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

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Abstract

From a simple (theoretical) growth argument, financial integration enables capital-scarce countries to raise capital inflows with positive effects on investment and on the speed of convergence. We first show that in a complete markets neoclassical growth model that although financial openness increases welfare, its quantitative effects are limited. However, we also show that when agents face uninsurable idiosyncratic risks on income and borrowing constraints the welfare implications of financial liberalization are sizeable. For instance, the average welfare of a typical emerging market economy that switches from financial autarky to perfect capital mobility would increase by roughly 7.5 percent of consumption equivalent. This is about 5 times larger than the welfare gains of the same policy under the complete markets environment. Finally, we also provide a rationality of why such large welfare gains might not be exploited, since the average welfare gain hides important distributional implications. In our calibration, the median agent is in favor of international financial integration, but if wealth positively affects the pivotal voter such reform might not be implemented, since richer agents have a vested interest on capital market closeness.

JEL Classification: E21; E60; F30

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1 Introduction

As emphasized by Kose, Prasad, Rogoff, and Wei (2006) the merits and effects of financial globalization have generated a passionate debate among researchers and policy makers. The empirical literature, based on cross country regressions, finds that financial liberalization is not a sufficient condition for rapid economic growth. Kose, Prasad, and Taylor (2009), for instance, show that financial openness can have positive effects on growth when certain conditions (e.g., creditor's protection) are met. There are other important factors that are key for growth, and financial integration *per se* does not deliver a higher rate of economic growth.[1] Henry (2007) criticizes the use of cross countries regression to test the effects of liberalization on economic growth, since liberalizing the capital account of a capital-poor country will only temporarily increase the growth rate of income per capita and cross countries growth regressions implicitly test for a permanent change in growth rates. Empirical studies (see Henry (2007) for an overview) that use policy experiment approaches and firm level data show that capital market liberalization has, in general, effects on investment and growth that are consistent to the neoclassical growth theory. Levchenko, Rancière, and Thoenig (2008), for instance, using industry level data show that financial liberalization has a positive effect on capital accumulation and economic growth.[2]

From a simple (theoretical) growth perspective for a given level and growth rate of TFP, international financial integration enables capital-scarce countries to raise capital inflows with positive effects on investment and on the speed of convergence. It also benefits capital abundant countries by allocating their savings into more

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[1]See Kose, Prasad, Rogoff, and Wei (2006) for a review of the literature on growth and financial openness. See also the arguments emphasized by Lucas (1990). Recently, using panel data techniques Bonfiglioli (2008) shows that international financial integration has a positive direct effect on total factor productivity, but the effects on capital accumulation are insignificant.

[2]In a recent paper, Gupta and Yuan (2008) show also using firm level data that liberalization reduces financing constraints, and industries that are more externally dependent and face better growth opportunities grow faster following capital market liberalization. They show that the growth impact of stock market liberalization is larger if it is accompanied by competition enhancing reforms, such as price liberalization and reduction in entry barriers.

productive investment.[3] 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.[4] They 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 (i.e., if it increases total factor productivity (TFP)).

In this paper, we also investigate the quantitative welfare implications of international financial integration in a neoclassical growth model. We, however, consider a heterogenous and an incomplete markets economy in the same spirit of Aiyagari (1994) and Huggett (1993). In this environment, households face uninsurable idiosyncratic shocks on their labor productivity and there are borrowing constraints.[5] There is no aggregate uncertainty in our framework. As in the deterministic growth model, openness in the capital market allows agents to borrow (at lower cost in capital scarce countries) in international markets to anticipate future increases in labor productivity, due to capital accumulation. However, when agents face idiosyncratic shocks on their labor productivity there is an additional motive for agents to engage in intertemporal trade. Given the economy wide average productivity and its trend, some households might be experiencing good shocks while others might be

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[3]There is also a literature on financial integration and output volatility. See Kose, Prasad, Rogoff, and Wei (2006) for a review of this literature. The theoretical literature shows that financial integration might allow poor countries to diversify their narrow production bases and therefore reduce macroeconomic volatility. However, it can increase specialization in open middle income countries, increasing output volatility. Financial integration could also expose countries to world interest rate shocks. Aizenman, Chinn, and Ito (2008) show that depending on the level of financial development, financial liberalization might reduce or increase output volatility. We will abstract from the effects of financial integration on output volatility and will emphasize its role on convergence and consumption smoothness.

[4]They also show that results are robust to the introduction of human capital, and perform other robustness exercises.

[5]We consider both a Kehoe and Levine (1993) endogenous borrowing constraint and an Aiyagari (1994) natural borrowing limit.

facing negative shocks. The latter might need to borrow to insure against shocks on their productivity. The integration of the economy to international capital markets decreases borrowing costs in capital scarce countries and allows current borrowers to increase their consumption possibility frontier. A lower interest rate also loosens borrowing constraints, with positive welfare effects on borrowers. The two effects might even increase the value function of current savers, since with positive probability they may need to borrow in the future due to the possibility of facing negative income shocks. However, with a lower interest rate rich agents will also be affected negatively, since interest income will be lower.

We show that the introduction of uninsurable idiosyncratic risks on labor productivity boosts aggregate welfare effects. 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 5 when compared to the complete markets Arrow-Debreu economy.[6] In addition, on average savers loose while borrowers might have large welfare gains from international financial integration. Current savers have an average welfare loss of about 5 percent of their consumption equivalent to the baseline level and borrowers have an average welfare gain of 12 percent.

