On the Welfare Implications of Financial Globalization without Financial Development*

Enrique G. Mendoza
University of Maryland, IMF and NBER

Vincenzo Quadrini
University of Southern California, CEPR and NBER

José-Víctor Ríos-Rull
University of Pennsylvania, CAERP, CEPR and NBER

June 9, 2007

Abstract

It is widely argued that countries can reap large gains from liberalizing their capital accounts if financial globalization is accompanied by the development of domestic institutions and financial markets. However, if liberalization does not lead to financial development, globalization can result in adverse effects on social welfare and the distribution of wealth. We use a multi-country model with non-insurable idiosyncratic risk to show that, if countries differ in the degree of asset market incompleteness, financial globalization hurts the poor in countries with less developed financial markets. This is because in these countries liberalization leads to an increase in the cost of borrowing, which is harmful for the poor because they have larger liabilities relatively to their assets. The quantitative analysis shows that the welfare effects are sizable and can justify policy intervention.

*This paper was prepared for the NBER's International Seminar on Macroeconomics (ISOM), Istanbul, June 15-16, 2007.

> "*...much of the Mexican banking system is now controlled by foreigners,... However, this influx of foreign capital has not led to cheaper banking. Fees remain high, producing bumper profits. Credit-card interest rates average over 30%... Banking in Mexico remains very profitable for banks, and intimidatingly expensive for the country's poor.*".
>
> *The Economist*, Nov. 25, 2006

1 Introduction

The question of whether financial globalization is beneficial for the participating countries is the subject of a profound and divisive debate in academic and policy circles. Critics like Stiglitz (2002), Soros (2002), and Bhagwati (2004) offer ominous assessments arguing that financial globalization at best has failed to produce the large benefits it promised and at worst is a flawed policy leading to economic collapses. On the other hand, supporters like Mishkin (2006), Rajan & Zingales (2003), Frankel (2007), and Obstfeld & Taylor (2004), make a strong case in defense of financial globalization. Their case is founded not just on traditional theoretical arguments highlighting the gains from global asset trading (international risk sharing, efficient reallocation of capital, etc.) but on acknowledging that financial globalization by itself is unlikely to do much good. They argue that the development of domestic financial systems—and the social, political and economic institutions that anchor them—is a necessary condition for countries to reap the potential benefits from financial globalization. This argument raises key unanswered questions: What are the implications of going forward with financial globalization if this does not create the conditions for financial convergence? Does this neutralize the gains from globalization without further implications or are there adverse consequences? In the case of adverse consequences, are those limited to the risk of financial crashes or "Sudden Stops", or are there systemic negative effects? How large are these effects and can economic policy mitigate them?

This paper aims to answer these questions by studying the effects of financial integration amongst countries that differ in the degree of domestic financial development. We formalize cross-country differences in financial development through the tightness of borrowing constraints in a multi-country, general equilibrium model with heterogenous agents and incomplete asset markets. We show that, if financial globalization is not accompanied by do-

mestic financial development, liberalization can have sizable consequences on the distribution of wealth and adverse welfare effects on some of the participating countries. In particular, we show that, even though liberalization leads to a significant increase in wealth inequality in the most financially developed country, the *aggregate* welfare consequences are still positive for this country. By contrast, in the less financially developed country, the *aggregate* welfare consequences are negative even though the wealth distribution does not change much. The welfare effects we estimate dwarf the small gains from international asset trading in open economy real-business-cycle models (see, for example, Backus, Kehoe, & Kydland (1992), and Mendoza (1991)), and they are comparable to existing measures of the welfare gains obtained by removing distortions on capital accumulation in open economies (e.g. Gourinchas & Jeanne (2006), Mendoza & Tesar (1998) and Quadrini (2005)). Moreover, these adverse effects arise with the gradual buildup of large global financial imbalances but without the occurrence of financial crises.

The analysis conducted in this paper is motivated by some of the findings from our previous work (see Mendoza, Quadrini, & Ríos-Rull (2007), MQR henceforth). Although the primary goal of that study was to investigate the emergence of global imbalances, we also found that financial integration could result in aggregate welfare costs for less financially developed countries. This suggestion was based on the quantitative predictions of a multi-country model where agents face non-insurable idiosyncratic shocks to endowments and risky investments, and where market incompleteness results from limited enforcement of credit contracts. This model was able to explain two key features of the global imbalances that started to emerged in the early 1980s, with the gradual process of financial globalization: (a) a secular decline in the net foreign asset position of the United States, which reached -8 percent of world GDP in 2006, and (b) a shift in the composition of the U.S. external asset portfolio featuring a large negative position on risk-free bonds and a positive position in risky assets.

In this paper, we use a model with some of the characteristics of the MQR setup but with modifications that sharpen the focus of the analysis on the consequences of financial integration for the distribution of wealth within countries and for social welfare across individuals and nations. On one hand, we simplify the MQR model by abstracting from shocks to risky 'investment' and consider only idiosyncratic shocks to 'earnings'. Investment shocks are important for capturing the portfolio composition of foreign asset holdings—which was one of the focus of our previous paper—but they

are not crucial for the welfare implications of capital markets liberalization. We further simplify the model by assuming the absence of state-contingent claims. Cross-country differences in financial markets derive from differences in borrowing constraints. In the previous paper, instead, differences in financial markets were derived endogenously through limited enforcement of financial contracts. On the other hand, we extend the MQR setup by introducing the accumulation of physical capital. This allows us to combine the analysis of the distributional effects of globalization with the traditional analysis of efficiency gains from capital reallocation.

The paper is organized as follows. Section 2 describes the model and defines equilibria under financial autarky and under global financial integration. Section 2.2 provides an intuitive characterization of the two equilibria and the implications of moving from financial autarky to financial globalization. Section 3 presents the quantitative results, with particular focus on the model's normative implications. Section 4 conducts a sensitivity analysis. Section 5 examines some policy implications and Section 6 concludes.

2 The model

Consider a world economy composed of I countries, indexed by i, all with identical characteristics except for the level of domestic financial development (or the deepness of domestic financial markets). Financial development is captured by a parameter $\underline{a}^i$ as specified below. In the quantitative exercise conducted in the next section, we also allow for heterogeneity in population and productivity to match the relative sizes of countries in the model with those in the real world. However, differences in population and productivity act only as re-scaling factors in the derivation of the equilibrium conditions with capital mobility and they are not relevant for the qualitative theory of the paper. Therefore, throughout this section, we present the model assuming that countries differ only in $\underline{a}^i$.

Each country is populated by a continuum of agents of total mass 1, and each agent maximizes expected lifetime utility $E\sum_{t=0}^{\infty}\beta^t U(c_t)$, where c_t is consumption at time t and β is the intertemporal discount factor. The utility function is strictly increasing and concave with $U(0)=-\infty$ and $U'''(c)>0$.

Agents are endowed with efficiency units of labor ε_t that they supply inelastically to the domestic labor market for the competitive wage w_t. The efficiency units of labor change stochastically according to a discrete Markov process which is independent across agents, *i.e.*, the shock is idiosyncratic.

There are no aggregate shocks, and therefore, the issue of cross-country risk-sharing, like in Clarida (1990), is not an issue here.

Each agent has the ability to operate the production technology $y_t = A(k_t^\theta l_t^{1-\theta})^\nu$, where k_t is the input of capital, l_t is the efficiency units of labor employed in production (i.e., an individual agent's labor demand) and A is the Total Factor Productivity which is constant. We assume that $0 < \nu < 1$ so that there are decreasing returns to scale in production. Capital depreciates at rate δ. For analytical convenience we define $F(k_t, l_t) = (1 - \delta)k_t + A(k_t^\theta l_t^{1-\theta})^\nu$ which represents the sum of output plus the capital stock net of depreciation.

The assumption that the production technology is individually operated and displays decreasing returns is not standard in heterogenous-agents models with idiosyncratic risks. This assumption allows us to distinguish physical capital from bonds for an individual agent and obtain a well-defined portfolio choice between these two assets. However, because there is no uncertainty in production, the aggregate properties of the model are similar to the standard model with an aggregate constant-returns-to-scale production function.

