quad \hat{a} = \frac{a}{AN}; \quad \hat{L} = \frac{L}{N}; \quad \hat{w} = \frac{w}{A} .$$

Define $\underline{\hat{a}}$ as the overall lower bound on assets per efficiency unit of labor. We

assume an upper bound on assets per efficiency unit of labor, $\hat{\bar{a}}$, such that if assets are larger than $\hat{\bar{a}}$ households would choose to decrease asset holdings. Define $X = [\hat{\underline{a}}, \hat{\bar{a}}] \times \mathcal{Z}$ and let $\chi$ be the associated Borel $\sigma$-algebra. For each $B \in \chi$, $\lambda(B)$ corresponds to the mass of households whose individual state vectors lie in $B$. The household's value function depends not only on the current idiosyncratic state and asset holding, but also on aggregate variables such as the wage and the interest rate, which are affected by the current measure $\lambda_t$. To compute such a measure in the next period, households need to know the current period's entire measure $\lambda_t$, and an aggregate law of motion, which we will call $H$, such that $\lambda_{t+1} = H(\lambda_t)$. We will define $H(\cdot)$ shortly.

For the borrowing limit, we follow Kehoe and Levine (1993) and assume that the penalty for those who default in their debt is the exclusion from future intertemporal trade. The borrowing limit is such that it is never in the household's best interest to default. In order to define the endogenous borrowing limit, it is necessary to calculate the utility in the case where households are excluded from intertemporal trade:

$$\underline{v}(z_t, \lambda_t) = u(\gamma\, \hat{w}_t\, z_t) + \tilde{\beta}\, \mathrm{E}[\underline{v}(z_{t+1}, \lambda_{t+1})|z_t]\,,$$

where $\tilde{\beta} = \beta(1+n)(1+g)^{1-\sigma}$ is the discount factor adjusted by technical progress and population growth, and $\gamma \in (0,1)$ accounts for a pecuniary loss due to the default stigma, as in Chatterjee, Corbae, Nakajima, and Ríos-Rull (2007).

In order to use the standard notation in dynamic programming we denote future variables by superscript prime (e.g., $\hat{a}_{t+1} = \hat{a}'$). The value function of a household with net worth $\hat{a}$ and labor productivity $z$ is defined by the following maximization problem:

$$v(\hat{a}, z, \lambda) = \max_{\hat{a}'} \quad u(\hat{a}(1+r) + \hat{w}z - (1+g)(1+n)\hat{a}') + \tilde{\beta}\, \mathrm{E}[v(\hat{a}', z', \lambda')|z] \qquad (6)$$

subject to the endogenous borrowing limit,

$$v(\hat{a}', z', \lambda') \geq \underline{v}(z', \lambda')\,, \qquad \forall z' \in \mathcal{Z}\,, \qquad (7)$$

and

$$\lambda' = H(\lambda)\,. \qquad (8)$$

Here we used budget constraint (5) to replace consumption in the one-period utility function. Since our focus is not only on the stationary equilibrium, but also on the transition to this equilibrium, we should also include an index of time in the value function and aggregate measure. For the sake of notation, we have omitted

it. Constraint (7) guarantees that households will honor their promises and will not default on their debt. Value function $v(\hat{a}, z, \lambda)$ is non-decreasing in $\hat{a}$ and value function $\underline{v}(z, \lambda)$ is independent of $\hat{a}$. Therefore, equation (7) defines a lower bound $\underline{\hat{a}}^{\text{EB}}(z', \lambda')$ such that $\hat{a}' \geq \underline{\hat{a}}^{\text{EB}}(z', \lambda')$. We assume that the overall lower bound defined above is such that $\underline{\hat{a}} < \underline{\hat{a}}^{\text{EB}}(z', \lambda')$.

## 2.3 Equilibrium

Let $x = (\hat{a}, z)$ be the individual state vector of a particular household. The policy function associated with problem (6) is $\hat{a}' = h(x, \lambda)$. Given policy function $h(x, \lambda)$ we can compute $\hat{c} = h_{\hat{c}}(x, \lambda)$ using the budget constraint. Define $Q(x, \lambda, B; h)$ as the endogenous transition probability of the households' state vector. It describes the probability that a household with state $x = (\hat{a}, z)$ will have a state vector lying in $B$ next period, given the current asset distribution $\lambda$ and decision rule $h$. Therefore,

$$Q(x, \lambda, B; h) = \sum_{(h(x,\lambda), z') \in B} \mathcal{P}(z, z').$$

The aggregate law of motion implied by transition function $Q$ is an object $T(\lambda, Q)$ that assigns a measure to each Borel set $B$. It can be computed as

$$T(\lambda, Q)(B) = \int_X Q(x, \lambda, B; h) d\lambda. \tag{9}$$

Note that $\lambda'(\cdot) = T(\lambda, Q)(\cdot)$. We now define a recursive competitive equilibrium and a recursive stationary equilibrium.

**Definition 1** *A **recursive competitive equilibrium** for this economy consists of value function $v(\hat{a}, z, \lambda)$; policy functions $\hat{a}' = h(x, \lambda)$ and $\hat{c} = h_{\hat{c}}(x, \lambda)$; vector of prices $(\hat{w}(\lambda), r^K(\lambda), r(\lambda))$; initial distribution $\lambda_0$; and aggregate forecasting rule $H(\lambda)$, such that:*

1. *Given prices, initial distribution and aggregate measure, policy function $\hat{a}' = h(x, \lambda)$ solves $v(\hat{a}, z, \lambda)$;*

2. *Factor prices are determined competitively, according to* (2), (3), *and $r(\lambda) = r^K(\lambda) - \delta$.*

*3. Markets clear:*

$$\hat{L} = \int_X z d\lambda \tag{10}$$

$$\int_X h(x,\lambda) d\lambda = \hat{K}' \tag{11}$$

$$\int_X h_{\hat{c}}(x,\lambda) d\lambda + (1+g)(1+n)\hat{K}' = \hat{K}^{\alpha}\hat{L}^{1-\alpha} + (1-\delta)\hat{K}\,. \tag{12}$$

*4. Distributions are consistent with individual behavior: $H(\lambda)$ coincides with $T(\lambda, Q)$.*

**Definition 2** *A **recursive stationary equilibrium** is an equilibrium where the probability measure $\lambda$ is stationary, i.e., $\lambda(B) = T(\lambda, Q)(B)$ for all $B \in \chi$.*

In the model with financially integrated capital markets, the equilibrium is similar to that of a small open economy, taking the world interest rate as given, such that $r(\lambda) = r^*$, where $r^*$ corresponds to the world interest rate, which we assume is the same as the interest rate of the stationary equilibrium of the financially closed economy. Given the world interest rate $r^*$, by arbitrage we have that the rental price of capital is determined by $r^K = r^* + \delta$ and the wage rate is given by $\hat{w}^* = (1-\alpha)\left(\frac{\alpha}{r^*+\delta}\right)^{\frac{\alpha}{1-\alpha}}$.

# 3 Quantitative experiments

The purpose of the quantitative analysis is to provide a numerical assessment of the welfare and distributional effects of financial integration. The quantitative exercises require us to calibrate the theoretical model. We must determine values for a set of parameters, which are related to: (i) preferences; (ii) technology; (iii) the stochastic process of labor productivity; and (iv) initial distribution.

## 3.1 Calibration and benchmark economy

Below we describe how we set parameter values. The model period is taken to be one year.

**Calibration** For comparison purposes, we set parameter values for technology, population growth, and labor productivity growth similar to those chosen by Gourinchas and Jeanne (2006). One important point is that the interest rate in the

long run is depressed relative to the deterministic neoclassical growth model because each household has an additional self-insurance (or precautionary) incentive to save. These additional savings increase the capital-labor ratio and reduce the equilibrium interest rate. Therefore, in order to make the interest rate of the model with idiosyncratic risks similar to the one defined by the deterministic model we decrease the value of the subjective discount factor $\beta$ (or, equivalently, $\tilde{\beta}$). Otherwise, welfare differences from the two models might be driven by the difference between the respective long run marginal productivity of capital, which will be larger in the model with *ex-post* heterogenous households. We chose $\beta$ so that the two models generate the same interest rate in the long run, hence the same capital to output ratio.