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

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[6]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.

gains from international financial integration.[7]

There is a vast literature on the welfare implications of financial integration. Most of this literature focuses on how financial integration might lead to risk sharing among countries and evaluate the benefits of cross country risk sharing.[8] 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. Recently, Townsend and Ueda (2009) analyze how capital market openness can affect financial deepening (in a similar way to Greenwood and Jovanovic (1990) and Acemoglu and Zilibotti (1997)) by reducing transaction costs. They also find large welfare effects. We emphasize different channels on how financial integration might affect welfare. We focus on two distinct channels: (i) the first one, which is similar to the one studied by Gourinchas and Jeanne (2006), corresponds to how financial integration allows capital scarce countries to grow faster towards the long run equilibrium; (ii) the second channel is how capital market openness affects the ability of households to insure against idiosyncratic risks, by reducing borrowing costs and loosening borrowing limits. Both channels benefit the poor, but the second one might decrease the welfare of those agents whose income depends heavily on the return of financial assets.[9] We show that the second effect can generate large welfare gains from

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[7]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.

[8]See, for instance, Athanasoulis and van Wincoop (2000), Lewis (2000) and Obstfeld (1994).

[9]Mendoza, Quadrini, and Ríos-Rull (2007) find the opposite. 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 producing distributional effects in opposite direction to ours. Notice that our results are not contradictory to theirs, since our exercise is different. In their model, the only difference among countries is the *ad-hoc* borrowing constraint. In a closed economy, countries with tighter borrowing constraints have lower interest rate. When these countries open their financial capital market, the interest rate rises instead of falling. In our model, borrowing constraints are either the endogenous or the natural one, and as in Gourinchas and Jeanne (2006) the only difference among countries is the level of capital scarcity. Notice that as our economy develops over time, the level of financial development (borrowing limits) also increases.

financial liberalization.

We therefore 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 do this by considering an economy with incomplete markets and borrowing limits. We believe that such extensions are important for our understanding on how financial liberalization might affect the aggregate welfare and how its effects are distributed in the economy.

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) of infinite-lived households who are *ex-ante* identical. Households, however, 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 economy in detail.

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[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.

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 rate $1 + g_t = \frac{A_{t+1}}{A_t}$, with $A_0 = 1$. Households competitively rent units of efficient labor and capital to firms. Input rental prices are given by their marginal productivity:

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

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

Because the production function is homogeneous of degree one, profits are zero, and firm ownership is unimportant. We therefore 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 $1 + n = \frac{N_{t+1}}{N_t}$, with 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 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:

$$E_0 \left[\sum_{t=0}^{\infty} \beta^t N_t u(c_t) \right], \quad \beta \in (0,1).$$ (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 giver by:[11]

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

For computational purposes, we transform variables in order to make the economic system into 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 $\hat{\underline{a}}$ as the overall lower bound on assets per efficiency unit of labor which will be determined endogenously (see below). We assume an upper bound on assets per efficiency unit of labor, $\hat{\bar{a}}$, such that if assets are larger than $\bar{a}$ agents would choose to decrease asset holding. Define $X = [\hat{\underline{a}}, \hat{\bar{a}}] \times \mathcal{Z}$ and let χ be the associated Borel σ-algebra. For each $B \in \chi$, $\lambda(B)$ corresponds to the mass of households whose individual state vectors lie in B. The agent's value function depends not only on the

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[11]Notice that $r_t = r_t^K - \delta$.

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 λ_t. To compute such measure in the next period, the households need to know the current period's entire measure λ_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.

We consider two types of borrowing limits: the natural borrowing limit and the endogenous borrowing limit. We study each case separately. borrowing

Natural borrowing limit: As in Aiyagari (1994), we define the natural borrowing limit by the value such that in an agent's worst possible state interest payments are not higher than the agent's labor income. Let $\underline{z}$ be the agents' worst possible state. Then the natural borrowing limit is given by:

$$\hat{a}_{t+1} \geq \hat{\underline{a}}_{t+1}^{\mathrm{NB}} = -\sum_{j=0}^{\infty} \frac{\hat{w}_{t+1+j}\underline{z}}{\prod_{s=0}^{j}(1 + r_{t+1+s})}.$$

Endogenous borrowing limit: In this case, 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 and the borrowing limit is defined such that it is never in agents' best interest to default. In order to define the endogenous borrowing limit, it is necessary to calculate the utility under financial autarky. Recall that in case of default, households are excluded from intertemporal trade. Then, the value of the household problem under autarky is:

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

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:[12]

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

with $\tilde{\beta} = \beta(1+n)(1+g)^{1-\sigma}$, subject to either: (i) the natural borrowing limit

$$\hat{a}' \geq \underline{\hat{a}}^{\mathrm{NB}}; \quad (7)$$

or (ii) the endogenous borrowing limit,

$$v(\hat{a}', z', \lambda') \geq \underline{v}(z', \lambda'), \qquad \forall z' \in \mathcal{Z}, \quad (8)$$

and

$$\lambda' = H(\lambda). \quad (9)$$

Constraint (8) guarantees that agents will honor their promises and they will not default in 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 (8) defines a lower bound $\underline{\hat{a}}^{\mathrm{EB}}$, such that $\hat{a}' \geq \underline{\hat{a}}^{\mathrm{EB}}$.