We also assume that there is a cost in changing the stock of capital. The role of this adjustment cost is to make the cross-country reallocation of physical capital sluggish.[1] This reflects the fact that financial capital is more mobile than physical capital. However, as we will show in the sensitivity analysis, the adjustment cost is not important for the welfare results of the paper. The adjustment cost takes the form $\varphi(K_t, k_{t+1}) = \phi \cdot (k_{t+1}/K_t - 1)^2$, where k_{t+1} is the individually-chosen input of capital for the next period and K_t is the 'aggregate' stock of capital in the current period. The assumption that the individual adjustment cost depends on the *aggregate* capital stock at t, instead of the *individual* capital at t, makes the formulation of the agent's problem simpler because we do not need to add k_t as an individual state variable. However, we will show in the sensitivity analysis that the use of the more standard adjustment cost, $\varphi(k_t, k_{t+1}) = \phi \cdot (k_{t+1}/k_t - 1)^2$, leads to very similar results.

In addition to capital, agents can trade non-state-contingent assets or bonds, b_{t+1}. The market interest rate on these bonds is r_t^i. Define a_t as the

[1] This assumption is typical in international real-business-cycle models and is used there for the same reason, that is, to make the reallocation of capital sluggish.

end-of-period net worth before consumption. The budget constraint is:

$$a_t = c_t + \varphi(K_t, k_{t+1}) + k_{t+1} + \frac{b_{t+1}}{1 + r_t} \tag{1}$$

Net worth evolves according to:

$$a_{t+1} = \varepsilon_{t+1} w_{t+1} + F(k_{t+1}, l_{t+1}) - l_{t+1} w_{t+1} + b_{t+1} \tag{2}$$

Thus, net worth is the sum of labor income, the value of operating the production technology, net of wage payments, and bonds.

The degree of domestic financial development is captured by a limited liability constraint requiring net worth not to be smaller than a minimum value $\underline{a}^i$, that is,

$$a_{t+1} \geq \underline{a}^i \tag{3}$$

This constraint imposes a borrowing limit: the lower is the value of $\underline{a}^i$, the higher is the agents' ability to borrow.[2] The lower bound $\underline{a}^i$ is the only *exogenous* difference among countries.

2.1 Optimization problem and equilibrium

Let $\{r^i_\tau, w^i_{\tau+1}\}_{\tau=t}^{\infty}$ be a (deterministic) sequence of prices in country i. A single agent's optimization problem can be written as:

$$V^i_t(\varepsilon_t, a_t) = \max_{c_t, b_{t+1}, k_{t+1}, l_{t+1}} \left\{ U(c_t) + \beta \sum_{\varepsilon_{t+1}} V^i_{t+1}\Big(\varepsilon_{t+1}, a_{t+1}\Big) g(\varepsilon_t, \varepsilon_{t+1}) \right\} \tag{4}$$

subject to (1), (2), (3)

[2]The asset market structure and the treatment of financial heterogeneity in this model are less general than the ones in the MQR setup. In MQR we allow for a full set of state-contingent assets which are constrained by an enforcement constraint. Here, instead, we allow only for non-state-contingent assets. With shocks to earnings only, the two market structures lead to similar results. With investment shocks, however, the different market structures have different implications for the composition of portfolio. Because in this paper we abstract from investment shocks, we decided to adopt the simpler specification.

Notice that this is the optimization problem for any deterministic sequence of prices, not only steady states. This motivates the time subscript in the value function.

The solution to the agent's problem provides the decision rules for consumption, $c_t^i(\varepsilon, a)$, bonds $b_{t+1}^i(\varepsilon, a)$, productive assets, $k_{t+1}^i(\varepsilon, a)$ and labor $l_{t+1}^i(\varepsilon, a)$. These rules determine the evolution of the distribution of agents over ε and a, which we denote by $M_t^i(\varepsilon, a)$. The definition of equilibria with and without international mobility of capital are as follows:

Definition 1 (Autarky) *Given the level of financial development, $\underline{a}^i$, initial aggregate capital, K_t^i, and distributions, $M_t^i(\varepsilon, a)$, for $i \in \{1, .., I\}$, a general equilibrium without mobility of capital is defined by sequences of: (a) agents' policies $\{c_\tau^i(\varepsilon, a), b_{\tau+1}^i(\varepsilon, a), k_{\tau+1}^i(\varepsilon, a), l_{\tau+1}^i(\varepsilon, a)\}_{\tau=t}^\infty$; (b) value functions $\{V_\tau^i(\varepsilon, a)\}_{\tau=t}^\infty$; (c) prices $\{r_\tau^i, w_{\tau+1}^i\}_{\tau=t}^\infty$; (d) aggregate capital $\{K_{\tau+1}^i\}_{\tau=t}^\infty$; (e) distributions $\{M_\tau^i(\varepsilon, a)\}_{\tau=t+1}^\infty$. Such that: (i) the agents' policies solve problem (4); (ii) the markets for assets clear, $\int_{\varepsilon,a} k_{\tau+1}^i(\varepsilon, a) M_\tau^i(\varepsilon, a) = K_{\tau+1}^i$, $\int_{\varepsilon,a} b_{\tau+1}^i(\varepsilon, a) M_\tau^i(\varepsilon, a) = 0$, for all $\tau \geq t$ and $i \in \{1, .., I\}$; (iii) the labor market clears $\int_{\varepsilon,a} l_{\tau+1}^i(\varepsilon, a) M_\tau^i(\varepsilon, a) = 1$, for all $\tau \geq t$ and $i \in \{1, .., I\}$; (iv) the sequence of distributions is consistent with the initial distribution, the individual policies and the idiosyncratic shocks.*

Definition 2 (Financial integration) *Given the level of financial development, $\underline{a}^i$, initial aggregate capital, K_t^i, and distributions, $M_t^i(\varepsilon, a)$, for $i \in \{1, .., I\}$, a general equilibrium with mobility of capital is defined by sequences of: (a) agents' policies $\{c_\tau^i(\varepsilon, a), b_{\tau+1}^i(\varepsilon, a), k_{\tau+1}^i(\varepsilon, a), l_{\tau+1}^i(\varepsilon, a)\}_{\tau=t}^\infty$; (b) value functions $\{V_\tau^i(\varepsilon, a)\}_{\tau=t}^\infty$; (c) prices $\{r_\tau^i, w_{\tau+1}^i\}_{\tau=t}^\infty$; (d) aggregate capital $\{K_{\tau+1}^i\}_{\tau=t}^\infty$; (e) distributions $\{M_\tau^i(\varepsilon, a)\}_{\tau=t+1}^\infty$. Such that: (i) agents' policies solve problem (4); (ii) the asset markets clear, $\int_{\varepsilon,a} k_{\tau+1}^i(\varepsilon, a) M_\tau^i(\varepsilon, a) = K_{\tau+1}^i$ for all $\tau \geq t$, $i \in \{1, .., I\}$, and $\sum_i \int_{\varepsilon,a} b_{\tau+1}^i(\varepsilon, a) M_\tau^i(\varepsilon, a) = 0$, for all $\tau \geq t$, and interest rates are equalized across countries, $r_\tau^i = r_\tau$ for all $\tau \geq t$ and $i \in \{1, .., I\}$; (iii) the labor markets clear $\int_{\varepsilon,a} l_{\tau+1}^i(\varepsilon, a) M_\tau^i(\varepsilon, a) = 1$, for all $\tau \geq t$ and $i \in \{1, .., I\}$; (iv) the sequence of distributions is consistent with the initial distribution, individual policies and the idiosyncratic shocks.*

The only difference between the two definitions is that with financial integration there is a global market for bonds, and therefore, interest rates are equalized across countries (condition (ii)). This implies that countries may have nonzero foreign asset positions.

2.2 Characterization of the equilibrium

This section characterizes the properties of the equilibrium with and without international financial integration. To show the importance of financial development, we compare the equilibrium of the economy with that of an alternative economy where asset markets are complete. This alternative economy would feature trade in a full set of claims that are contingent on the realization of the idiosyncratic shock. First we look at the autarky regime and then the regime with financial integration. In both cases we will contrast the complete-markets setup with the environment where markets are incomplete.

