

This PDF is a selection from a published volume from the National Bureau of Economic Research

Volume Title: NBER International Seminar on Macroeconomics 2007

Volume Author/Editor: Richard Clarida and Francesco Giavazzi, organizers

Volume Publisher: University of Chicago Press

ISSN: 1932-8796

Volume URL: <http://www.nber.org/books/clar07-1>

Conference Date: June 15-16, 2007

Publication Date: January 2009

Chapter Title: On the Welfare Implications of Financial Globalization without Financial Development

Chapter Author: Enrique G. Mendoza, Vincenzo Quadrini, José-Víctor Ríos-Rull

Chapter URL: <http://www.nber.org/chapters/c3012>

Chapter pages in book: (283 - 312)

---

## 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*

*"... 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 percent. . . . Banking in Mexico remains very profitable for banks, and intimidatingly expensive for the country's poor."*

*The Economist*, Nov. 25, 2006

### 6.1 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 and Zingales (2003), Frankel (2007), and Obstfeld and 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.). 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 domestic financial markets remain underdeveloped in some countries? 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 amongs 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 multicountry, general equilibrium model with heterogenous agents and incomplete asset markets. We show that, if financial globalization is not accompanied by domestic 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 country with less developed financial markets, the *aggregate* welfare consequences are negative even though the distribution of wealth 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, and 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 and Jeanne 2006; Mendoza and 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, and 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 multicountry model where agents face noninsurable idiosyncratic shocks to endowments and investments, and market incompleteness derives from the limited enforcement of credit contracts. This model was able to explain two key features of the global imbalances that started to emerge 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 gross domestic product (GDP) in 2006, and (b) a shift in the composition of the U.S. ex-

ternal 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 each country and for the social welfare across individuals and nations. On one hand, we simplify the MQR model by abstracting from shocks to investments 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 foci 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 exogenous differences in borrowing constraints. 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 induced by financial integration.

The paper is organized as follows. Section 6.2 describes the model and defines equilibria under financial autarky and under global financial integration. Section 6.2.2 provides an intuitive characterization of the two equilibria and the implications of moving from financial autarky to financial globalization. Section 6.3 presents the quantitative results, with particular focus on the model's normative implications. Section 6.4 conducts a sensitivity analysis. Section 6.5 examines some policy implications, and section 6.6 concludes.

## 6.2 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  $a^i$  as specified following. 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 and in the real world. However, differences in population and productivity act only as rescaling factors in the derivation of the equilibrium conditions with capital mobility and they are not relevant for the qualitative theory of the paper. Therefore, through-

out this section, we present the model assuming that countries differ only in  $q^i$ .

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  $\beta$  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  $\epsilon_t$  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 that 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 that is constant. We assume that  $0 < \nu < 1$  so that there are decreasing returns to scale in production. Capital depreciates at rate  $\delta$ . 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 assumptions that the production technology is individually operated and displays decreasing returns are not standard in heterogeneous-agents models with idiosyncratic risks. These assumptions allow us to distinguish the portfolio choice of an individual agent between physical capital and bonds. However, because there is no uncertainty in production, the aggregate properties of the model are similar to those of a 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.<sup>1</sup> 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  $\phi(K_t, k_{t+1}) = \phi \cdot (k_{t+1}/K_t - 1)^2$ , 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 end-of-period net worth before consumption. The budget constraint is:

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

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 an exogenous borrowing limit: the lower the value of  $\underline{a}^i$ , the higher the agents' ability to borrow.<sup>2</sup> The lower bound  $\underline{a}^i$  is the only *exogenous* difference among countries.

### 6.2.1 Optimization Problem and Equilibrium

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

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

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

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

The only difference in the definition of the two equilibria is that with financial integration there is a global market for bonds, and therefore, interest rates are equalized across countries (condition [ii]). As a result, countries may have nonzero foreign asset positions.

## 6.2.2 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 also consider 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 au-

tarky. In this case, agents choose contingent claims  $b(\epsilon_{t+1})$ , physical capital  $k_{t+1}$ , and labor  $l_{t+1}$ .