As a robustness check, in an appendix of the accompanying technical note,[11] we also report the welfare implications of capital market integration when all parameters are identical to the calibration reported by Gourinchas and Jeanne (2006), except for the introduction of labor productivity shocks. This is also important since when $\beta$ decreases households value relatively more the present than the future, which might also affect welfare. As we show, the two effects (distance to the steady state and lower value of $\beta$) almost cancel each other, and results are roughly the same with the two approaches.

It remains to define the income labor process and the initial distribution. For the idiosyncratic process, we followed Krueger and Perri (2005).[12] We use a finite approximation of process

$$\ln(z') = \rho \ln(z) + \epsilon' , \tag{13}$$

where $\epsilon'$ is normal, serially uncorrelated, with zero mean and variance $\sigma_\epsilon^2$ . We set $\rho$ equal to 0.98, the value used by Krueger and Perri (2005). These authors show that the cross-section variance of idiosyncratic income is 0.719, after removing the effects of observables. We therefore set $\sigma_\epsilon^2$ to 0.0285 . We undertook some sensitivity analysis regarding the income labor process. For instance, in figure 11 we increase the variance of the idiosyncratic shock by 50% and results are roughly similar.

The pecuniary cost parameter $\gamma$ is set by equating the level of credit to output ratio in the model to the observed US level. Since in our model there is only unsecured debt, we use total revolving credit as reported in table G.19 of the Federal

[11] Available at `http://sites.google.com/site/tiagovcavalcanti/research-1`.

[12] We also have results for the case where the idiosyncratic shocks have a persistent component and an serially uncorrelated component, as in Heathcote, Storesletten, and Violante (2008). They were quantitatively consistent with those reported here, but more computationally demanding since their process is a composition of two discrete processes.

Reserve Board Statistics and Historical Data pages. This table reports all short-and medium-term credit extended to individuals not secured by real estate. Revolving credit does not include auto loans, loans for mobile homes, education, vacations, and certain other items. Non-revolving credit can be secured or unsecured, so we excluded it from our measure. The average US level is 7.7 percent of the GDP in the last 5 years; we have targeted 8 percent in the calibration. Table 1 contains the calibrated parameter values. In subsection 3.6 we consider the economy without any borrowing or when the borrowing constraint is fixed.

For the initial distribution of assets and labor shocks, which must be specified from outside the model but must imply a low aggregate capital relative to its steady-state level, we consider the unconditional invariant distribution of the stationary equilibrium scaled down in the asset dimension by a relatively large factor.[13] We then compute the transition under the assumption that there is no financial integration. The capital to output ratio will go from the initial (low) value to the steady-state level, which is equal to the world level. In order to reduce the impact of the shape of the initial distribution on our results, we start our analysis only when the capital to output ratio is roughly 1.4, which occurs after 4 years. For each level of the capital to output ratio, we compute the welfare gain by comparing the value function under no financial integration with the utility under perfect financial integration, which, for each household, is just the value function under exogenous price levels equal to world levels. In subsection 3.5 below we provide additional exercises using different assumptions regarding the shape of the initial asset distribution; there are no important quantitative changes in the welfare results relative to the benchmark calibration.

**Benchmark economy** Table 2 reports statistics for the US economy and model. The model has less earnings inequality than the data, but observe that not all inequality in the data comes from idiosyncratic shocks to labor productivity. Part is also due to differences in individual characteristics, such as schooling and experience.

Table 2 shows that the model with the endogenous borrowing limit produces a wealth Gini index of 87 percent, while in the data it is 78 percent. Moreover, the top 1 percent of US households have 29.6 percent of all wealth. Under the borrowing constraint with permanent exclusion, the top 1 percent of households hold only 16 percent of total wealth and the bottom 20 percent have more negative wealth than

[13]The actual procedure to compute the initial distribution was to calculate the stationary equilibrium of the model and then scale down this distribution by a number between zero and one. This distribution is, apart from differences arising from the state space discretization, a version of the final stationary equilibrium distribution scaled down in the asset dimension to 15 percent of its original size.

**Table 1:** Parameter values, benchmark economy: values similar to those in Gourinchas and Jeanne (2006).

| Parameters | Calibration | Comment/Observations |
|---|---|---|
| $\sigma$ | 1 | Risk aversion coefficient |
| $\alpha$ | 0.30 | Capital income share |
| $\tilde{\beta}_{\text{deterministic}}$ | 0.96 | Adjusted subjective discount factor |
| $\tilde{\beta}_{\text{endogenous}}$ | 0.9545 | Adjusted subjective discount factor |
| $\delta$ | 0.06 | Depreciation rate |
| $g$ | 0.012 | Growth rate of labor productivity |
| $n$ | 0.0074 | Population growth rate |
| $\rho$ | 0.98 | Autocorrelation of idiosyncratic productivity from Krueger and Perri (2005) |
| $\sigma_\epsilon^2$ | 0.02847 | Variance of innovations in productivity based on Krueger and Perri (2005) |
| $\gamma$ | 0.85 | Pecuniary loss on wages due to credit default set to have credit to output ratio of 8 percent |

in the data.[14] This model misses the top and bottom tails of the distribution, but does a reasonable job in the middle.[15]

## 3.2 Welfare in the model with complete markets and a representative agent

In the absence of any initial individual heterogeneity and under complete asset markets, our economy is identical to the standard neoclassical growth model used by Gourinchas and Jeanne (2006). We therefore first replicate their main quantitative results. In this economy capital to output ratio in the long run is equal to 2.63 (see part I of 2) and the interest rate is equal to 5.4 percent. In order to focus on the impact of international financial integration on consumption smoothing, we assume that this number corresponds to the world interest rate.

We reproduce figure 1 in Gourinchas and Jeanne (2006). Figure 1 presents the welfare gains[16] measured by the consumption equivalent variation from international financial integration as a function of the initial capital to output ratio. The vertical

[14]The model with a natural borrowing limit produces roughly the same level of inequality, but it still does not match the tails of the asset distribution. Importantly, it tends to have too much credit: the model has a ratio of credit to output of 34 percent.

[15]Quadrini and Ríos-Rull (1997) and Castañeda, Díaz-Giménez, and Ríos-Rull (2003) note that this is a common feature of neoclassical growth models with heterogeneous households and uninsurable idiosyncratic shocks to earnings. See also Quadrini (2000) and the accompanying note mentioned in footnote 11.

[16] As Gourinchas and Jeanne (2006), we calculate the consumption equivalent, $\mu$, for the benchmark economy and for the economy after the policy change, such that $(1+\mu)^{1-\sigma} v^{\text{Closed}} - v^{\text{Lib}} = 0$.

**Table 2:** Selected statistics, US data and models. Data for the US economy are from Castañeda, Díaz-Giménez, and Ríos-Rull (2003) and authors' calculations.

| | Capital to output ratio | Revolving credit to output ratio (%) | Wealth Gini (%) | Income Gini (%) | Percentage wealth in the top 1% | 5% | 10% | in the bottom 20% | 60% |
|---|---|---|---|---|---|---|---|---|---|
| US data | 3 | 7.7 | 78 | 63 | 29.6 | 54 | 66 | -0.39 | 7.1 |
| | | | Part I: $\sigma = 1$ | | | | | | |
| Deterministic model | 2.63 | | | | | | | | |
| Model with idiosyncratic shocks (endogenous constraint) | 2.63 | 8.2 | 87 | 58 | 16 | 50 | 72 | -3.9 | -3.5 |
| | | | Part II: $\sigma = 2$ | | | | | | |
| Deterministic model | 2.37 | | | | | | | | |
| Model with idiosyncratic shocks (endogenous constraint) | 3.26 | 8.4 | 81 | 56 | 12 | 42 | 63 | -1.9 | 0.8 |
| | | | Part III: $\sigma = 1$ and two *ad-hoc* borrowing constraints | | | | | | |
| *Ad-hoc* borrowing limit (52 percent of benchmark's long run level) | 2.63 | 4.2 | 85 | 57 | 15 | 49 | 70 | -1.5 | -0.5 |
| *Ad-hoc* borrowing limit (no lending) | 2.64 | 0 | 82 | 57 | 15 | 48 | 69 | 0.5 | 1.9 |

line corresponds to the long-run level of the capital to output ratio. This figure shows that a country must have a very low capital to output ratio to significantly benefit from international financial integration. The capital to output ratio must fall below 1.29 for the gains from integration to exceed 2 percent of annual consumption. Using the Heston, Summers, and Aten (2006) Penn World Tables 6.2, we construct the capital to output ratio for 157 non-OECD countries in 2000.[17]