Consider first the economy with complete markets in financial autarky. In this case, agents choose contingent claims $b(\varepsilon_{t+1})$, physical capital k_{t+1} and labor l_{t+1}. The first-order conditions are:

$$U'(c_t) = (1+r_t)\beta\Big[U'(c(\varepsilon_{t+1})) + \lambda(\varepsilon_{t+1})\Big], \qquad \forall\, \varepsilon_{t+1} \tag{5}$$

$$U'(c_t) = \frac{F_k(k_{t+1}, l_{t+1})}{1+\varphi_k(K_t, k_{t+1})}\beta E\Big[U'(c(\varepsilon_{t+1})) + \lambda(\varepsilon_{t+1})\Big] \tag{6}$$

$$F_l(k_{t+1}, l_{t+1}) = w_{t+1} \tag{7}$$

where $\lambda(\varepsilon_{t+1})$ is the lagrange multiplier associated with the limited liability constraint (3).

The first condition holds for any realization of ε_{t+1}, which implies that next period consumption, $c(\varepsilon_{t+1})$, must be the same for all ε_{t+1} (full insurance). The first two conditions imply together that $F_k(k_{t+1}, l_{t+1})/[1 + \varphi_k(K_t, k_{t+1})] = 1 + r_t$, that is, the marginal return from the productive asset (net of the adjustment cost) is equal to the interest rate. Together with condition (7), this implies that all agents choose the same inputs of capital and labor.

The following lemma establishes that the condition $\beta(1+r) = 1$ holds in the steady state equilibrium with complete markets.

Lemma 1 *Consider the autarky regime and assume that there are complete markets. Then the steady state interest rate satisfies* $r = 1/\beta - 1$.

Proof 1 *If* $\beta(1+r) = 1$ *is not satisfied, condition (5) implies that the consumption growth of all agents will be either positive or negative. This cannot be a steady state because aggregate consumption is not constant. Q.E.D.*

Consider now the economy with incomplete markets, where only non-state contingent claims are traded. The first-order conditions are:

$$U'(c_t) = \beta(1+r_t)E\Big[U'(c(\varepsilon_{t+1})) + \lambda(\varepsilon_{t+1})\Big] \tag{8}$$

$$U'(c_t) = \frac{F_k(k_{t+1}, l_{t+1})}{1+\varphi_k(K_t, k_{t+1})}\beta E\Big[U'(c(\varepsilon_{t+1})) + \lambda(\varepsilon_{t+1})\Big] \tag{9}$$

$$F_l(K_t; k_{t+1}, l_{t+1}) = w_{t+1} \tag{10}$$

In this case we obtain again that $F_k(k_{t+1}, l_{t+1})/[1+\varphi_k(K_t, k_{t+1})] = 1+r_t$ and the allocations of production inputs are the same for all agents. Individual consumption, however, is not constant but depends on the realization of the efficiency units of labor. This is akin to the typical Bewley (1986) economy with uninsurable risks and aggregate production. Because all agents use the same production inputs, they get the same investment income. As it is known from the savings literature (see Huggett (1993), Aiyagari (1994) and Carroll (1997)), the uninsurability of the idiosyncratic risk generates precautionary savings and in the steady state $\beta(1+r) < 1$.

Lemma 2 *Consider the autarky regime and assume that only non-contingent bonds are traded. Then the interest rate satisfies* $r_t < 1/\beta - 1$.

Proof 2 *Suppose that* $\beta(1+r_t) \geq 1$. *Because* $U'(.)$ *is convex, condition (5) implies that for all agents the expected next period consumption is bigger than current consumption. Therefore, next period aggregate consumption will be greater than today consumption, which cannot be a steady state equilibrium. Therefore,* $r_t < 1/\beta - 1$. *Q.E.D.*

Lemmas 1 and 2 establish that in autarky the economy with incomplete markets has a lower interest rate than the complete-markets economy, at least in the steady state. Suppose now that an economy with complete markets (country 1) becomes financially integrated with an incomplete-markets economy (country 2). The following proposition characterizes the steady state equilibrium with capital mobility.

Proposition 1 *Suppose that country 1 has complete markets while in country 2 markets are incomplete. In the steady state equilibrium with financial integration* $r < 1/\beta - 1$ *and country 1 accumulates a negative net foreign asset position.*

Proof 1 *Appendix A.*

The case of financial integration between a complete-markets economy and an incomplete- markets economy allowed us to establish analytical results. From these results we can infer the properties of the equilibrium when markets are incomplete in both countries and $\underline{a}^1 < \underline{a}^2$. In general, a higher value of $\underline{a}$ for a given country increases savings and thus reduces the equilibrium interest rate in the autarky regime. Figure 1 shows the equilibrium of the model under autarky and under financial integration. The figure plots the aggregate supply of savings in each country as an increasing, concave function of r.[3] Country 1 has deeper financial markets ($\underline{a}^1 < \underline{a}^2$), and hence lower supply of savings for each interest rate. Because the demand for productive capital, which is inversely related to the interest rate, is the same in the two countries, country 1 must have a higher autarky interest rate than country 2, that is, $r^1 > r^2$.

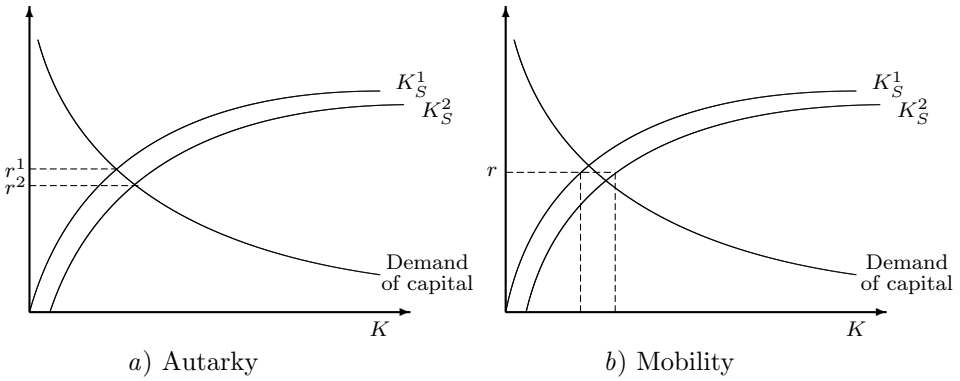


Figure 1: Steady state equilibria with heterogeneous financial conditions.

When the countries become financially integrated, the interest rates are equalized. Compared to autarky, the interest rate and the supply of savings

[3]The savings supply curves in Figure 1 correspond to the well-known aggregate savings curve from the closed-economy heterogenous agents literature (e.g. Aiyagari (1994)). Aggregate savings converge to infinity as the interest rate approaches the rate of time preference from below, because agents need an infinite amount of precautionary savings to attain a non-stochastic consumption profile. The demand of savings is downward sloping because of the diminishing marginal productivity of capital.

fall in country 1 and rise in country 2, and hence the country with deeper financial markets ends up with a negative foreign asset position. Moreover, the capital stock rises relative to its autarky level in country 1 and it falls in country 2. Thus, financial globalization leads capital to flow from the less financially developed country to the more financially developed country. Interestingly, this relocation of capital is akin to those driven by efficiency gains due to country-specific improvements in productivity or removal of distortions on capital accumulation, but here this is a by-product of global financial integration amongst countries that are identical except for $\underline{a}^1 < \underline{a}^2$.

3 Quantitative analysis

In this Section, we study the quantitative properties of the model in a two-country version calibrated to actual data. The first country is calibrated to represent the United States and the second the aggregate of all other OECD countries plus emerging economies.[4]

The two countries in the model are set to match differences in population size and productivity observed in the data (using data from the World Bank's *World Development Indicators*). The mass of agents in country 1 is 0.064, which is the actual US population share in the entire OECD and emerging economies, and hence the mass of agents in country 2 is 0.936. The productivity parameters A^1 and A^2 are chosen so that the per-capita GDP of the two countries in the steady state with capital mobility match the relative per-capita GDP of the United States vis-a-vis the aggregate of other OECD and emerging economies. In 2005 the per-capita GDP of this group of countries, compared to the US, was 0.152. In the model, the relative per-capita GDP of the two countries can be expressed as $y^1/y^2 = (A^1/A^2)^{1/(1-\theta\nu)}$. Hence, normalizing $A^1 = 1$, the two countries in the model match the relative per-capita GDP of the countries in the data by setting $A^2 = 0.152^{1-\theta\nu}$. Using the parameter values $\nu = 0.9$ and $\theta = 0.289$, as specified below, we get $A_2 = 0.248$. This calibration of population sizes and productivity pa-