The first-order conditions are:

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

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

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

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

The first condition holds for any realization of  $\epsilon_{t+1}$ , which implies that next period consumption,  $c(\epsilon_{t+1})$ , must be the same for all  $\epsilon_{t+1}$  (full insurance). The first two conditions imply together that  $F_k(k_{t+1}, l_{t+1})/[1 + \phi_k(K_t, k_{t+1})] = 1 + r_t$ , 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 nonstate contingent claims are traded. The first-order conditions are:

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

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

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

In this case we obtain again that  $F_k(k_{t+1}, l_{t+1})/[1 + \phi_k(K_t, k_{t+1})] = 1 + r_t$ , 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 noncontingent bonds are traded. Then the steady state interest rate satisfies  $r_t < 1/\beta - 1$ .*

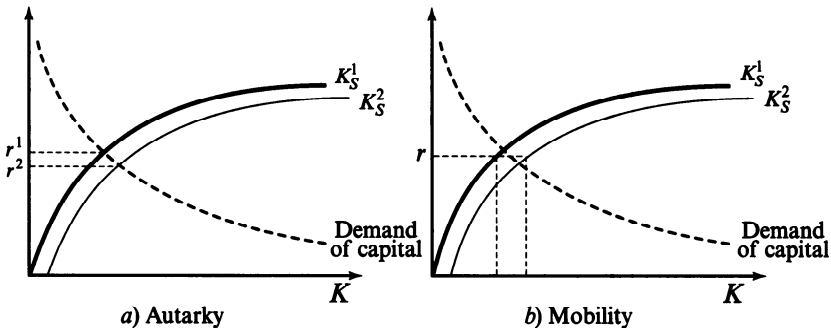
**PROOF 2.** Suppose that  $\beta(1 + r_t) \geq 1$ . Because  $U'(\cdot)$  is convex, condition (8) implies that for all agents the expected next period consumption is bigger than current consumption. Therefore, next period aggregate consumption will also be bigger than today's consumption, which cannot 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  $\underline{a}$  leads to higher savings and thus reduces the equilibrium interest rate in the autarky regime. Figure 6.1 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  $r$ .<sup>3</sup> Country 1 has deeper financial mar-



**Figure 6.1**  
Steady state equilibria with heterogeneous financial conditions

kets ( $\underline{a}^1 < \underline{a}^2$ ), 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,  $r^1 > r^2$ .

When the countries become financially integrated, the interest rates are equalized. Compared to autarky, the interest rate and the supply of savings 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 developed country. Interestingly, this relocation of capital is akin to those driven by country-specific improvements in productivity or removal of distortions on capital accumulation, but here this is a by-product of global financial integration among countries that are identical except for  $\underline{a}^1 < \underline{a}^2$ .

### 6.3 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 Organization for Economic Cooperation and Development (OECD) countries plus emerging economies.<sup>4</sup>

The two countries are assumed to differ in population and productivity so that we can match the actual population size and per capita GDP

observed in the data (using the World Bank's *World Development Indicators*). The mass of agents in country 1 is set to 0.064, which is the actual U.S. population share in the entire OECD and emerging economies. The mass of agents in country 2 is then set to 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-à-vis the aggregate of other OECD and emerging economies. In 2005 the per capita GDP of this group of countries, compared to the United States, was 0.152. In the model, the relative per capita GDP of the two countries can be expressed as  $y^1/y^2 = (A^1/A^2)^{1/(1-\theta)}$ . Hence, normalizing  $A^1 = 1$ , the model matches the relative per capita GDP of the countries in the data by setting  $A^2 = 0.152^{1-\theta}$ . After setting  $\nu = 0.9$  and  $\theta = 0.289$ , as specified below, we get  $A_2 = 0.248$ .

This calibration of the relative population and productivity 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 percent share derives from differences in population size, productivity, or both, is irrelevant for the economic consequences of liberalization.<sup>5</sup>

For the calibration of the production function, we first set the returns-to-scale coefficient to  $\nu = 0.9$  and then we choose  $\theta$  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 used by Kehoe and Perri (2002) to match the observed cyclical variability of investment in industrial countries.<sup>6</sup> 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, which is in the range of values estimated by Storesletten, Telmer, and Yaron (2004).