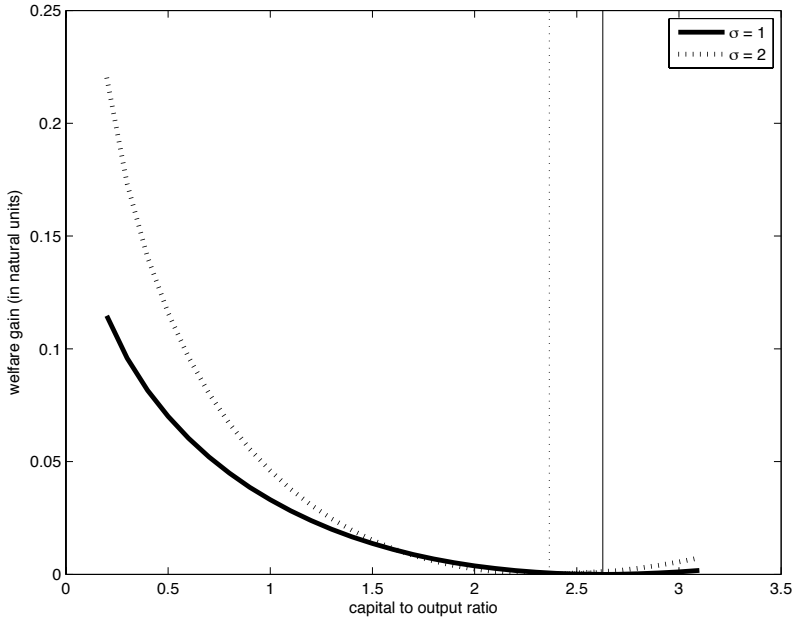


**Figure 1:** Welfare gains from international financial integration and the capital to output ratio. The welfare measure corresponds to the consumption equivalent variation.

The average capital to output ratio for this sample is 1.47 and the population-weighted average is 1.91.[18] Because differently parameterized models have different

[17]In order to construct the capital to output ratio in 2000, we calculate:

$$\left(\frac{K}{Y}\right)_{1990} = \frac{\left(\frac{I}{Y}\right)_{1990}}{\delta + n + g},$$

where $\left(\frac{I}{Y}\right)_{1990}$ corresponds to the average investment rate from 1980 to 1990, $\delta = 0.06$, $g = 0.012$, and $n$ is the average population growth from 1980 to 1990. We then use the equation of motion of the capital stock to construct the value of capital stock and the capital to output ratio in 2000. See Klenow and Rodríguez-Clare (1997) for a similar approach. For some transition countries, because of data availability, we use the average from 1985 to 1990.

[18]Caselli and Freyer (2007) find that the return from investing in capital in the developing economies is more than twice as large as in the developed economies. However, when they consider natural resource endowments and differences in the price of capital, the average difference in the marginal product of capital between poor and rich countries disappears. Nevertheless, even using these two corrections there is some important variation in the data. The marginal productivity of capital, for instance, in Singapore (or Botswana) is twice as large as in Switzerland. See also the discussion of this issue in the introduction.

capital to output steady-state ratios, we define *capital abundance* as the capital to output ratio in terms of its steady-state level. Therefore, the capital abundance of the average non-OECD country is $\frac{1.47}{2.63} = 0.56$, while the population-weighted figure is 0.73 . At a level of capital abundance of 0.56 , the gains from capital openness are 1.4 percent of consumption equivalent when $\sigma = 1$ and 2.3 percent when $\sigma = 2$ .

This analysis is important to show that welfare gains from international financial integration emphasized by standard growth arguments are not substantial. Our goal, however, is to: (i) investigate how welfare benefits change when we introduce individual heterogeneity and market incompleteness; and (ii) study the distributional implications from financial integration.

## 3.3 Welfare in the model with incomplete markets

As in the deterministic model, the economy with non-insurable idiosyncratic shocks on labor productivity also implies that international financial integration raises capital inflows in capital-scarce countries. Such an inflow of capital increases the wage rate and reduces the interest rate, and this has important distributional effects on consumption and welfare and on the ability of households to insure against idiosyncratic shocks. On the one hand, the insurance effect on welfare of capital flows is negative because it increases the price of the risk factor (labor) and reduces the price of the riskless asset (capital). On the other hand, it reduces borrowing costs and looses borrowing constraints, which allows agents to better insure against shocks.

**Transition** For a detailed account of the procedure to calculate the full transition of the economy closed capital markets, see the companion technical note mentioned in footnote 11. Panel (a) of Figure 2 depicts the evolution of the interest rate of the economy when capital markets are closed to capital flows during the transition to stationary equilibrium. The transition is relatively fast, taking about 15 years to cover 90 percent of the gap between an interest rate of roughly 16 percent and the steady-state rate of 5.4 percent. Figure 2 also shows the transition for the complete markets case when the initial capital abundance is exactly that of the incomplete markets case. Despite the difference in the ability of agents to insure against risks, we see that the two paths are barely distinguishable. This result suggests that the representative household model is quite accurate if one is predominantly of interest for the convergence of aggregate quantities, as noted previously by Ríos-Rull (1994). Therefore, any welfare gains to heterogeneous households of international financial integration above those of the deterministic case must come from an improvement in the allocation of resources across individuals.

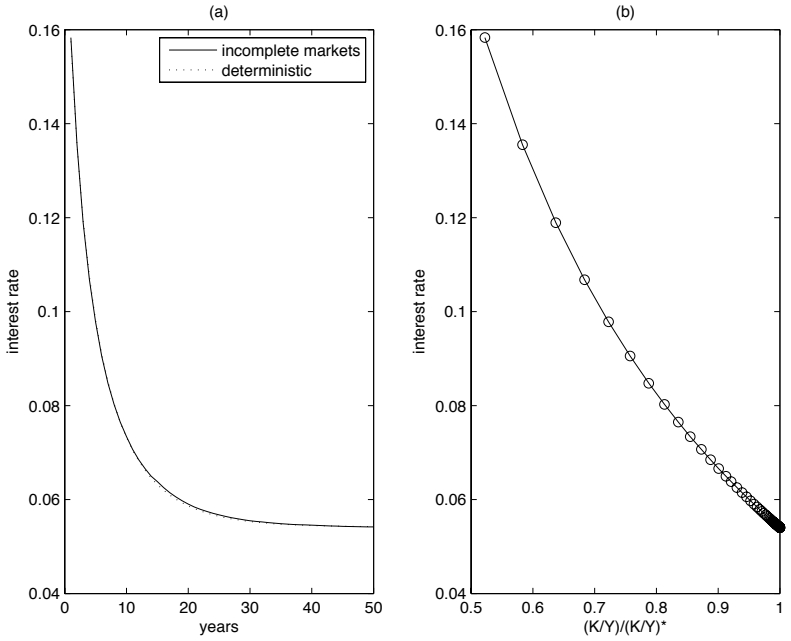


**Figure 2:** Transition of the interest rate in an economy closed to foreign capital inflows. Each circle represents a period. Model with endogenous borrowing limit.

Panel (b) of Figure 2 plots the interest rate against capital abundance in each period for the model with idiosyncratic shocks. Each circle corresponds to one period in the model. When capital abundance is slightly above 0.5, the interest rate is about 16 percent. The figure shows the expected negative relationship between interest rate and capital abundance, but also suggests that capital scarceness is rapidly eliminated through aggregate savings.

One important dimension of the model is the amount of credit in the economy. Figure 3 documents one important prediction of the model that fits the available data (Levine, 1997): the amount of credit increases and credit constraints become slacker as the economy develops. Panel (a) of the figure depicts the endogenous credit limit as a function of capital abundance in the economy closed to foreign capital inflows. We see that, when capital abundance is 0.53, the total amount of credit that households can borrow goes from 16 percent of the average yearly wage to about one quarter. Given that the wage also increases along the transition, in absolute terms this increase of the borrowing limit is even more pronounced: the credit limit roughly doubles.