[4]The emerging economies are Argentina, Brazil, Chile, China, Colombia, Costa Rica, Ecuador, Egypt, El Salvador, Hong Kong, India, Indonesia, Malaysia, Morocco, Nigeria, Pakistan, Peru, Philippines, Singapore, Sri Lanka, South Africa, Taiwan, Uruguay, and Venezuela. In general, these are the developing countries that today are most active in international financial markets. Because the OECD and the emerging economies represent a very large share of world output, the inclusion of all other countries would not make a big difference for the quantitative results.

rameters implies that the model matches the U.S. share of total GDP for the aggregate of OECD and emerging economies, which in 2005 was about 31 percent at current exchange rates. Notice that it is the share in total GDP that matters for the quantitative results. Whether the 31% share derives from differences in population size, productivity or both, is irrelevant for the economic consequences of liberalization.[5]

For the calibration of the production function, we first set the returns-to-scale coefficient to $\nu = 0.9$ and then we choose θ to match a capital income share of 0.36. Because the capital income share is $1 - \nu(1 - \theta) = 0.36$, this requires $\theta = 0.289$. The depreciation rate is set to $\delta = 0.06$ and the subjective discount factor is chosen to produce a capital-output ratio of 3 in the steady state with capital mobility. This requirement implies $\beta = 0.949$. We set the adjustment cost parameter to $\phi = 0.6$, which is the value that Kehoe & Perri (2002) obtained in order to match the observed cyclical variability of investment in industrial countries.[6] The coefficient of relative risk aversion parameter in the utility function is set to $\sigma = 2$.

The stochastic endowment of labor efficiency follows a two-state Markov process, $\varepsilon = \bar{\varepsilon}(1 \pm \Delta_\varepsilon)$, with symmetric transition probability matrix. We calibrate this process to match recent estimates of the U.S. earning process by setting the persistence probability to 0.975 and $\Delta_\varepsilon = 0.6$. These values imply that log-earnings display a first-order autocorrelation of 0.95 and a standard deviation of 0.3. This is in the range of values estimated by Storesletten, Telmer, & Yaron (2004).

The remaining parameters that need to be calibrated are the lower bounds for net worth, $\underline{a}^1$ and $\underline{a}^2$. These are set to replicate the volume of 'domestic credit to the private sector', in percentage of GDP, observed for the United States and the aggregate of other OECD and emerging economies. According to the World Bank's *World Development Indicators*, in 2005 this variable was

[5]With proper re-scaling of the limited liability constraints, $\underline{a}^i$, differences in population and productivity do not affect the autarky interest rates. The post-liberalization interest rate will be closer to the autarky interest rate of the country with the larger economy, independently of whether the bigger size derives from larger population of higher productivity.

[6]Capital adjustment costs are widely used in international RBC models but there is no consensus on the calibration strategy to parameterize them. For example, Baxter & Crucini (1993) calibrated the elasticity of investment relative to Tobin's q to match investment variability in industrial countries. Chari, Kehoe, & McGrattan (2000) calibrated the parameter ϕ to match the relative variability of consumption to output. Kehoe & Perri (2002) targeted the variability of investment.

195% for the U.S. and 119% for the aggregate of the other countries. We replicate these values in the steady state with capital mobility by setting $\underline{a}^1 = -2.6$ and $\underline{a}^2 = -0.02$.

3.1 The macroeconomic implications of financial integration

We conduct a simple exercise to study the consequences of capital markets liberalization. We derive the effects of a complete and fully-unanticipated removal of all barriers to financial asset trading between countries 1 and 2, starting from a pre-liberalization equilibrium in which the two countries are in the autarky steady state. In reality, the actual liberalization has been gradual. However, once we understand the effects of an immediate, full liberalization, it will be easy to infer the effects of a gradual reform.

Figure 2 plots the transition dynamics of key macroeconomic variables from the autarky steady state to the new steady state under capital markets integration. Except for the interest rate, the dynamics are shown as percent deviations relative to the autarky steady state in each country. Country 1 starts with a higher interest rate than country 2 (3.1 percent versus 2.6 percent). This is a consequence of the lower pre-liberalization savings of country 1 because of the weaker borrowing constraint. As soon as capital markets are opened, the two interest rates are equalized at 2.76 percent. After that, the world interest rate rises only slightly. As a result of the lower interest rate relative to autarky, the stock of physical capital in country 1 increases. The opposite occurs in country 2.[7] The two stocks of capital converge to the post-liberalization steady state, but the convergence is gradual because of the adjustment cost. As shown in the next section, the convergence without the adjustment cost would be much faster.

The dynamics of outputs and wages follow from the dynamics of capital: as country 1 increases the stock of capital, output and wages increase. The opposite arises in country 2. The dynamics of interest rates and wages will be key for understanding the welfare consequence discussed below.

Figure 3 plots the transition dynamics for the external accounts in percent of each country's domestic output. The first panel shows that country 1 accumulates a large stock of net foreign liabilities. In the long run these

[7]Interestingly, the investment rate in the emerging countries of South East Asia (excluding China) fell by 10 percentage points of GDP in 1998 and this decline has persisted for a decade. The initial drop can be attributed to the Asian crisis, but the persistence of the decline suggests that there was also some structural change at play.

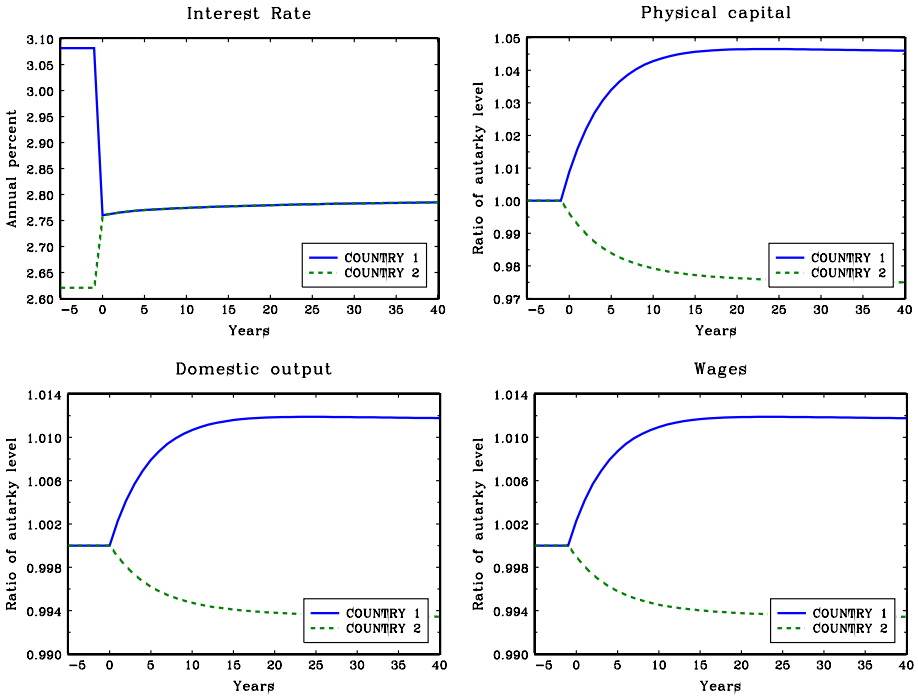


Figure 2: Transition dynamics of macroeconomic variables.

liabilities reach 81 percent of GDP. This is a gradual process that takes more than 40 years.

The remaining panels of Figure 3 display the flow transactions starting with the current account balance. The current account falls into a large deficit close to 5 percent of GDP on impact and stays negative until it converges to zero in the long run. Net exports also decline sharply. The trade balance remains in deficit during the early stages of the transition but it shifts into a surplus in the post-liberalization steady state. This surplus is necessary to service the foreign debt (see the plot showing the factor payments). Note that both the current account and the trade balance satisfy world equilibrium conditions because country 1 is about 31 percent of the world's GDP (e.g., a current account deficit of 5 percent in country 1's GDP is offset, approximately, by a 2.2 percent surplus in country 2).