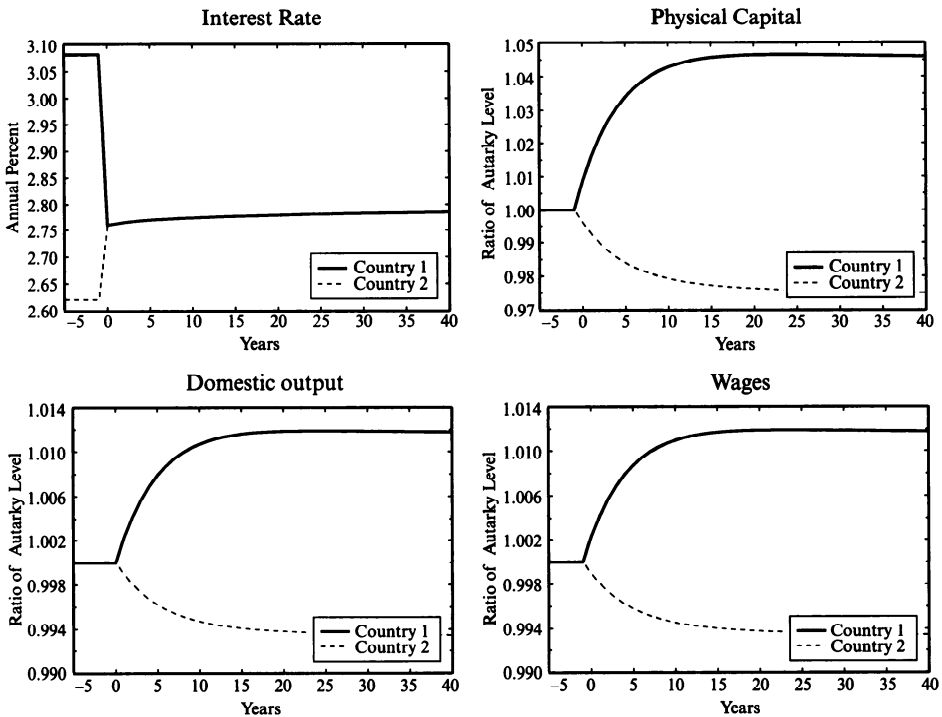
The remaining parameters that need to be calibrated are the lower bounds for net worth,  $\underline{a}^1$  and  $\underline{a}^2$ . These are set to replicate the volume of

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 2005 *World Development Indicators*, this variable was 195 percent for the United States and 119 percent 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  $\underline{a}^2 = -0.02$ .

### 6.3.1 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 unanticipated removal of barriers to financial asset trading between countries 1 and 2, starting from a preliberalization equilibrium in which the two countries are in the autarky steady state.<sup>7</sup>