2.3 Equilibrium

Let $x = (\hat{a}, z)$ be the individual state vector of a particular agent. 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

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[12]Here we used budget constraint (5) into 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 omit it.

next period, given the current asset distribution λ 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

$$T(\lambda, Q)(B) = \int_X Q(x, \lambda, B; h) d\lambda. \tag{10}$$

Note that $\lambda'(\cdot) = T(\lambda, Q)(\cdot)$. We now define a recursive competitive equilibrium and a 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 $(\hat{w}, r^K, r)$; initial distribution λ_0; and aggregate measure $H(\lambda)$, 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 $r = r^K - \delta$.*

3. *Markets clear:*

$$\hat{L} = \int_X z d\lambda. \tag{11}$$

$$\int_X h(x, \lambda) d\lambda = \hat{K}' \tag{12}$$

$$\int_X h_{\hat{c}}(x, \lambda) d\lambda + (1+g)(1+n)\hat{K}' = \hat{K}^\alpha \hat{L}^{1-\alpha} + (1-\delta)\hat{K} \tag{13}$$

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

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

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) stochastic process on labor productivity; and (iv) initial distribution.

Given that we are studying the transition of economies considerably away from the steady state, we cannot directly compare steady state outcomes. Our exercise is not possible without computing the entire transition path of the economy. This is a cumbersome task which involves keeping track of the whole assets and idiosyncratic shocks distribution. The welfare of any policy change is assessed through direct computation of the value functions in the two situations (with and without financial markets liberalization) given the same initial distribution of assets and shocks.

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 β. Otherwise, welfare differences from the two models might be driven by the distance of the initial and long run marginal productivity of capital, which will be larger in the model with ex-post heterogenous agents. Consequently, to make the numbers comparable we chose β such that the two models generate the same interest rate in the long run. For each capital to output ratio the distance to the steady-state will be identical, which is by assumption similar to the international interest rate.

As a robustness check, in appendix A we also report the welfare implications of capital market integration when all parameters (including β) are identical to the calibration reported by Gourinchas and Jeanne (2006), except for the introduction of labor productivity shocks. This is also important since in the models with idiosyncratic shocks on labor productivity there is precautionary saving which implies that to generate the same interest rate in the long run, the value of β has to be smaller than in the deterministic case. When β 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 β) almost cancel each other.

It remains, however, to define the income labor process and the initial distribution. For the idiosyncratic process, we followed Krueger and Perri (2004). As in Aiyagari (1994), they use a finite approximation of an *AR(1)* process:

$$\ln(z') = \rho \ln(z) + \epsilon, \quad \epsilon \sim \text{iidN}(0, \sigma_\epsilon^2). \tag{14}$$

They set $\rho = 0.989$, which is a value estimated by Storesletten, Telmer, and Yaron (2004). By allowing heterogeneity in the labor income process, Guvenen (2007), however, estimated a significantly lower persistence for the AR(1) process ($\rho = 0.82$). We set ρ to be equal to 0.9. Since not all difference on income comes from

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

Parameters	Calibration	Comment/Observations
σ	1	Risk aversion coefficient
α	0.30	Capital income share
$\beta_{\text{deterministic}}$	0.96	Subjective discount factor
$\beta_{\text{exclusion}}$	0.954	Subjective discount factor
β_{natural}	0.95	Subjective discount factor
δ	0.06	Depreciation rate
g	0.012	Growth rate of labor productivity
n	0.0074	Population growth rate
ρ	0.9	Intermediate value from Storesletten et al (2004) and Guvenen (2007)
σ_ϵ	0.719	Cross-sectional standard deviation of shocks based on Krueger and Perri (2004)

idiosyncratic shocks, Krueger and Perri (2004) regressed household earnings from the US Consumer Expenditure Survey data on age, race, sex, and education. They interpret the residuals as idiosyncratic shocks on labor productivity. Parameter σ_ϵ was calibrated such that the cross-sectional standard deviation of idiosyncratic household income is similar to the data, i.e., equal to 0.719.

For the initial distribution of assets and labor shocks, we do the following: First, we assume the unconditional stationary distribution of the shocks. In addition, for each level of the capital to output ratio there is an invariant distribution of assets that is consistent with a stationary equilibrium. We assume for the initial capital stock we assume such stationary distribution. In section ??, we do some robustness exercise for the initial distribution and consider also an economy with a labor process that is different from the one of the United States economy. Table 1 contains the calibrated parameter values.

Benchmark economy   Table 2 reports statistics for the US economy and model, under the two different borrowing constraints. In the two types of borrowing constraint, 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.

When we evaluate the distribution of assets, Table 2 shows that the model predictions for this distribution depend on the form of the borrowing limit. The model with the endogenous borrowing limit produces a Gini index of 91 percent, while in the data is 78 percent. In addition, the first row of Table 2 shows that in the data, the top 1 percent of households have 29.6 percent of all wealth. Under the borrowing constraint with permanent exclusion, the top 1 percent of households hold only 14 percent of total wealth and the bottom 20 percent have more negative wealth than in the data. This model misses the top and bottom tails of the distribution, but does a reasonable job in the middle.[13] The model with a natural borrowing limit produces less inequality, but it still does not match the tails of the asset distribution. We investigate in section ?? how results change with the distribution of assets and the stochastic labor process.

3.2 Welfare

3.2.1 Model without idiosyncratic shocks on labor productivity

In the absence of labor productivity shocks or if there are 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 and the interest rate is equal to 5.42 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.

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[13]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 agents and uninsurable idiosyncratic shocks to earnings. Quadrini (2000), for instance, shows that entrepreneurs accumulate more assets because they face risk associated with business activities and higher returns on savings than workers. Therefore, entrepreneurs play an active role in shaping the wealth distribution.