Since in the model the external accounts are responding to the effects that financial integration has on investment and savings, the last two panels of Figure 3 decompose the current account into the changes generated by

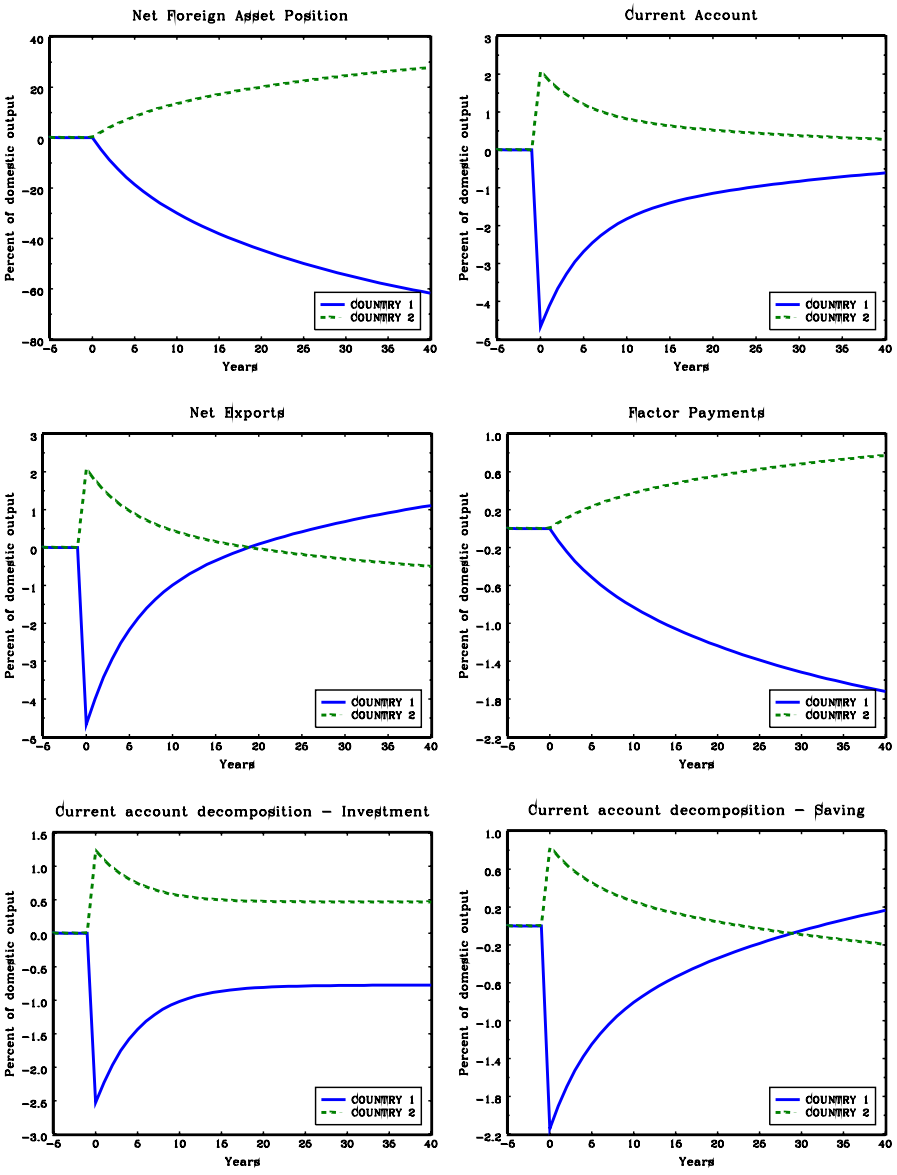


Figure 3: Transition dynamics of foreign account variables.

those two components. From the national accounting identity we have that $CA = S - I$, where CA is the current account balance, S national savings and I domestic investment. In terms of deviation from the pre-liberalization steady state, this identity can be written as $\Delta CA = \Delta S - \Delta I$, where ΔCA is the deviation of the current account from the steady state value (which is zero). Similarly, ΔS and ΔI are the deviations of savings and investment from the steady state values. The bottom panels of Figure 3 plot these two variables. The decomposition shows that the fall (rise) of the current account in country 1 (country 2) derives from both an increase (fall) in investment and a decline (rise) in savings. This follows from the fact that the interest rate in country 1 (country 2) declines (rises) after liberalization. Lower interest rates encourage investment but discourage savings in country 1, and the opposite occurs in country 2. During the first few periods after liberalization, the contribution of savings to the current account imbalance is of similar magnitude as the contribution of investment.

The macroeconomic dynamics illustrated in Figures 2 and 3 are qualitatively similar to those obtained in international representative-agent neoclassical models in response to the unilateral removal of distortions on capital accumulation (see Mendoza & Tesar (1998)), or when financial integration leads to a change in tax structure as a consequence of increased tax competition (see Quadrini (2005)). Representative-agent models, however, are silent about the distributional effects of financial liberalization, which is the primary goal of this paper. As we will see in the next section, globalization affects welfare unequally among the population of each country: some agents gain greatly while others are negatively affected.

3.2 The welfare consequences of liberalization

We study next the welfare implications of financial integration. In the model agents are ex-ante identical but ex-post heterogeneous in asset holdings and earning abilities. As a result, the welfare effects of financial integration are different for each agent depending on their position in the initial distribution of wealth and earning abilities.

The top panels of Figure 4 plot the steady state wealth distributions in the autarky steady state. Since there are two realizations of earnings, the distribution over net worth is plotted separately for agents with low and high earning abilities. As can be seen, a large share of agents have very low levels of wealth, in particular among those with low earning ability. The lower level

of financial development in Country 2 prevents agents in this country from building large net debt positions, but results in a large mass of agents around the lower bound for assets.

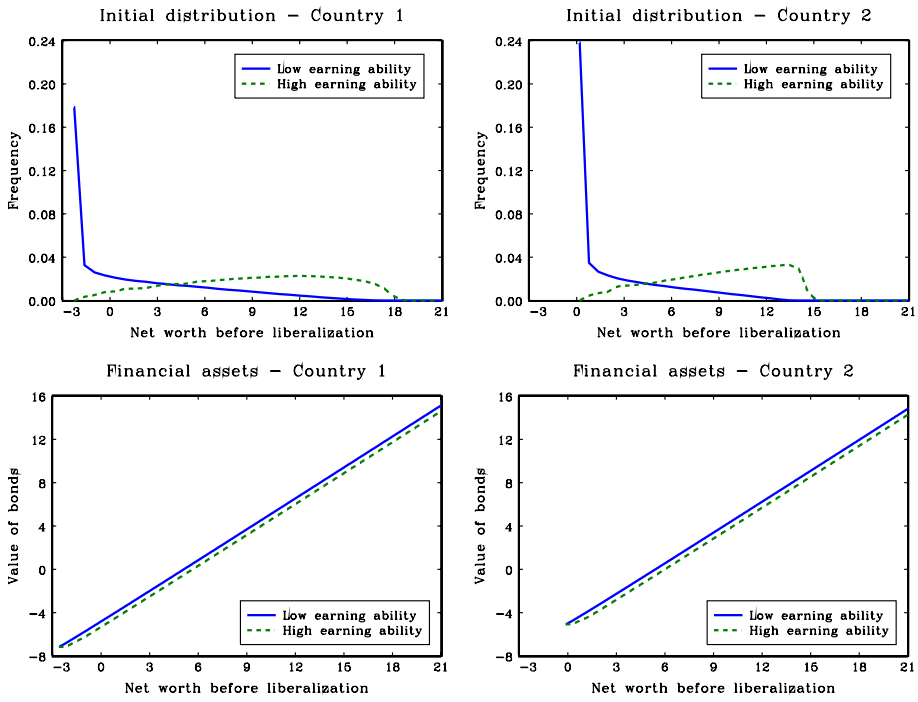


Figure 4: Distribution and portfolio composition.

The bottom panels of Figure 4 show the bond holdings b_{t+1} as a function of net worth a_t in the autarky steady state. Physical capital is the same for all agents within each country, because they all choose the same k_{t+1}. The important point to note is that agents with lower assets choose negative values of b_{t+1}, that is, they borrow. It is then easy to see how changes in the interest rate triggered by financial globalization affect these agents: they gain from a reduction in the interest rate and they lose when the interest rate increases.