Panel (b) of the same figure illustrates the credit to output ratio against different levels of capital abundance. This quantity is roughly 3.5 percent when capital abundance is 0.53 and goes to the steady-state level of 8.2 percent. This is a strong increase. Again, in absolute terms the increase in the amount of credit is even larger.

Panel (b) of Figure 3 also documents another important feature of the transition. Contrary to what occurs with prices, aggregate capital and the borrowing limit, the transition of the amount of credit is quite slow.

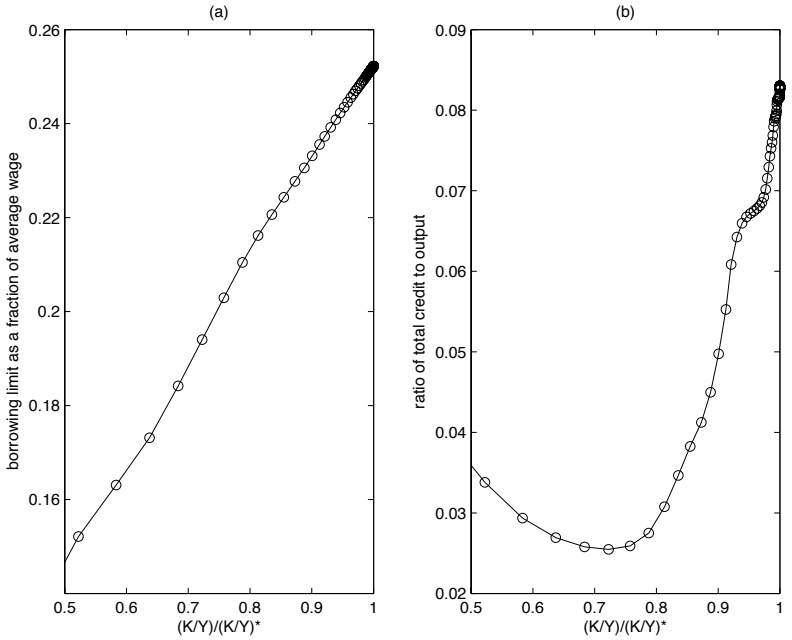


**Figure 3:** Transition of borrowing limits and total credit. Each circle represents a period. Model with endogenous borrowing limit.

**Welfare** We now turn to the welfare effects of international capital openness. Figure 4 displays a three dimensional graph of the welfare gains.[19] The welfare gains are on the $z$-axis, while the $x$-axis and $y$-axis contain capital abundance (the capital to output ratio as a fraction of its steady-state level), $\frac{K}{Y} / \left(\frac{K}{Y}\right)^*$, and household asset holdings, $\hat{a}$, respectively. Quantitatively, households with a negative net asset position benefit from this policy, while welfare decreases for some current savers. Notice that as capital becomes scarcer in the economy, the effects of openness of capital markets on welfare are greater. For some households, the effects are sizeable. For a country with the observed average capital to output ratio of non-OECD economies (roughly 0.56 of the steady-state level), the welfare gains for some households with

[19]For each point of the state space, the welfare gain in consumption terms $\mu$ is calculated as in Gourinchas and Jeanne (2006); see footnote 16. To compute average welfare gains over sets of agents, we assume a benevolent planner who assigns equal weight to each household, and integrate $\mu$ across the relevant set of agents using measure $\lambda$. For a slightly different approach see Mendoza, Quadrini, and Ríos-Rull (2007). They integrate the utility of each agent across agents using measure $\lambda$, and then obtain an equivalent gain in terms of consumption. In practice, undertaking this in our case would lead to slightly higher average welfare gains than those reported.

negative asset position can reach about 10 percent of their consumption when capital markets are closed to foreign flows. For households with positive net wealth, the welfare loss can reach about the same order of magnitude. The average effect depends on the welfare gains/losses of each household and on the mass of agents in each node of the wealth distribution.

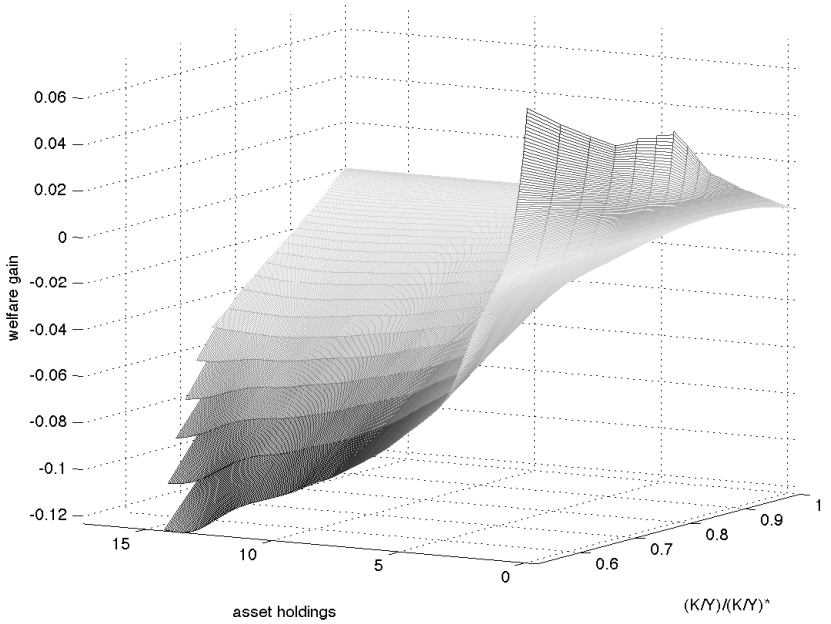


**Figure 4:** Welfare gains per asset holdings and capital abundance. Parameter values as in table 1. Asset holdings are asset levels normalized to their steady-state average. Model with endogenous borrowing limit.

Figure 5 displays the average welfare measure of an economy with the endogenous borrowing constraint that switches from a closed capital market to perfect capital mobility for each level of initial capital abundance. The most salient feature of the curve is that, unlike figure 1, the curve is not flat in the vicinity of the steady-state capital to output level. This is an important point. Gourinchas and Jeanne (2006) note that figure 1 delivers the stark message that the welfare curve is very flat around the steady-state capital to output level. Therefore, the welfare effects of international financial integration are second-order. In contrast, with incomplete markets the curve is actually not flat around the stationary equilibrium; moreover, it hides important differences across households.

The average welfare gain of a country with the observed capital abundance of a typical non-OECD country is about 5.4 percent of consumption equivalent relative to the baseline (economy with a closed capital market). This is about 3.9 times larger than the welfare gain of the same policy in a deterministic representative

agent version of the neoclassical growth model. In addition, for the average welfare gain to exceed 2 percent of the benchmark consumption, the capital to output ratio should be lower than 2.1, instead of 1.29 as in the deterministic case. Therefore, even for small differences in capital scarcity (or rate of returns as in Caselli and Freyer, 2007), the welfare gains of international financial integration might be quantitatively significant.

These results can be rationalized as follows. International financial integration of a capital scarce economy increases the average wage and lowers the interest rate. This tends to increase the average consumption and reduce consumption inequality. Under an utilitarian welfare measure, this increases average welfare. This effect is larger when households face non-insurable idiosyncratic shocks on labor productivity than when agents have access to complete markets since, for the same initial distribution of wealth and idiosyncratic labor productivity, incomplete markets lead to higher consumption inequality. For example, if capital abundance is that of the typical non-OECD country and integration occurs, then the consumption Gini goes from 0.54 to 0.51, while under complete markets the consumption Gini is 0.496 and remains at this value. The average welfare gain is, as seen above, 5.4 percent. As a comparison, if the same policy was implemented under complete markets but with the same initial distribution of assets and shocks of the model with incomplete markets, then the average welfare gain would be 4.1 percent of consumption equivalent to the baseline. These are both well above the gain for the representative agent under complete markets. Also interesting is the convergence path of the correlation between earnings and wealth under openness, which lies below that of the closeness case. For example, if capital abundance is that of the typical non-OECD country, the correlation between earnings and wealth is 0.61, which contrasts with 0.66 for the closeness case. The steady-state value of the correlation is 0.74. Lower correlation between wealth and earnings under openness along the transition and the fact that consumption is highly correlated with earnings makes individual agents better off, since they start relatively poor and enjoy immediately the steady-state wage rate.