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

	Capital-output ratio	Wealth Gini (%)	Income Gini (%)	Percentage wealth in the top			in the bottom	
				1%	5%	10%	20%	60%
US data	3.0	78	63	29.6	54.0	66	-0.39	7.1
Part I: $\sigma = 1$								
Deterministic model	2.63							
Model with idiosyncratic shocks (Endogenous)	2.63	91	44	14	51	80	-20	-31
Model with idiosyncratic shocks (Natural)	2.63	86	44	12	41	65	-10	-14
Part II: $\sigma = 2$								
Deterministic model	2.63							
Model with idiosyncratic shocks (Endogenous)	2.63	87	44	12	43	68	-24	-23
Model with idiosyncratic shocks (Natural)	2.63	80	44	10	36	56	-8	-4

We reproduce Figure 1 in Gourinchas and Jeanne (2006). This figure presents the welfare gains[14] measured by the equivalent variation from international financial integration as a function of the initial capital to output ratio. The vertical 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.[15] The average capital
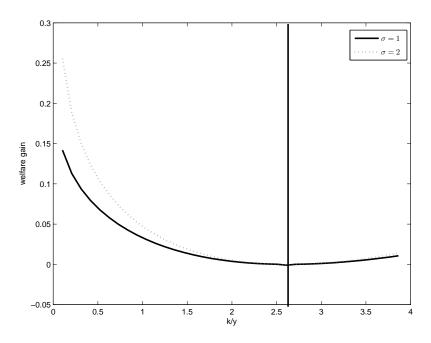
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[14]As Gourinchas and Jeanne (2006), we calculate the consumption equivalent for the baseline economy and for the economy after the policy change. This is:

$$(1 + \mu)^{1-\sigma} v^{\text{Close}} - v^{\text{Lib}} = 0.$$

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

$$\left(\frac{K}{Y}\right)_{2000} = \frac{\left(\frac{I}{Y}\right)_{2000}}{\delta + n + g},$$

where $\left(\frac{I}{Y}\right)_{2000}$ corresponds to the average investment rate from 1990 to 2000, $\delta = 0.06$, $g = 0.012$, and n is the average population growth from 1990 to 2000. See Klenow and Rodriguez-Clare

Figure 1: Welfare gains from international financial integration and the capital to output ratio. The welfare measure corresponds to the equivalent variation. Solid black line: $\sigma = 1$. Dotted gray line: $\sigma = 2$.

to output ratio for this sample is 1.47 and the population-weighted average is 1.91.[16]

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 risks but not aggregate uncertainty; and (ii) study the distributional implications from financial integration: who are the winners and losers of such reform?

(1997) for a similar approach. For some transition countries, because of data availability, we use the average from 1995 to 2000.

[16]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.

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3.2.2 Model with idiosyncratic shocks on labor productivity

As in the deterministic model, the economy with idiosyncratic shocks on labor productivity also implies that international financial integration raises capital inflows in capital-scarce countries. Capital inflows increase the speed of convergence towards the long run equilibrium and allow households to better smooth consumption over time. With openness in the capital market, agents can borrow in international markets to anticipate future increases in labor productivity due to capital accumulation, a feature also present in the standard deterministic growth model.

When agents face idiosyncratic shocks on their labor productivity there is, however, an additional motive for agents to engage in intertemporal trade. Given the economy wide average productivity and its trend, some households might be experiencing good shocks while others might be facing bad shocks. The latter might need to borrow to insure against such shocks. Therefore, in an economy where households can trade intertemporally and face idiosyncratic shocks on labor productivity there is, in each point is time, a mass of agents with positive and negative net asset position. The integration of the economy to international capital markets decreases borrowing costs in capital scarce countries and allows current borrowers to increase their consumption possibility frontier. This certainly increases the welfare of such agents. In addition, borrowing constraints loosen with lower interest rate (in both natural and endogenous borrowing limits). These two effects might even positively affect the welfare of current savers, since with positive probability they may need to borrow in the future due to the possibility of facing future bad labor productivity shocks. However, with a lower interest rate rich agents will also be affected negatively, since interest income will be lower.

Figure 2 displays a three dimensional graph of the welfare gains of capital market openness.[17] The welfare gains are on the *z-axis*, while the *x-axis* and *y-axis*

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[17]This figure reports the effects on welfare of international financial integration in a model with endogenous borrowing constraint (Kehoe and Levine (1993)). The shape of the figure is similar

contain the capital to output ratio $\frac{K}{Y}$ and agent net worth a, respectively.[18] Quantitatively, agents with negative net asset position benefit from this policy, while welfare decreases for most current savers. Notice that the more scarce is capital in the economy the larger are the effects of openness of capital markets on welfare. For some households, the effects are sizeable. For a country with the observed average capital to output ratio (roughly 1.5), the welfare gains for some households with negative asset position can reach about 15 percent of their baseline consumption. While 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.
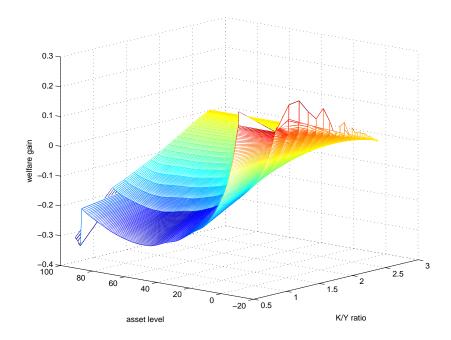

Figure 2: Distribution of welfare gains per capital to output ratio.

Figure 3 displays the average welfare measure[19] (green line) of an economy that

for a model with natural borrowing limit. Therefore, for the sake of space we do not report that figure here.