Figure 5 plots the distributions of the welfare effects of financial integration in countries 1 and 2 as a function of initial net worth, a, and for different initial earning abilities, ε. The welfare effects are computed as the proportional increase in consumption in the autarky steady state, g, that would make each individual agent indifferent between remaining in financial

autarky (FA) or shifting to the regime with financial integration (FI). In the second case agents would experience the transition dynamics from the pre-liberalization steady state to the steady state with capital mobility. Formally, for each agent j, who is identified by initial states (ε, a), the welfare gain from capital markets liberalization is the value of g^j that solves:

$$E_0 \sum_{t=0}^{\infty} \beta^t u\left(c_t^{FA}(1+g^j)\right) = E_0 \sum_{t=0}^{\infty} \beta^t u\left(c_t^{FI}\right)$$

where c_t^{FA} is agent j's consumption under the autarky regime and c_t^{FI} is agent j's consumption under the regime with capital mobility. Because of the homotheticity of the utility function, the above equation can also be written as:

$$(1+g^j)^{1-\sigma} V^{FA}(\varepsilon, a) = V_0^{FI}(\varepsilon, a)$$

In country 1 the welfare gains decrease with initial wealth and at some point they become negative. The opposite holds true for country 2 where (initially) poorer agents experience a loss from capital markets liberalization. As suggested above, this is a consequence of the changes in interest rates after financial markets integration. The decline in the interest rate relative to autarky in country 1 is beneficial for poorer agents because, as shown in the previous figure, they are net borrowers. At the same time, their wages increase because of the increase in the input of capital. On the other hand, wealthy agents are net lenders and a small part of their income derives from wages. It is then not surprising that they lose from a fall in the interest rate. The opposite is true in country 2 where the interest rate increases after financial markets integration. Poorer agents in country 2 are also borrowers, but for them the increase in the interest rate increases the cost of servicing the debt. On the other hand, richer agents in country 2 benefit from the higher interests payments. Because a smaller share of income is derived from wages, the benefit from higher interest payments more than compensates the lower wages.

The question we ask next is whether the welfare consequences of those gaining from liberalization offset the negative effects for those experiencing losses. We address this question by assuming for each country an egalitarian social welfare function that assigns equal weight to all agents residing in the country. This can be interpreted as the utility of a benevolent country planner that assigns the same weight to each agent. The *aggregate* welfare gain is computed as the proportional increase in the autarky consumption of

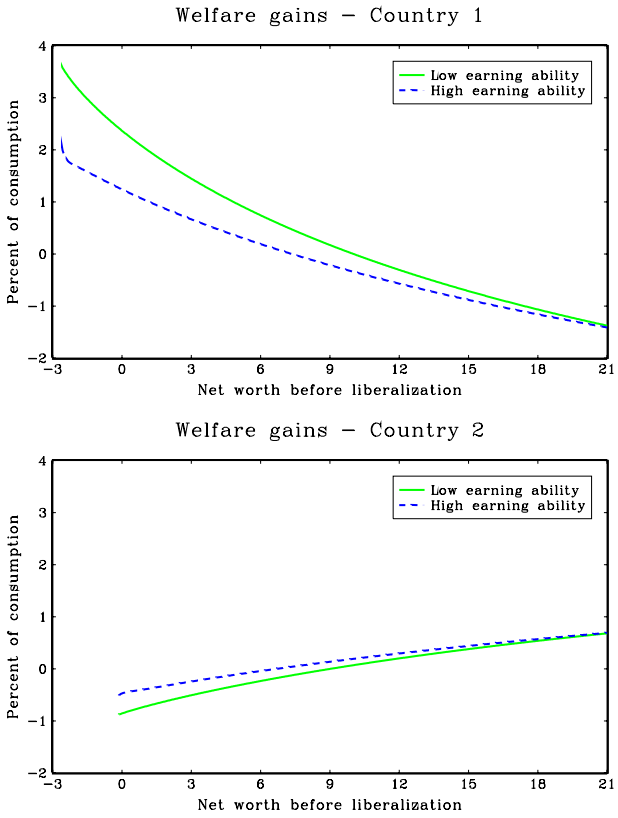


Figure 5: Welfare implications of liberalization.

all agents that makes the planner indifferent between remaining in autarky (but with the consumption increase) and liberalizing. For country i, the aggregate welfare gain is the value of G^i that solves:

$$(1+G^i)^{1-\sigma}\int_{\varepsilon,a} V^{FA}(\varepsilon,a)M^i(\varepsilon,a) = \int_{\varepsilon,a} V_0^{FI}(\varepsilon,a)M^i(\varepsilon,a)$$

In this aggregate welfare measure, the percentage increase in consumption is the same for all agents within each country. Therefore, this is also the percentage increase in aggregate consumption. The aggregate welfare gains are 1.7 percent in country 1 and -0.4 percent in country 2. Hence, financial integration produces a substantial welfare gain for country 1 and a non-trivial loss for country 2.

To understand these aggregate welfare results, it is useful to look back at the pre-liberalization distributions plotted in Figure 4. Because most of

the agents are concentrated on the left-hand-side of the distribution, the aggregate welfare effects are dominated by the gains and losses of the poorer agents. As a result, country 1 gains on average while country 2 is on average worse off.

These welfare results have some common elements with the normative results of Davila, Hong, Krusell, & Ríos-Rull (2005), who study the constrained optimal allocation chosen by a benevolent planner in a one-sector neoclassic growth model with uninsurable idiosyncratic shocks. In this environment, the planner can only affect the relative wellbeing of different households using changes in relative prices and not individualized transfers. They find that the planner would be willing to induce large changes in the capital stock. In particular, in a calibrated model where the poor households have an income composition that is labor intensive, the planner would choose a stock of capital that is bigger than in the laissez-faire world. In our environment there is a related mechanism at work, a reduction in the capital stock and the consequent increase in the interest rate (which is what happens in country 2 after liberalization) is undesirable because it tilts the prices against the poor and in favor of the rich.

We conclude the welfare analysis by separating the welfare effects caused by capital reallocation, which also arise in representative agent models, from those caused by the distributional effects of financial globalization. The advantage of using a model with heterogeneous agents is that we can separate the two.

In order to isolate the welfare consequences of financial liberalization that are due to redistributional effects, we conduct the following experiment. As in the previous section, we consider a full and unanticipated liberalization of capital markets starting from the autarky steady state. However, we do not allow agents to re-optimize the input of physical capital and continue to use the same inputs they were using in the autarky equilibrium. This is equivalent to assuming that the adjustment cost is infinitely large.

Although the stocks of capital in the two countries remain the same, the interest rates are equalized immediately. This leads to a change in savings similar to the one obtained in the previous section. Therefore, country 1 starts borrowing from country 2 and accumulates foreign asset liabilities. The distribution of welfare gains among the population of the two countries is also very similar: the poor in country 1 gain while the poor in country 2 lose. The aggregate welfare gain for country 1 is 2.2% and for country 2 is -0.74%. Therefore, without capital reallocation, the welfare losses for

country 2 are larger (0.74 versus 0.41). By allowing capital to be efficiently reallocated, the losses are reduced somewhat but not completely. In country 1, instead, the gains are even larger without capital reallocation (2.2 versus 1.55). Clearly, the welfare consequences coming from the redistributional impact of globalization dominate the welfare consequences from capital reallocation.

3.3 The distributional consequences of liberalization

In addition to the aggregate and distributional welfare effects of liberalization explored in the previous subsection, financial integration affects the distribution of wealth within each country. Figure 6 plots the Gini index for the distribution of net worth a in each country. Before liberalization, the Gini index is about 66 percent in country 1 and 48 percent in country 2. The higher Gini in country 1 is explained by the lower borrowing limit: because of the higher ability to borrow, a significant fraction of agents in country 1 end up with large liabilities, leading to a highX concentration of wealth. Agents in country 2 have tighter borrowing constraints, and therefore, they cannot accumulate very large liabilities.

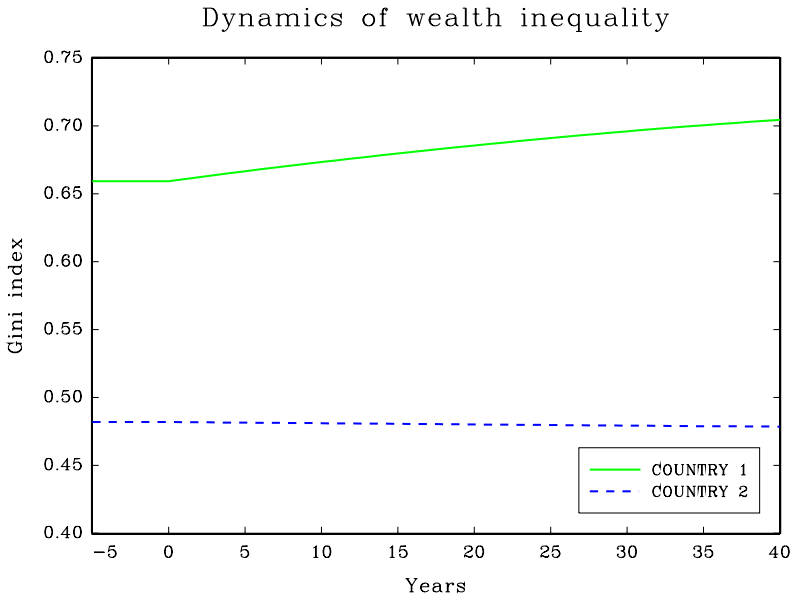


Figure 6: Implications of liberalization for the distribution of wealth.