Figure 6.2 plots the transition dynamics of key macroeconomic vari-



**Figure 6.2**  
Transition dynamics of macroeconomics variables

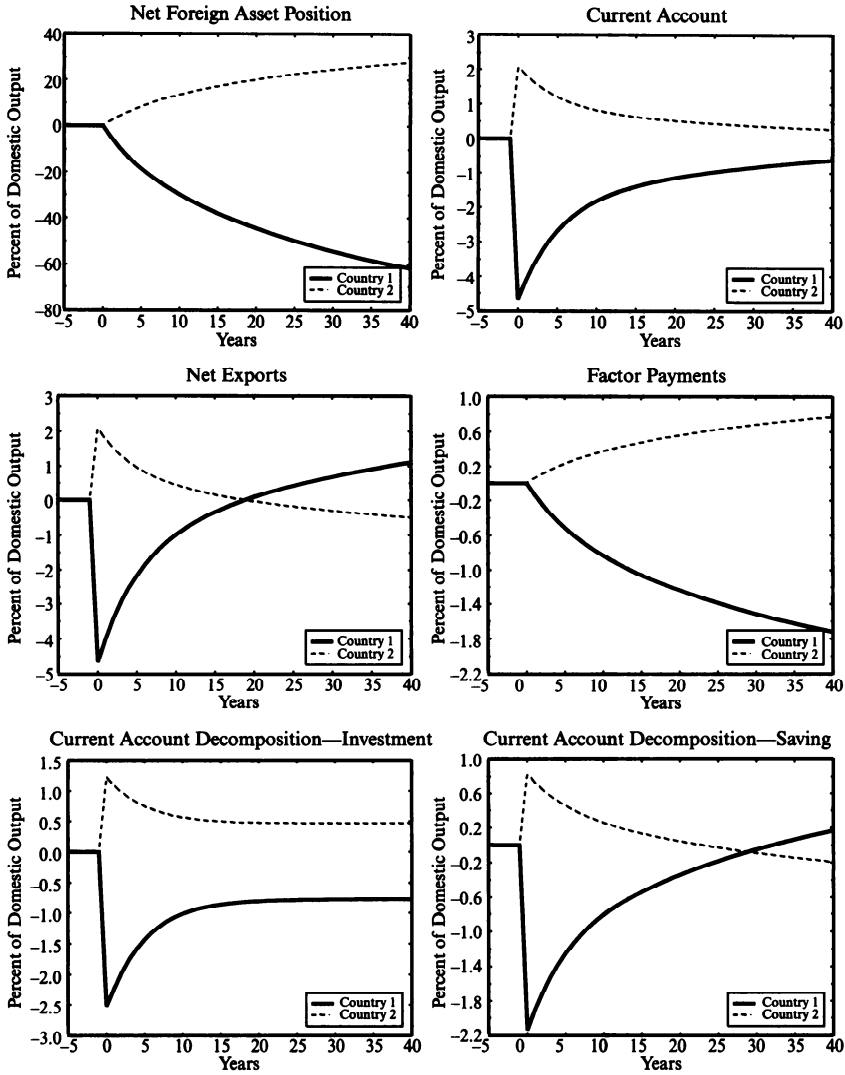
ables from the autarky steady state to the new steady state under capital markets integration. Except for the interest rate, the dynamics are shown as percent deviations relative to the autarky steady state in each country. Country 1 starts with a higher interest rate than country 2 (3.1 percent versus 2.6 percent). This is a consequence of the lower preliberalization 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.<sup>8</sup> The two stocks of capital converge to the postliberalization 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 following.

Figure 6.3 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 liabilities reach 81 percent of GDP. This is a gradual process that takes more than forty years.<sup>9</sup>

The remaining panels of figure 6.3 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 postliberalization 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 corresponds, approximately, by a 2.2 percent surplus in country 2).

Since the responses of the external accounts to financial integration result from the responses of investment and savings, the last two panels of figure 6.3 decompose the current account into these 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 in-



**Figure 6.3**  
Transition dynamics of foreign account variables

vestment. In terms of deviation from the preliberalization steady state, this identity can be written as  $\Delta CA = \Delta S - \Delta I$ , where  $\Delta CA$  is the deviation of the current account from the steady state value (which is zero). Similarly,  $\Delta S$  and  $\Delta I$  are the deviations of savings and investment from the steady state values.

The bottom panels of figure 6.3 plot these two variables. The fall (rise)

in the current account balance of 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. 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.