[18]We use the shocks and the net worth of each agent in the period before the policy change.

[19]We assume a benevolent planner who assign equal weight to each agent:

$$(1 + \mu)^{1-\sigma} \int v^{Close}(\lambda) d\lambda - \int v^{Lib}(\lambda) d\lambda = 0.$$
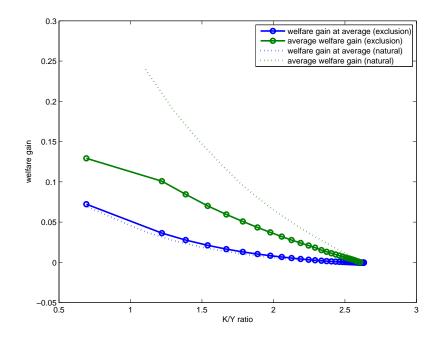
switches from financial autarky to perfect capital mobility for each level of capital scarcity. In the endogenous borrowing constraint model, the average welfare gain of a country with the observed mean of the capital to output ratio is about 7.5 percent of consumption equivalent of the baseline level. This is about 5 times larger than the welfare gains of the same policy in a deterministic version of the neoclassical growth model. In addition, for the average welfare gain to exceed 2 percent of the baseline consumption, the capital to output ratio should be lower than 2.2, 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. Similar results are found when the natural borrowing constraint is in effect. For this case, we have that for countries with the average capital to output ratio of emerging market economies, the average welfare benefits of financial capital openness are about 10 times larger than in the deterministic case.[20]

Figure 3 also reports the welfare gains of households with the average level of asset value. Welfare gains at the average asset value are lower than the average welfare gains, but they are still positive and are larger than the aggregate welfare gains of financial openness for economies without idiosyncratic shocks on labor productivity. Observe that the welfare benefits of financial integration for households with the average asset position are similar in the model where the penalty for default is the intertemporal trade exclusion or when the borrowing constraint is defined by the natural borrowing limit.

Finally, Figure 4 displays the average welfare gain of net savers and net borrowers per different levels of the capital to output ratio. As shown in Figure 2, depending on the net asset position, households might incur in welfare losses or gains when the countries open their financial capital markets. In the model with the endogenous

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For a similar approach see also Mendoza, Quadrini, and Ríos-Rull (2007).

[20]Even though there is less borrowing in the natural limit, average welfare is still larger than in the endogenous borrowing limit. The difference might be explained on how financial liberalization relaxes borrowing constraints in the two cases.
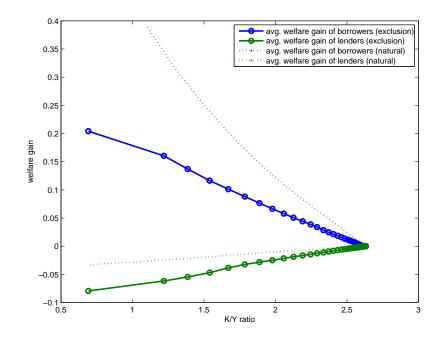
Figure 3: Green line: Average welfare gain versus capital to output ratio; blue line: Welfare gain of households with the average asset value versus capital to output ratio. Solid line: Model with endogenous borrowing limit; dotted line: Model with natural borrowing limit.

borrowing constraint, at the average level of the capital to output ratio, current savers on average have a loss in welfare of about 5 percent of their consumption equivalent of the baseline level, while current borrowers have an average welfare gain of about 12 percent. When we use the natural borrowing limit lenders in an economy with the average capital to output ratio loose a bit less (roughly 2 percent — instead of 5 — of their baseline consumption) than in the model with endogenous borrowing limit. However, for borrowers at the average capital to output ratio the welfare gains of capital market openness are about twice that observed in the model with the intertemporal exclusion restriction.

3.2.3 Risk aversion coefficient sensitivity

Calibration: As a robustness exercise, we decrease the elasticity of intertemporal substitution (increased the coefficient of relative risk aversion), by assuming that σ
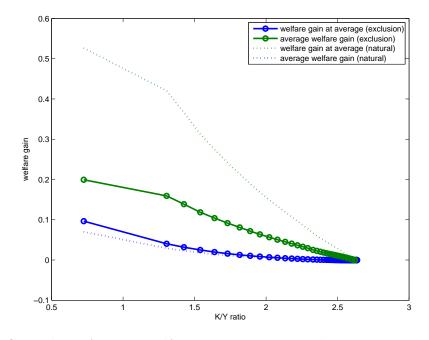
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Figure 4: Green line: Average welfare gain of savers versus capital to output ratio; blue line: Average welfare gain of borrowers versus capital to output ratio. Solid line: Model with endogenous borrowing limit; dotted line: Model with natural borrowing limit.

is equal to 2 instead of 1.[21] We also choose the subjective discount factor β such that the capital to output ratio is similar to the one in the model with log utility, 2.63. We accomplish this by setting $\beta = 0.9715$ in the deterministic model, and for the models with uninsurable shocks on labor productivity the values are $\beta = 0.93$ and $\beta = 9214$, when the borrowing constraint is the endogenous and the natural one, respectively. The other parameters are identical to those reported in Table 1.