Figure 5 also reports the welfare gains of households with the average level of asset holdings and average productivity. These welfare gains are lower than the average welfare gains and are slightly larger than the aggregate welfare gains of financial openness for economies without individual heterogeneity and with complete markets. For example, the welfare gain of the average household of the typical non-OECD country is about 1.87 percent of consumption equivalent to the baseline, while in the representative agent and deterministic economy the comparable figure

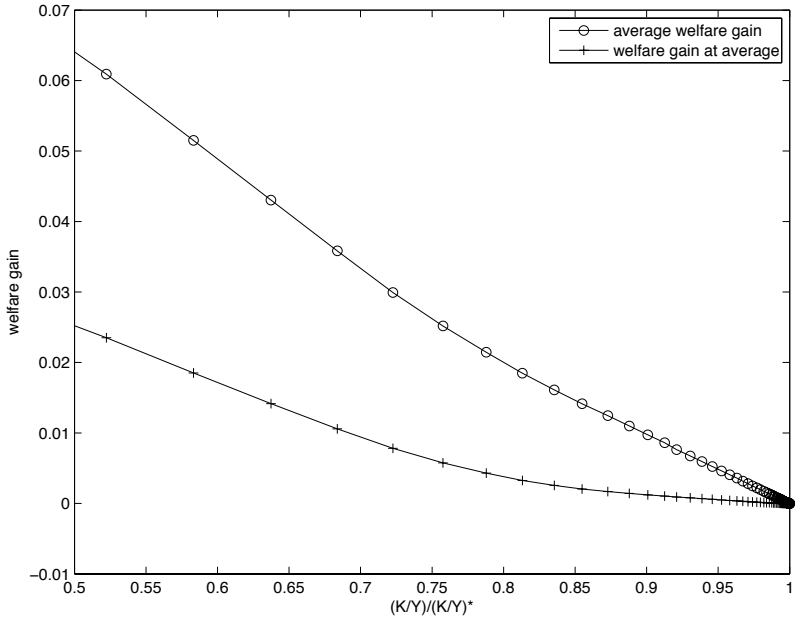


**Figure 5:** Average welfare gain versus capital abundance. Also depicted: welfare gain of households with the average asset value and average productivity versus capital abundance. Model with endogenous borrowing limit.

is 1.4 percent. This model replicates the main results of the deterministic economy in the sense that the welfare gains of the average household are comparable with those of the representative household of the deterministic model, while at the same time uncovering discrepancies in gains once we look at different levels of asset holdings and productivity.

Figure 6 displays the average welfare gain of net savers and net borrowers, as well as the welfare gain of households in the top and bottom quintiles of the asset distribution, for different levels of capital abundance. Depending on the net asset position, households might incur welfare losses or gains when the countries open their financial capital markets. At the average level of the capital to output ratio of non-OECD economies, current savers have an average welfare gain of about 3 percent of their consumption equivalent of the benchmark level, while current borrowers have an average welfare gain of about 8 percent. If we look at households in the top quintile, we see that they have a loss of about 0.6 percent of consumption equivalent, while households in the bottom quintile have a welfare gain of 8.5 percent.

In order to investigate this distributional difference in welfare gains further, Figure 7 displays the welfare gain of households by percentile of asset holdings, for an economy with a capital abundance of 0.56 relative to the long-run level, the average of non-OECD countries. In the logarithm utility case, we see that gains are about 8 percent up to the 20th percentile, then decline smoothly until they become negative

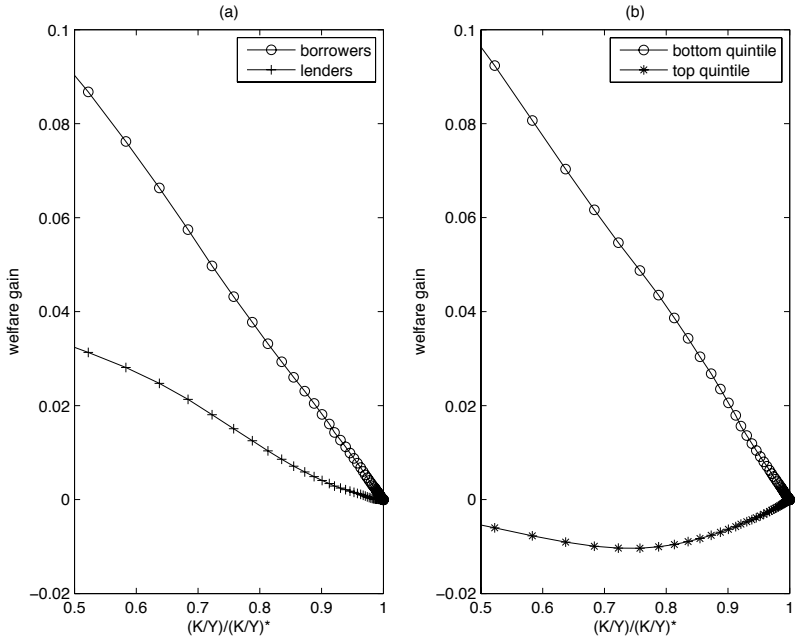


**Figure 6:** Panel (a): average welfare gain of net savers and borrowers versus capital abundance. Panel (b): average welfare gain of households in the top and bottom quintiles of the asset distribution versus capita abundance. Model with endogenous borrowing limit.

after the 90th percentile. We therefore see that gains are very large for the poorest households, and negative only for a small measure of households.

## 3.4 Sensitivity to the risk aversion coefficient

We next investigate the quantitative implications of changing the risk aversion coefficient. In brief, we conclude that when risk aversion becomes higher, the welfare effects of international financial integration are larger, as expected, since a large coefficient of relative risk aversion implies a stronger preference for consumption smoothing.

**Calibration** As a robustness exercise, we decrease the elasticity of intertemporal substitution (increasing the coefficient of relative risk aversion), by assuming that $\sigma$ is equal to 2 instead of 1.[20] In the case of the endogenous borrowing constraint, we also choose the pecuniary penalty $\gamma$ so that the credit to output ratio is roughly 8

[20]It has long been recognized in the macroeconomics literature (e.g., King and Rebelo, 1990) that the welfare effects of economic policies critically depend on the elasticity of intertemporal substitution (EIS), where $\sigma = \frac{1}{\text{EIS}}$. In addition, there is a large literature on empirical estimates of the EIS and a large range of estimates. Individual data estimates tend to yield larger values (higher than 2) than the aggregate data — time series — estimates (lower than two and close to one). See Guvenen (2006) for a discussion. See Gourinchas and Parker (2002) for a model-based estimation of the EIS.

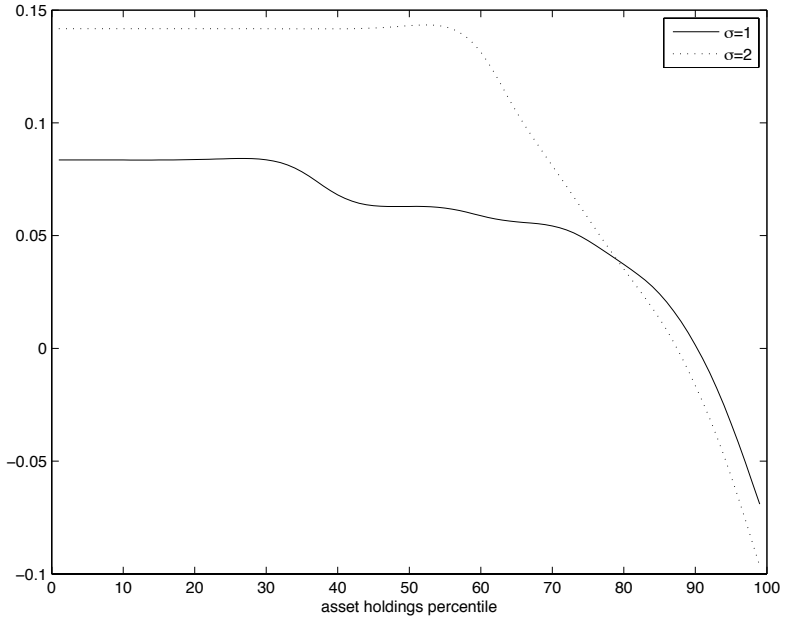


**Figure 7:** Welfare gain by percentile of asset holdings, in natural units.

percent. We accomplish this by setting $\gamma = 0.9$. All the remaining parameters are kept identical to those reported in Table 1.