As the two countries liberalize, the concentration of wealth increases gradually in country 1 and in the long-run the Gini index reaches the value of 0.73. In country 2, instead, the Gini index remains almost the same. These changes are a direct consequence of the changes in interest rates after liberalization.

Consider first country 1. Liberalization induces a fall in the interest rate (relatively to the autarky rate), which reduces the incentive to save. As a result of the lower savings, a larger fraction of agents borrow up to the limit, and therefore, more agents end up with large liabilities. This pattern is consistent with the increase in inequality observed in the US economy in recent years, at least for the part generated by the higher indebtness of the household sector.

For country 2, instead, liberalization leads to an increase in the interest rate. Because of this, savings tend to raise and fewer agents hit the borrowing limit. This should decrease inequality. At the same time, however, a higher interest rate reduces the incomes of those borrowing, that is the poorer agents. This feature tends to keep more agents closer to the borrowing limit. For our parametrization, the two effects are of similar magnitude and the Gini index does not change much. Interestingly, the limited data available on the evolution of Gini coefficients over the last 20 years also show small changes in the majority of emerging economies. Using the income distribution data available in the World Bank's *World Development Indicators,* we found that the median across emerging economies of the change between the most recent value of the Gini coefficient (generally for 2003) and the values reported for the mid 1980s (mainly for 1984-1986 depending on the country) was about 1 percentage point. In typical emerging countries like Brazil, Malaysia, Mexico, and Turkey, the changes in the Gini coefficients range between -0.9 and 0.5 percentage points.

4 Sensitivity analysis

This Section examines the robustness of our findings to changes in the specification of capital adjustment costs and the relative size of the countries' borrowing constraints (differences in financial development).

In the baseline model we assumed that the capital adjustment cost depends on the aggregate capital stock. We show below that the results are robust to using a standard adjustment cost function $\varphi(k_t, k_{t+1}) = \phi \cdot (k_{t+1}/k_t - 1)^2$, where k_t is the *individual* stock of capital. The optimization problem is

Figure 7: Transition dynamics for different adjustment costs in country 1.

similar to problem (4) but the arguments of the value function now include k_t, that is, $V(\varepsilon_t, a_t, k_t)$. The first-order conditions for bond holdings and labor do not change. The first-order condition with respect to physical capital, however, is now slightly different:

$$\begin{aligned} U'(c_t) &= \frac{F_k(k_{t+1}, l_{t+1})}{1 + \varphi_{k_{t+1}}(k_t, k_{t+1})} \beta E\Big[U'(c(\varepsilon_{t+1})) + \lambda(\varepsilon_{t+1})\Big] \\ &- \frac{\varphi_{k_{t+1}}(k_{t+1}, k_{t+2})}{1 + \varphi_{k_{t+1}}(k_t, k_{t+1})} \beta E U'(c(\varepsilon_{t+1})) \end{aligned}$$

The last term captures the effect of capital accumulation on future adjustment costs that were ignored in the previous formulation. This additional term makes the analysis more complicated. In particular, it is no longer the case that all agents choose the same input of capital. Agents that are constrained ($\lambda(\varepsilon_{t+1}) > 0$), will choose a lower adjustment of capital to increase current consumption. As a result, they will have a different stock of capital than unconstrained agents. This implies that in the economy there will be a non-degenerate distribution of physical capital in addition to net worth and earning abilities.

Figure 7 reports the transition dynamics after capital markets liberalization when we use this new specification of the adjustment cost. The parameter ϕ is set to the same value used in the baseline model, that is, 0.6. The figure also reports the transition dynamics for the baseline model analyzed earlier and for the economy without adjustment cost. For economy of space we report only the dynamics for country 1.

The new specification of the adjustment cost leads to a faster reallocation of capital compared to the baseline model. This is because now agents internalize that higher reallocation today reduces the cost of future reallocations. Consequently, the speed of adjustment is higher. Without adjustment costs, the reallocation is obviously very quick. In this case the marginal productivity of capital is immediately equalized to the interest rate. With adjustment costs, instead, the equalization arises only in the long-run. But beyond the differences in the speed of adjustment, the qualitative properties of the model do not change and, as reported in Table 1, the welfare numbers are very similar.

Table 1: Welfare gains for different adjustment cost functions. Percent of consumption.

	Country 1	Country 2
Model without adjustment cost	1.55	-0.34
Model with 'individual' adjustment cost	1.60	-0.37
Model with 'aggregate' adjustment cost (baseline)	1.67	-0.41

Another sensitivity exercise we conduct is with respect to the lower bound $\underline{a}$, that is, to differences in financial markets development. Table 2 reports the welfare consequences when the two economies are characterized by different values of $\underline{a}$. In the first row we report the baseline model. In the second we decrease the bound for country 1 and in the third we decrease the bound for country 2.

Table 2: Welfare gains for different bounds on assets. Percent of consumption.

Lower bounds on assets $(\underline{a}^1, \underline{a}^2)$	Interest rate (autarky)		Welfare gains	
	Country 1	Country 2	Country 1	Country 2
$(-2.6, -0.02)$ (baseline)	3.08	2.62	1.67	-0.41
$(-4.0, -0.02)$	3.25	2.62	3.02	-0.58
$(-2.6, -0.30)$	3.08	3.00	0.35	-0.13

The results are as expected: The larger is the difference between the lower bounds, the larger are the welfare effects. For example, when we decrease the limit for country 1 to -4.0 (keeping the limit of country 2 unaltered), the gains of country 1 and the losses of country 2 increase by a factor of 1.8 and 1.4 respectively. When instead we decrease the limit for country 2 from -0.02 to -0.3 (making the limit closer to country 1), the welfare consequences become less than half.[8] So, in general, what matters is not how small the

[8]Notice that the lower bound for country 2 is not directly comparable to country 1

borrowing limits are but how much they differ across countries.

The last sensitivity exercise is with respect to the volatility of individual labor efficiencies. Labor efficiencies can take two values and the proportional deviation from the mean, Δ_ε, was set to 0.6 for both countries. We now allow the two countries to have different volatilities of earnings. Table 4 reports the welfare consequences when the two economies are characterized by different values of Δ_ε. In the first row we report the baseline model. In the second and third rows we change the earning volatility in country 1 and in the fourth and fifth rows we change the earning volatility in country 2.

Table 3: Welfare gains for different volatility of earnings. Percent of consumption.

Volatility of earnings $(\Delta_\varepsilon^1, \Delta_\varepsilon^2)$	Interest rate (autarky)		Welfare gains	
	Country 1	Country 2	Country 1	Country 2
$(0.60, 0.60)$ (baseline)	3.08	2.62	1.67	-0.41
$(0.55, 0.60)$	3.41	2.62	2.64	-0.69
$(0.65, 0.60)$	2.73	2.62	0.43	-0.10
$(0.60, 0.55)$	3.08	3.00	0.29	-0.06
$(0.60, 0.65)$	3.08	2.22	3.21	-0.83

Lower (higher) volatility of earnings leads to lower (higher) savings, and therefore, a higher (lower) interest rate in the autarky equilibrium. The larger the interest rate differential before capital liberalization, the larger the welfare consequences from liberalizing. In other words, liberalization brings higher welfare gains or lower welfare losses as we reduce the relative volatility of individual earnings.

The results reported in rows 2 and 5 are of particular interest. These are the cases in which agents in country 1 face lower volatility of earnings compared to agents in country 2 (in addition to a weaker borrowing constraints).

because country 1 has a higher per-capita income. To make the bound comparable, we should re-scale it by the per-capita income ratio of the two countries. Because the ratio is 0.152, the bound of country 2 $\underline{a}^2 = -0.3$ corresponds to $-0.3/0.152 = -1.97$ in country 1. Financial integration would be without consequences if $\underline{a}^2 = -0.3952$ because this corresponds to $-0.3952/0.152 = -2.6$ in country 2.