From Table 2 we observe that the model produces lower inequality than in the data, but they do a better job on the lower tail of the wealth distribution. Figure 1 shows that in the deterministic model welfare gains from international financial integration is monotonically higher when the coefficient of relative risk aversion is

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[21]Gourinchas and Jeanne (2006) also do some sensitivity analysis with respect to the elasticity of intertemporal substitution (EIS). 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 inter-temporal substitution (EIS), where $\sigma = \frac{1}{EIS}$. In addition, there is a large literature on empirical estimates of the EIS and a large range of estimates. The point is that individual data estimates tend to be higher (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.

equal to 2 instead of 1.[22] The farther the economy is from its long run equilibrium, the larger is the difference in welfare gains of the two economies. A higher coefficient of relative risk aversion implies that households value more consumption smoothing and capital market openness allows households to borrow such that consumption jumps from its initial level to its long run value. With $\sigma = 2$, at the observed average capital to output ratio the welfare gain of switching from complete financial autarky to perfect capital mobility is roughly 1.65 percent of consumption equivalent to its baseline value, instead of 1.2 as in the economy in which $\sigma = 1$.

Figure 5: Green line: Average welfare gain versus capital to output ratio; blue line: Welfare gain of households with the average asset value versus capital to output ratio. Solid line: Model with endogenous borrowing limit; dotted line: Model with natural borrowing limit.

When we introduce uninsurable shocks on labor productivity, then the quantitative effects change substantially from those when the coefficient of relative risk aversion is equal to 2 instead of 1. A large σ implies that agents value more consumption smoothing and a lower interest rate makes borrowing costs and consumption

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[22]When we just modify σ, but keep the same value of β as in the first calibration, then (as in Gourinchas and Jeanne (2006)) the welfare does not change monotonically. See appendix A.

smoothing less costly, especially for those at the lower tail of the wealth distribution. A lower interest rate also relaxes borrowing constraints, increasing welfare. Figure 5 reports the average welfare impacts of capital market liberalization per level of the capital to output ratio when $\sigma = 2$. When the penalty for default is the permanent exclusion from intertemporal trade, the average welfare gain is about 12 percent of consumption equivalent of the baseline level for a country with the observed mean of the capital to output ratio. This is about 60 percent larger than when the coefficient of relative risk aversion is equal to 1. Moreover, for the average welfare gain to exceed 2 percent the capital to output ratio has to be smaller than 2.38 only. Similar quantitative differences are also observed for the model with natural borrowing constraints when we compare results with the lower and the higher coefficient of relative risk aversion. More specifically, when $\sigma = 2$ average welfare gains for each level of the capital to output ratio are about 1.6 times higher than when $\sigma = 1$.

The distribution of the average welfare gains among lenders and borrowers looks similar to those of Figure 4. There are only shifts in the numbers of welfare benefits of capital market liberalization.[23] For instance, when there are endogenous borrowing constraints, at the average capital to output ratio the average welfare gain of capital market openness for borrowers is about 20 percent of the baseline consumption, while when σ was equal to 1 it was about 12 percent. There is a smaller welfare loss for lenders when $\sigma = 2$ than when it is equal to 1. This is because households value more consumption smoothing when σ increases and there is a positive probability that lenders might have to resort on borrowing (due to bad shocks on productivity) to smooth consumption. This compensates, in terms of welfare, the decrease in interest income.

From the exercises above we can learn two important lessons: (i) When households face idiosyncratic shocks on their labor productivity, international financial integration decreases the cost of borrowing, improving therefore the ability of house-
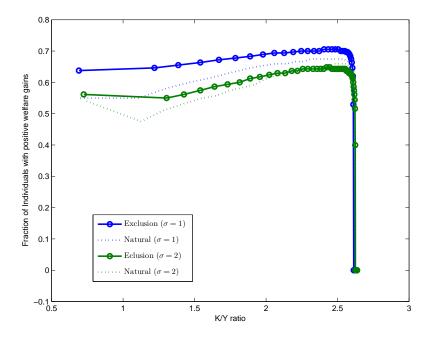
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[23]For the sake of space, we do not report that graph here.

holds to insure against such shocks. In our calculations, comparing to the model that abstracts from uninsurable productivity shock, the average welfare gains can increase by, at least, a factor of 5; and (ii) the average welfare measure hides important distributional effects: while there are some losses among net savers, there are gains among borrowers. International financial integration benefits mainly the poor. However, would the pivotal voter benefit from such a reform on the capital market?

3.3   The political economy of capital market openness

In this subsection we analyze, based on the previous results, the political economy of international financial integration. Figure 6 reports the fraction of individuals that benefit from a policy that switches the capital market from being close to open. The fraction of agents that benefit from international financial integration corresponds to: (i) agents with negative wealth; and (ii) agents with positive wealth, but in which the gains of a lower borrowing cost[24] compensate the welfare losses of lower interest income. Notice that the closer the economy is from its long run equilibrium (higher capital to output ratio), the lower will be the loss in interest income due to capital market openness. This explains why the fraction of individuals that benefits from capital market openness increases with the capital to output ratio. Observe that when the coefficient of relative risk aversion is equal to one, then for an economy with the observed average level of capital to output ratio, the model with endogenous (natural) borrowing limit implies that about 65 (57) percent of individuals would benefit from a policy that switches the economy from complete financial autarky to perfect capital mobility. When the coefficient of relative risk aversion is equal to two, then the faction of agents that benefits from the reform decreases, but it is still larger than 50 percent. It is about 54 (52) percent for the model with endogenous

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[24]All agents have a positive probability of facing persistent negative shocks (including those with positive net wealth) on their productivity and therefore might have to rely on borrowing to smooth consumption.

(natural) borrowing limit.