From part II of Table 2 we observe that the model produces lower inequality than in the data, but it does a better job at the lower tail of the wealth distribution. Figure 1 shows that in the deterministic model welfare gains from international financial integration are higher when the coefficient of relative risk aversion is equal to 2 instead of 1 if the capital to output ratio is far from its long-run equilibrium. A higher coefficient of relative risk aversion implies that households value more consumption smoothing, and capital market openness allows households to borrow so that consumption jumps from its initial level to its long-run value. With $\sigma = 2$, at the observed average capital to output ratio of non-OECD economies the welfare gain of switching from complete financial closeness to perfect capital mobility is roughly 2.3 percent of consumption equivalent to its benchmark value, instead of 1.4 as in the economy in which $\sigma = 1$.

When we introduce uninsurable shocks on labor productivity, the quantitative effects change substantially when we compare the economies with $\sigma$ equal to 2 and 1. Figure 8 reports the average welfare impacts of capital market liberalization per capital abundance for the two cases. When $\sigma = 2$ the average welfare gain is about 7.4 percent of consumption equivalent for a country with the observed mean of capital abundance of non-OECD countries. This is about 48 percent larger than when the coefficient of relative risk aversion is equal to 1. Moreover, for the average

welfare gain to exceed 2 percent, capital abundance has to be smaller than 0.85, which translates to a capital to output ratio of 2.24 only (this compares with 2.1 in the $\sigma = 1$ case).

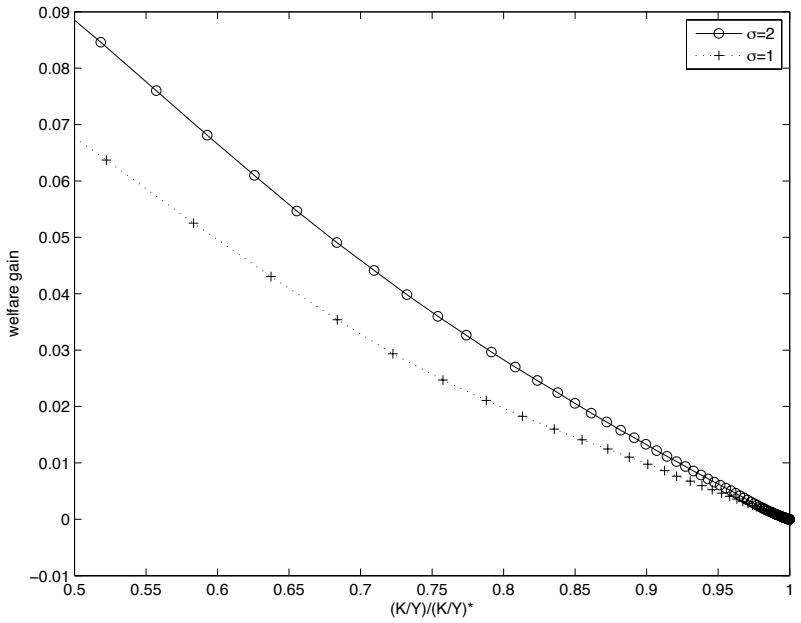


**Figure 8:** Average welfare gain versus capital abundance for two values of $\sigma$. Model with endogenous borrowing limit.

The distribution of the average welfare gains among lenders and borrowers looks similar to those of figure 6. There are only shifts in the numbers of welfare benefits of capital market liberalization.[21] Figure 7 shows that, for $\sigma = 2$, welfare gains are higher than the logarithm case for most households. The difference is larger in the lower tail, and slightly negative in the upper tail of the wealth distribution.

## 3.5 Sensitivity to the initial distribution

In the benchmark, we use an initial distribution $\lambda_0$, which is essentially the scaled-down version of the stationary asset distribution, and then ignore the first few years of the transition in order to dampen the effect of the particular shape of the initial distribution on our results. Here we investigate the robustness of our results with respect to different specifications of the initial asset distribution, with the only requirement that aggregate capital must be scarce relative to the steady-state level. We compute welfare gains under three different assumptions. First, we use a distribution equal to $\lambda_0$ except that all borrowers are considered to have zero assets.

[21] For the sake of space, we do not report this graph here.

The mass of borrowers is imputed to the lowest, non-negative asset level. In the second case, we perform a mean-preserving shrinkage of the initial distribution. This is done by multiplying the difference between the asset holdings of each household and the average level by 0.75, and adding that amount to the average level. Next, we conducted a mean preserving spread by applying the same procedure as before but using a factor of 1.25. The average welfare gains of the three experiments described above and the benchmark case are displayed in Figure 9.

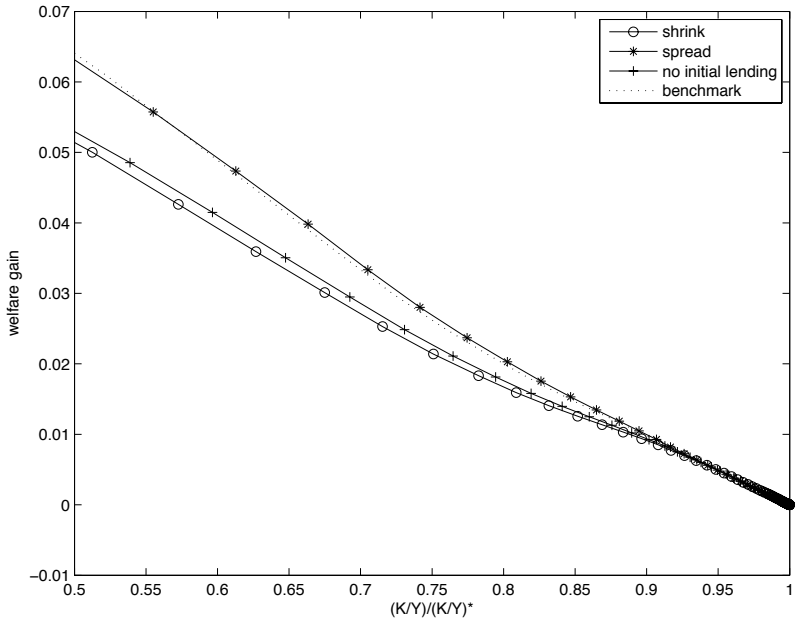


**Figure 9:** Average welfare gain versus capital abundance under different initial distributions: (i) no initial borrowing; (ii) mean-preserving shrinkage by 25 percent of $\lambda_0$; (iii) mean-preserving spread by 25 percent of $\lambda_0$. Model with endogenous borrowing limit.

If the distribution starts out without borrowing, the average welfare gains are slightly smaller than in the benchmark. For instance, at the capital abundance of a non-OECD country, 0.56, the difference in welfare gains is about 0.9 percentage points: The case with no initial borrowing generates an average welfare gain of about 4.5 percent of consumption equivalent, while with benchmark case this number is 5.4 percent. When there is a mean-preserving shrinkage of the initial asset holdings, the behavior is similar: we have smaller welfare gains, although still quite large when compared with the deterministic case without any individual heterogeneity. When we do a mean-preserving spread of the initial asset holdings, we arrive at roughly the same gains as in the benchmark. To the extent that in poor countries wealth inequality is typically large and the amount of lending is typically low, the gains documented in Figure 9 should be viewed as upper and lower bounds for the case of the benchmark calibration. These results show that the choice of the initial

distribution, arguably subjective, there are no significant changes over the gains that can be attained from international financial integration by a large absolute amount, as long as there is substantial wealth inequality.