This is another way of capturing, in reduced form, the higher financial deepness of country 1. In the current paper we have assumed that financial market differences are only captured by the borrowing limits. More generally, however, financial development is also associated to the availability of a larger variety of contracts, like derivatives, that are essentially state-contingent and provide some form of insurance. Because greater insurance reduces the need of precautionary savings, liberalization leads to larger imbalances and larger welfare consequences. This is the approach we have taken in Mendoza et al. (2007) where the availability of insurance is determined endogenously by the degree of contract enforcement.

5 Policy implications

One important result we obtained from the welfare analysis of financial liberalization is that in country 2—the country with less developed financial markets—the aggregate welfare consequences are negative. In this section we ask whether there is a simple domestic policy that, when applied in conjunction with financial liberalization, can make the aggregate welfare consequences positive for country 2 (in addition to country 1). Of course, there are many policies we can think of. Here we simply consider a one-time redistributive tax on wealth.

Suppose that at time zero, just before liberalization, the government imposes a tax on the net worth a and redistributes the revenues as lump-sum transfers. Formally, $T^i = \int_{\varepsilon,a} \tau^i a M^i(\varepsilon, a)$, where T^i is the lump-sum transfer, τ^i the wealth tax rate and i is the index for the country. This redistributive tax is applied only at time zero and it is not anticipated, as is the case with the liberalization of capital markets. In the quantitative exercise, we tried different tax rates for country 2 and the aggregate welfare results are reported in Table 4.

As more wealth is initially redistributed, and therefore, there is less initial inequality, the aggregate welfare consequences improve. It is sufficient a 2.5 percent tax rate to turn the aggregate welfare cost of liberalization in country 2 to a welfare gain. The welfare gain is further improved by increasing the one-time tax rate. It is also interesting to note that the redistributive tax in country 2 has almost no effect on the welfare consequences of liberalization for country 1.

Table 4: Welfare gains from liberalization when country 2 implements a one-time wealth redistribution. Percent of consumption.

Tax Rate	Initial wealth gini after redistribution in country 2	Welfare gains country 1	Welfare gains country 2
0.0%	0.482	1.67	-0.41
1.0%	0.477	1.64	-0.20
2.5%	0.470	1.61	0.12
5.0%	0.458	1.56	0.62

6 Conclusion

This paper studied the welfare and distributional consequences of capital markets liberalization among countries that are heterogeneous in financial development. We found that, if financial globalization does not lead to financial development, globalization can result in adverse effects on the social welfare of the less developed countries. The quantitative analysis shows that these effects are sizable and can justify policy intervention.

These conclusions were obtained by studying the quantitative implications of a two-country model with heterogenous agents and non-insurable idiosyncratic risk, where countries differ in their degree of financial development as represented by borrowing constraints. After calibrating the model to the United States and an aggregate of the rest of the OECD countries plus emerging economies, we showed that financial globalization without financial development leads to an aggregate welfare gain of 1.7 percent in the United States and a loss of -0.4 percent in the aggregate of the other countries. This occurs because, relative to financial autarky, the integration of capital markets increases the cost of borrowing to poor agents in the less financially developed countries and lowers it in the more financially developed country. Moreover, the model predicts that financial globalization without financial development has adverse effects on wealth inequality. It worsens the distribution of wealth in the United States and fails to reduce inequality in the other countries.

If financial integration leads to faster convergence in the development of

financial markets, then there could be some net benefits for the countries that are less financially developed. This is more likely to happen in the long run. In the short run fiscal policy can play a useful role in redistributing the gains and losses. We found that a redistribution of initial wealth in countries with lower financial development can make the aggregate welfare consequences from liberalization positive for all countries.

A Appendix: Proof of Proposition 1

In both economies we have that in the steady state $F_k(K, L) = 1 + r$. Because with capital mobility there is a single worldwide interest rate, all agents employ the same input of capital in steady state. We want to show that the steady state interest rate is smaller than the intertemporal discount rate. Suppose, on the contrary, that $\beta(1 + r) \geq 1$. Under this condition agents in country 1 will have non-negative consumption growth (see Lemma 1) and agents in country 2 will have positive consumption growth (see Lemma 2). This implies that worldwide consumption growth is positive which cannot be a steady state equilibrium. Therefore, the equilibrium must satisfy $\beta(1 + r_t) < 1$. Under this condition, agents in country 1 will experience negative consumption growth (see again Lemma 1). Therefore, consumption in country 1 keeps falling until the limited liability constraint (3) binds for all agents, that is, the net worth equals $\underline{a}^1$ under the lower realization of the earning shock. Because country 1 holds the same amount of K as country 2, the binding constraint for net worth implies that country 1 has a negative net foreign asset position. *Q.E.D.*

References

Aiyagari, S. R. (1994). Uninsured idiosyncratic risk, and aggregate saving. *Quarterly Journal of Economics*, *109*, 659–684.

Backus, D. K., Kehoe, P. J., & Kydland, F. (1992). International business cycles. *Journal of Political Economy*, *100*(4), 745–75.

Baxter, M. & Crucini, M. J. (1993). Explaining saving-investment correlations. *American Economic Review*, *83*(3), 416–36.

Bewley, T. (1986). Stationary monetary equilibrium with a continuum of independently fluctuating consumers. In Hildenbrand, W. & Mas-Colell, A. (Eds.), *Contributions to Mathematical Economics in Honor of Gérard Debreu*. North Holland, Amsterdam.

Bhagwati, J. (2004). *In Defense of Globalization*. Oxford University Press, New York.

Carroll, C. D. (1997). Buffer-stock saving and the life cycle/permanent income hypothesis. *Quarterly Journal of Economics*, *112*(1), 1–55.

Chari, V. V., Kehoe, P., & McGrattan, E. (2000). Sticky price models of the business cycle: can the contract multiplier solve the persistence problem?. *Econometrica*, *68*, 1151–1180.

Clarida, R. H. (1990). International lending and borrowing in a stochastic stationary equilibrium. *International Economic Review*, *31*(3), 543–558.

Davila, J., Hong, J. H., Krusell, P., & Ríos-Rull, J.-V. (2005). Constrained efficiency in the neoclassical growth model with uninsurable idiosyncratic shocks. Mimeo, CAERP.

Frankel, J. (2007). New perspectives on financial globalization. Panel presentation at IMF conference, April 27.

Gourinchas, P.-O. & Jeanne, O. (2006). The elusive gains from international financial integration. *Review of Economic Studies*, *73*(3).

Huggett, M. (1993). The risk free rate in heterogeneous-agents, incomplete insurance economies. *Journal of Economic Dynamics and Control*, *17*(5/6), 953–970.

Kehoe, P. J. & Perri, F. (2002). International business cycles with endogenous incomplete markets. *Econometrica*, *70*(3), 907–928.

Mendoza, E. (1991). Capital controls and the dynamic gains from trade in a business cycle model of a small open economy. IMF Staff Papers, September.

Mendoza, E. G., Quadrini, V., & Ríos-Rull, J.-V. (2007). Financial integration, financial deepness and global imbalances. NBER Working Paper # 12909.

Mendoza, E. G. & Tesar, L. L. (1998). The international ramifications of tax reforms: supply-side economics in a global economy. *American Economic Review*, *88*(1), 226–45.

Mishkin, F. S. (2006). *The Next Great Globalization*. Princeton University Press, Princeton, New Jersey.

Obstfeld, M. & Taylor, A. M. (2004). *Global Capital Markets: Integration, Crisis, and Growth*. Cambridge University Press, New York.

Quadrini, V. (2005). Policy commitment and the welfare gains from capital market liberalization. *European Economic Review*, *49*(8).

Rajan, R. & Zingales, L. (2003). *Saving Capitalism from the Capitalists: Unleashing the Power of Financial Markets to Creat Wealth and Spread Opportunity*. Crown Business, New York.

Soros, G. (2002). *On Globalization*. Public Affairs Books, New York.

Stiglitz, J. E. (2002). *Globalization and its Discontents*. W. W. Norton & Company, New York.

Storesletten, K., Telmer, C., & Yaron, A. (2004). Cyclical dynamics in idiosyncratic labor-market risk. Forthcoming, Journal of Political Economy.