Figure 6: Blue lines: Fraction of agents that benefit from international financial integration versus capital to output ratio, coefficient of relative risk aversion equal to one. Green lines: Fraction of agents that benefit from international financial integration versus capital to output ratio, coefficient of relative risk aversion equal to two. Solid lines: Model with endogenous borrowing limit; dotted lines: Model with natural borrowing limit.

Given our calibration, the median agent is therefore in favor of a reform that integrates a close financial economy to the international capital market. Consequently, if the political power depends on the vote of the median agent, then countries would implement such a reform. However, if the political power is unequal and its concentration depends on wealth (as argued by Engerman and Sokoloff (2005) and others), then financial integration will not occur and will be less likely the farther the economy is from its long run equilibrium. Therefore, if in our model economy the pivotal agent is an individual with some rank μ^* of wealth (see, for instance, Bénabou (1996)), which is not necessarily equal to the median ($\mu = 0.5$) agent, then as capital accumulates, political power might change hands and the reform that opens the capital market might be implemented. Notice that the reform is less likely the higher is the coefficient of relative risk aversion.

4 Concluding remarks

This paper investigates the welfare effects of financial liberalization on developing economies. We use a standard neoclassical growth model with incomplete markets and two types of borrowing constraints (endogenous and natural limits). We show that the introduction of uninsurable idiosyncratic risks on labor productivity boosts aggregate welfare effects. For an economy with the average capital to output ratio, welfare increases by at least a factor of 5 compared to the complete markets Arrow-Debreu economy.

For capital scarce economies, the openness of the capital market decreases borrowing costs and loosens borrowing limits with positive effects on the welfare of borrowers. Lenders can also benefit of such reform, since they might face persistent bad shocks on their labor productivity. However, interest income decreases affecting negatively lenders welfare. Therefore, the average welfare gain hides important distributional implications. We show that, in general, the median agent is in favor of international financial integration, but if wealth positively affects the pivotal voter such reform might not be implemented, since richer agents have a vested interest on capital market closeness.

We believe that our results contribute to the existing literature on the welfare effects of international financial integration. Further studies should also consider the effects of capital market openness when institutions differ across countries. In our model countries are similar with respect to their institutional quality, but capital would flow in to capital scarce countries only if there is sufficient creditor protection in these countries. For instance, low enforcement of financial contracts depresses the capital market, making borrowing constraint tighter and lowering the interest rate (e.g., Antunes, Cavalcanti, and Villamil (2008)). Therefore, capital market openness in economies with poor institutional quality may induce capital to flow out of developing countries. It will be important to investigate the tradeoff between institutional quality and capital scarcity in the analysis of the welfare effects of

international financial integration, but this is clearly not the go of this article.

A policy implication of our analysis is related to the optimal capital structure during capital market liberalization. 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 on the interest rate, hurting therefore poor agents that have a large wage/wealth ratio. Greulich and Marcet (2008) show in a standard growth model with heterogeneous agents 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 not only on the long run but also on the short run. We leave these issues for future research.

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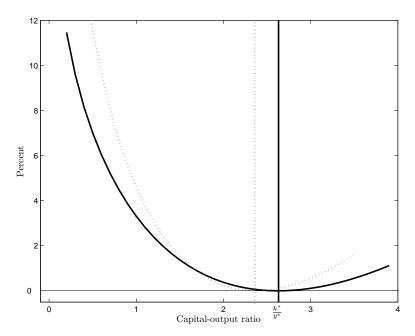
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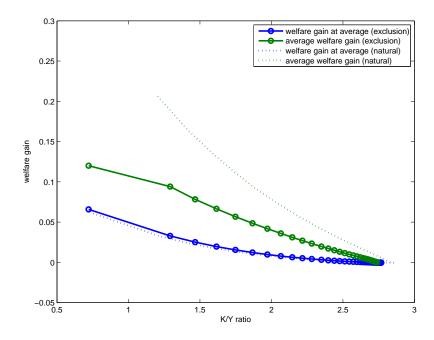WRIGHT, M. L. J. (2005): "On the Gains from International Financial Integration," *Economics Letters*, 87(3), 379–386.

A   Similar β

In this appendix, we consider the welfare implications of capital market liberalization when all parameters (including β) are identical to the calibration reported by Gourinchas and Jeanne (2006), except for the introduction of labor productivity shocks. First, let's investigate the effects in the deterministic version of the model. Notice in Figure 7 that when σ increases but we do not adjust β, then the long run level of the capital to output ratio decreases from 2.63 to 2.34. Observe that now the welfare does not change monotonically for this case, when we compare the two economies with different levels of relative risk aversion. However, for a higher σ the farther the economy is from its long run equilibrium, the larger are the welfare effects compared for an economy with a smaller σ. For the gain from integration

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to exceed 2 percent of annual per capita consumption, the capital to output ratio must fall bellow 1.4 instead of 1.26. At the average observed level of the capital to output ratio, the welfare gains are roughly the same in the two economies.

For the economy with uninsurable idiosyncratic risks on labor productivity, the average welfare gains of financial liberalization for countries with the observed mean of the capital to output ratio are about 8 percent and 14 percent of consumption equivalent for an endogenous and a natural borrowing constraint, respectively. For the average welfare to exceed 2 percent of consumption equivalent to the baseline consumption, the capital to output ratio has to be lower than 2.57 and 2.6 for the economy with endogenous and natural borrowing limits, respectively. These numbers are quantitatively of the same order of magnitude of those in the calibration where we changed the value of β to match the capital to output ratio of the deterministic case. Figure 9 produces results similar to those reported in Figure 4. Therefore, our results on section 3.2.2 are not driven by changing the subjective discount factor.