## 3.6 The role of borrowing constraints

As documented in Figure 3, the model displays financial development, since borrowing limits increase as the economy converges to the steady state. Here we investigate the role of borrowing constraints in the welfare effects of international financial integration. We consider two fixed *ad-hoc* borrowing constraints. The first is defined as the borrowing limit that prevails in the benchmark calibration of section 3.1 when the capital to output ratio is equal to the observed average of the capital to output ratio in emerging economies, 1.47. We then permit the economy to adjust without changing the credit limit. This value is equal to 52 percent of the benchmark's long-run endogenous limit. The second is the extreme case where the borrowing limit is zero, that is, no lending is allowed. These are important exercises, since Table 2 shows that there is more borrowing in the calibrated model than in the data. Therefore, the quantitative welfare results might be driven by the large mass of agents who are borrowing. We show that this is not the case.

Consider the first case, where the borrowing limit is fixed. The statistics of the stationary equilibrium of this economy are presented in part III of Table 2. In the long-run, there is less borrowing and inequality in this model. Credit falls to about half the previous value, while the other indicators are slightly changed. In the case where the borrowing limit is zero, credit is, as expected, zero, and the other indicators follow the trend described above. With regard to welfare, Figure 10 provides the average welfare gain of international financial integration under the fixed *ad-hoc* borrowing constraints defined above. We may observe that for the first case the average welfare gain of capital market openness is quite similar to the case of the endogenous borrowing limit.

While extreme, the case where there is no lending is interesting. At a capital abundance of 0.56, the welfare gain of international financial integration is roughly 4.5 percent of consumption equivalent to the baseline, below the benchmark gain of 5.4 percent. Given that such allocation prevents any borrowing and that the welfare gain is still substantial, this suggests that the source of most of the welfare gains observed in incomplete markets models is due mainly to how the movement in the price of factors reallocate consumption among individuals. In fact, allowing households to borrow in an incentive compatible manner only gives them a small additional gain of roughly 1 percentage point of consumption equivalent. Therefore,

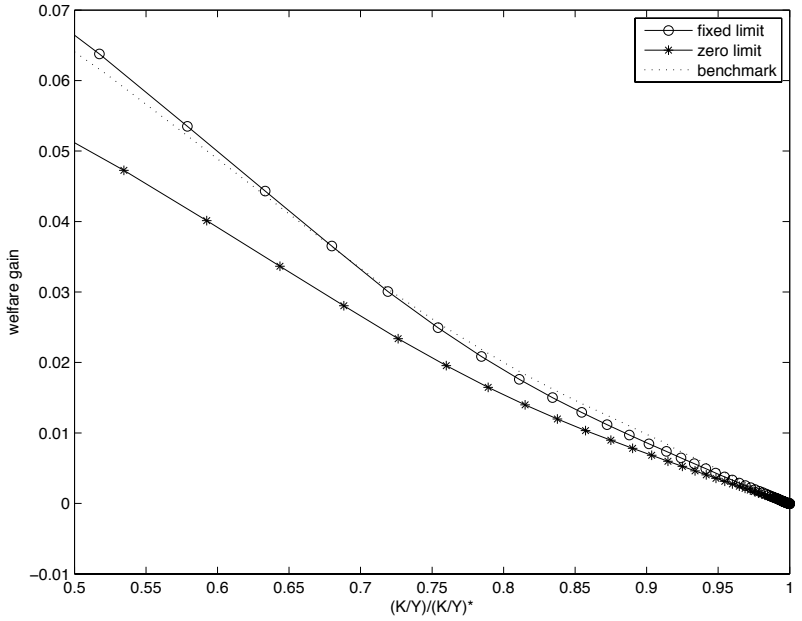


**Figure 10:** Average welfare gain versus capital abundance for two *ad-hoc* borrowing constraints and the benchmark model. The fixed limit is defined as 52 percent of the long-run endogenous limit of the benchmark calibration. Model with endogenous borrowing limit.

financial development accounts for at most one fifth of the average welfare gain of international financial integration.

## 3.7 Total Factor Productivity (TFP) catch up

There are some relevant articles which point out that not only differences in capital to output ratio across countries are best viewed as permanent rather than transitory (e.g., Lucas, 1990, Caselli and Freyer, 2007), but also that total factor productivity (TFP) differences across countries explain why capital does not flow from capital-rich to capital-scarce countries.[22] If this is the case, then financial deregulation of domestic capital markets and the liberalization of the capital account on developing countries would not attract any capital to these countries and the welfare gain of financial integration in most emerging economies will be roughly zero. On the other hand, reforms[23] that increase total factor productivity would have a positive impact on the return of capital and therefore would attract foreign capital in financially integrated economies. This clearly depends on the assumption that high productive

[22] As mentioned previously, some empirical evidence suggests that financial liberalization has a transitory positive effect on capital accumulation and economic growth, as suggested by the neoclassical growth model (e.g., Levchenko, Rancière, and Thoenig, 2008).

[23] Some well known reforms that boost economic productivity are: reducing barriers to entry and to the adoption of technology; trade reforms; improvements in financial contract enforcement.

firms have access to international capital markets, as suggested in two recent related papers. Song, Storesletten, and Zilibotti (2011) have built a model illustrating how countries might have high output growth, sustained high returns on capital, and a foreign surplus throughout the transition. Their model is consistent with the transition in China and is based on the idea that while state-owned firms have lower productivity they have a higher access to outside finance than privately-owned firms. Buera and Shin (2010) investigate how the rise in TFP might lead to capital outflows in economies with strong contractual enforcement frictions.[24]

Here we implement the following exercise. We consider the same model as before and assume that a particular country with a lower TFP than the United States economy is in a stationary equilibrium in which the domestic interest rate is similar to the international interest rate. Then we assume that this country implements reforms that increase its TFP relative to that of the United States. Following growth facts of Post-War economic miracles, such as those in Chile, South Korea, Taiwan, among others countries, documented by Buera and Shin (2010), we assume that TFP relative to the baseline economy (US) increases by about one third during a period of 20 years. We then investigate the transition of this economy under a closed and open capital market to foreign flows in order to evaluate the welfare gains of having a financially integrated capital market during reforms that boost productivity. In particular, normalizing the detrended US TFP to 1, we assume that the TFP of country $i$ is:

$$\text{TFP}_t^i = 1 - \frac{1}{3}e^{-\frac{t}{5.70}},\ t = 0, 1, 2, ...$$

This rule implies that $\text{TFP}_0^i = 0.667$ and $\text{TFP}_{20}^i = 0.99$, and is a milder change in TFP than the one used in the rest of the paper. The function above is smooth and concave with respect to $t$. In the data provided by Buera and Shin (2010) there is a jump in the TFP just after the reform period and the catch up in productivity is, in general, a concave function of time.

If we consider the complete markets and representative agent model as in Gourinchas and Jeanne (2006), the welfare gains of having an economy open to foreign inflows of capital is about 1.53 percent of consumption equivalent. This is not a negligible number, which shows the benefits of capital market openness in reforms that lead to productivity catch up, a point also emphasized by Gourinchas and Jeanne (2006). In the case of incomplete markets, the average welfare gain of having a financially integrated capital market in the event of TFP increases is about

[24]Using related but different arguments, both articles explain the allocation puzzle as indicated by Gourinchas and Jeanne (2011) that highly productive growth countries tend to have a net foreign surplus.

2.42 percent of consumption equivalent, which is about 1.6 times larger than what is observed in the representative agent model.[25] The distributional effects are quite similar to the previous case of capital accumulation but with no TFP catch up, in which rich agents lose, while poor agents have large welfare gains.[26] This exercise shows that even in the case in which the rate of return on capital is similar across countries, capital market openness might have a sizeable effect on welfare when countries implement reforms that boost productivity growth. The message of the above results is similar in spirit to two different policies: Antunes, Cavalcanti, and Villamil (2008) and Castro, Clementi, and MacDonald (2004), for instance, show that financial reforms have stronger effects on productivity if the economy is open to foreign capital flows; and Kambourov (2009) argues that the welfare gains of trade liberalization are much higher if the economy has flexible rather than rigid labor markets.

## 3.8 The political economy of capital market openness

From the exercises above we have learnt two important lessons: (i) under individual heterogeneity and incomplete markets, international financial integration can substantially improve welfare in capital scarce countries and in reforms that boost productivity growth; and (ii) the average welfare measure hides important distributional effects. International financial integration benefits mainly the poor in capital-scarce countries or when capital is flowing in. However, would the pivotal voter benefit from such a reform on the capital market?