Figure 7: Welfare gains from international financial integration and the capital to output ratio. The welfare measure corresponds to the equivalent variation. Solid black line: $\sigma = 1$. Dotted gray line: $\sigma = 2$.

Figure 8: Green line: Average welfare gain versus capital to output ratio; blue line: Welfare gain of households with the average asset value versus capital to output ratio. Solid line: Model with endogenous borrowing limit; dotted line: Model with natural borrowing limit.

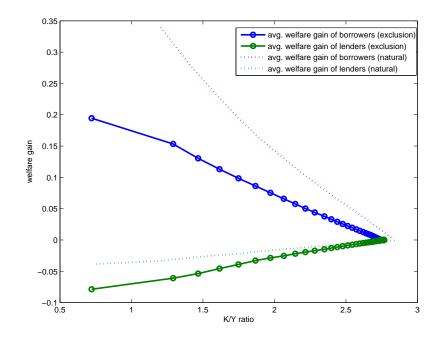# B   The role of relaxing borrowing constraints

In this appendix, we investigate the role of borrowing constrains in the welfare effects of international financial integration. We consider an *ad-hoc* borrowing constraint, such that when a capital-scarce economy opens its capital market, capital flows in decreasing the interest rate, but now borrowing constraints are not affected. We assume that the *ad-hoc* borrowing limit is similar to the initial borrowing limit of the baseline economy studied in subsection 3.1.[25] We have two cases for the initial borrowing limit: the exclusion an the natural borrowing limits.[26] In the long run, there is less borrowing and inequality in this model (see Table 3).[27]

The left panel of Figure 10 provides the average welfare gain of international

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[25]Since results do not change much, we do not provide for this case simulations for the economy with a large coefficient of relative risk aversion, $\sigma = 2$.

[26]In order to have the same capital to output ratio, we have to decrease the discount factor β. When the initial borrowing limit is given by the exclusion restriction, we have that β decreases from 0.954 to 0.9527.

[27]Compare the economies in Table 3 with the economies in Table 2 part I.
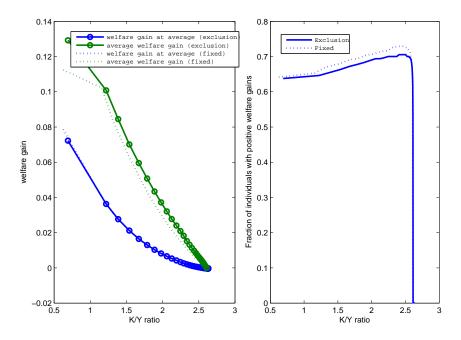
Figure 9: Green line: Average welfare gain of savers versus capital to output ratio; blue line: Average welfare gain of borrowers versus capital to output ratio. Solid line: Model with endogenous borrowing limit; dotted line: Model with natural borrowing limit.

financial integration under fixed borrowing constraint, but when the initial borrowing limit is determined by the exclusion restriction. We can observe that the average welfare gain is lower than in the case of the endogenous borrowing limit, but the difference is small. At the average capital to output ratio of emerging market economies, the average welfare gain is now roughly 7 percent (instead of 7.5 percent). Observe in the right panel of Figure 10 that the fraction of agents that benefits from this policy increases.
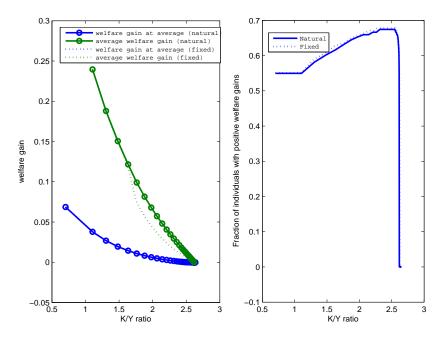
Figure 11 is similar to Figure 10, the only difference being the initial borrowing constraint, which is determined by the natural borrowing limit. Observe again the small difference in welfare gains of international financial integration of the simulations with an *ad-hoc* borrowing limit and a limit that changes with the policy reform. Therefore, we can conclude from these exercises that the welfare effects of openness of the capital market are driven mostly by the incompleteness of the financial market, since agents cannot insure against idiosyncratic risk on labor productivity.

Table 3: Selected statistics: US data and benchmark. Data for the US economy are from Castañeda, Díaz-Giménez, and Ríos-Rull (2003)

| | Capital-output ratio | Wealth Gini (%) | Income Gini (%) | Percentage wealth | | | | |
| | | | | in the top | | | in the bottom | |
				1%	5%	10%	20%	60%
US data	3.0	78	63	29.6	54.0	66	-0.39	7.1
$\sigma = 1$								
Deterministic model	2.63							
Model with idiosyncratic shocks (Endogenous)	2.63	89	44	14	47	73	-7	-9
Model with idiosyncratic shocks (Natural)	2.63	85	44	12	41	64	-8	-13

Figure 10: Left panel: Green line: Average welfare gain versus capital to output ratio; blue line: Welfare gain of households with the average asset value versus capital to output ratio. Right Panel: Fraction of agents that benefits from international financial integration versus capital to output ratio. Solid line: Model with endogenous borrowing limit; dotted line: Model with *ad-hoc* borrowing limit.

Figure 11: Left panel: Green line: Average welfare gain versus capital to output ratio; blue line: Welfare gain of households with the average asset value versus capital to output ratio. Right Panel: Fraction of agents that benefits from international financial integration versus capital to output ratio. Solid line: Model with natural borrowing limit; dotted line: Model with *ad-hoc* borrowing limit.