In this subsection, based on the results of capital-scarce countries, we analyze the political economy of international financial integration. Figure 11 reports the difference between the fraction of individuals that benefit at least marginally (that is, at least 0.1 percent of consumption equivalent) from a policy that switches the capital market from being closed to open, and the fraction of those who oppose it, defined as those households who have at least marginal losses. We call this quantity the *net political support* of the reform.

In panel (a) of Figure 11 we can see that political support is a decreasing function of capital abundance. The closer the economy is to its long-run equilibrium (higher capital to output ratio), the lower will be the loss in interest income due to capital

[25] In the model with individual heterogeneity, but in which agents have access to a full set of Arrow-Debrer securities, the average welfare gains of the same exercise is about 1.82 percent of consumption equivalent.

[26] Agents at the top quintile of the wealth distribution have an average welfare loss of 0.9 percent of consumption equivalent, while those on the bottom quintile of the wealth distribution have a welfare gain of 3.9 percent.

market openness. This explains why the fraction of individuals that benefit from capital market openness decreases with the capital to output ratio. Observe that for the benchmark case and for an economy with the observed average level of capital to output ratio the net political support of a policy that switches the economy from complete financial closeness to perfect capital mobility is 82 percent.

In order to investigate the robustness of this result further, we consider the political consequences of financial integration in an economy with higher inequality. We increase the standard deviation of innovations in the labor productivity process by 50 percent. The result is depicted in panel (a) of Figure 11. When the inequality in wages is higher, for most of the range of capital abundance, net political support for openness is smaller than under the benchmark. For instance, at the 0.9 relative capital to output ratio level, net political support is 10 percentage points lower when inequality in labor income is 50 percent larger than in the benchmark economy. For capital abundance lower than 0.63, net political support for openness is roughly similar to the benchmark case. When the coefficient of relative risk aversion is equal to 2 instead of 1, net political support for openness is as expected, also lower than in the benchmark case. The reason is that a higher coefficient of relative risk aversion implies higher preferences for consumption smoothing and a higher accumulation of assets.

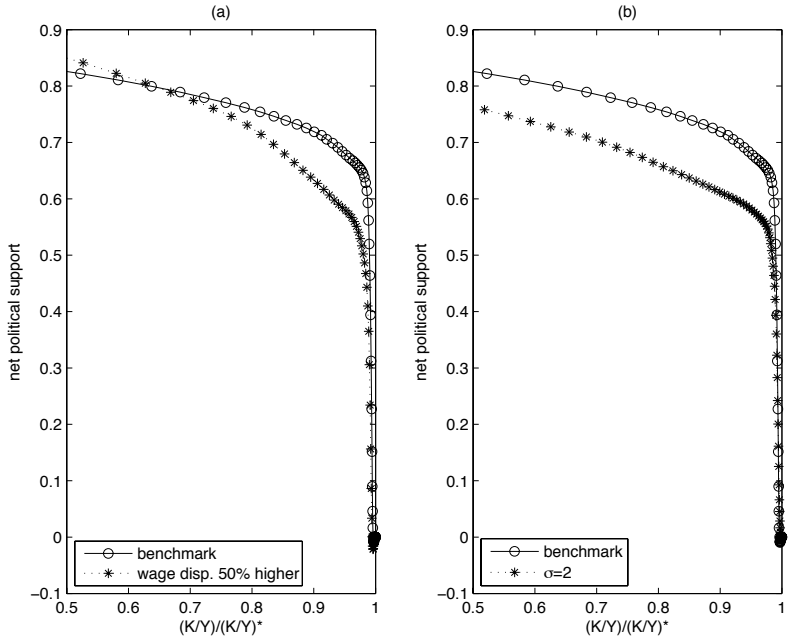


**Figure 11:** Difference between fraction of households that benefit more than 0.1 percent of consumption equivalent from international financial integration, and fraction of households whose losses are larger than 0.1 percent of consumption equivalent. The benchmark parameters are those of table 1. Model with endogenous borrowing limits.

Given our calibration, the median household is therefore in favor of a reform that integrates a closed financial economy to the international capital market, at the average level of capital abundance of non-OECD countries. Consequently, if political power depends on the vote of the median household, the typical non-OECD country would implement such a reform. However, if political power is unequal and its concentration depends on wealth (as argued by Engerman and Sokoloff, 2005, and others), then financial integration might not occur. Notice that this result is consistent with the empirical evidence on democracy and financial liberalization. Quinn (2000) and Quinn and Toyoda (2007), for instance, show a positive relation between democracy and financial liberalization and that sustained democratization produces sustained liberal international financial regulation.

# 4 Concluding remarks

This paper investigates the welfare effects of financial deregulation of domestic capital markets and the liberalization of the capital account on developing countries. We corroborate previous findings (e.g., Gourinchas and Jeanne, 2006) that international financial integration does not have a significant impact on welfare in a model with complete markets and no individual heterogeneity. We also show that the introduction of market incompleteness and individual heterogeneity are quantitatively important in the welfare analysis of capital market policies. In particular, we show that:

1. The introduction of individual heterogeneity and market incompleteness boosts aggregate welfare effects. For an economy with the average capital to output ratio of non-OECD countries, welfare increases by a factor of at least 3.9 compared to the representative agent model. In addition, we show that individual heterogeneity accounts for 2/3 of this increase in the average welfare gain, while market incompleteness accounts for the remaining 1/3.

2. Even in the case in which the rate of return on capital is similar across countries, capital market openness may have a sizeable effect on welfare when countries implement reforms that boost productivity growth, as observed in the data.

3. We also show that, in general, the median household is in favor of international financial integration, but if the pivotal voter is wealthy enough such reform might not be implemented, since richer households have a vested interest in capital market closeness.

We explain why this is the case. Financial integration in capital-scarce countries leads to capital inflow, which increases the average marginal productivity of labor and decreases the domestic interest rate. Income from interest decreases, damaging the welfare of rich agents. An increase in the average productivity of labor increases the welfare of all agents, but particularly those with a low asset position and low consumption, whose marginal utility of consumption is relatively higher.

4. Finally, we indicate that borrowing constraints play a small role in accounting for the effects of financial liberalization on welfare; they account for at most one fifth of the average welfare gains.

It is our belief that our results contribute to the existing literature on the welfare effects of international financial integration and to the policy discussion on capital controls. Recently, the International Monetary Fund (IMF) has published a policy staff position note[27] discussing the circumstances under which controls on capital inflows to emerging market economies can be a legitimate component in a toolkit of macroeconomic policies. Although this IMF policy report justifies capital controls in order to avoid excessive exchange rate appreciation and to reduce financial vulnerability, the low benefit of financial liberalization on welfare through the investment and growth channels could give more support to capital control policies.

Regarding some extensions, as in Gourinchas and Jeanne (2006) we could also add human capital to the model, which might potentially increase the welfare gains; however, they did not find any important quantitative changes in the results. In our case, it will depend on who invests in human capital. If human capital accumulation is mainly undertaken by capital owners (who stand to lose from integration), they may have an incentive to slow human capital accumulation, which would then lower the gains from integration. But if it is mainly undertaken by borrowers, then the opposite result may happen, which would strengthen our results. This would add another political economy dimension to the analysis.

One further policy implication of our analysis is related to the optimal tax structure during capital market liberalization. Domeij and Heathcote (2004) and Garcia-Milà, Marcet, and Ventura (2008), for instance, show that poor households might experience large welfare losses if capital income taxes were eliminated. This is because, during the transition, a decrease in the capital income tax will lead to an increase in the labor tax and in the interest rate, afflicting therefore poor households that have a large wage/wealth ratio. Greulich and Marcet (2008) indicate

[27] See Ostry, Ghosh, Habermeier, Chamon, Qureshi, and Reinhardt (2010).

in a standard growth model with heterogeneous households that the optimal tax reform is to cut labor taxes and leave capital taxes very high in the short and medium run. Only in the very long run would capital income taxes be zero. Since in our model capital market openness benefits heavily the poor, financial liberalization might compensate the poor when the government decides to cut capital income taxes. Therefore, a zero tax on capital income might be optimal also in the short run.

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