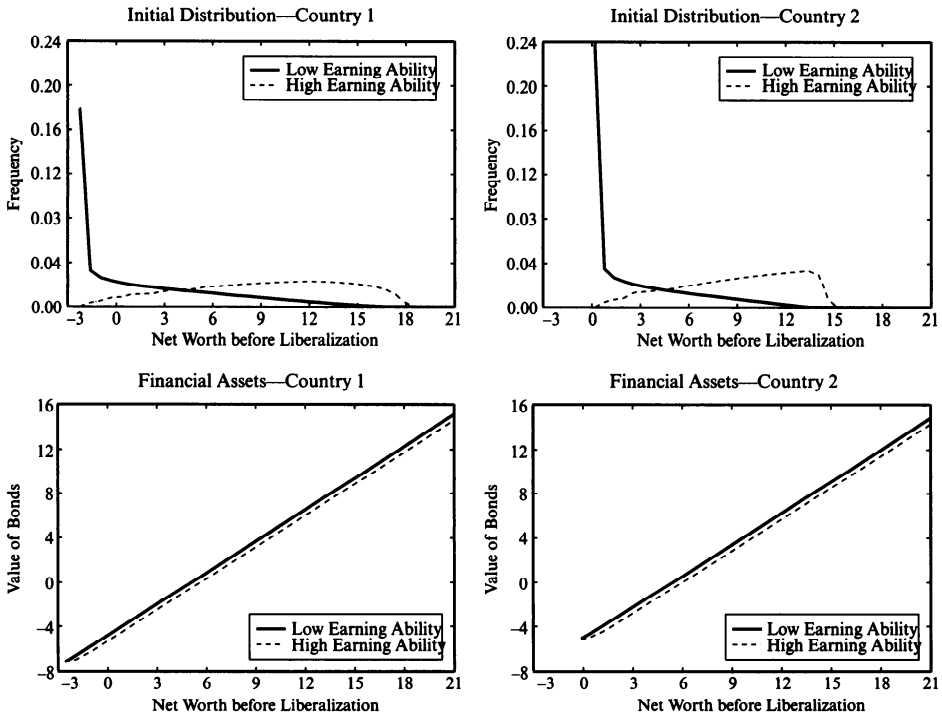
The macroeconomic dynamics illustrated in figures 6.2 and 6.3 are qualitatively similar to those obtained in international representative-agent neoclassical models in response to the unilateral removal of distortions on capital accumulation (see Mendoza and Tesar 1998), or when financial integration 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. Our setup instead allows us to investigate how the welfare consequences of globalization are distributed among the population of each country. As we will see, some agents gain greatly while others are negatively affected.

### 6.3.2 *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 6.4 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.

The bottom panels of figure 6.4 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

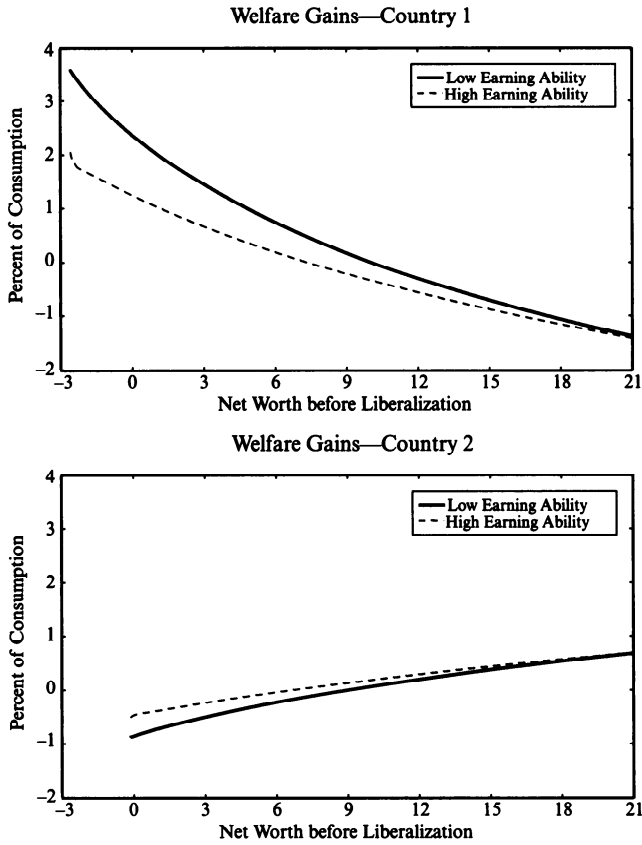


**Figure 6.4**  
Wealth distributions and portfolio composition

changes in the interest rate triggered by financial globalization affect these agents: they gain from a reduction in the interest rate but they lose when the interest rate increases.

Figure 6.5 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,  $\epsilon$ . 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 preliberalization steady state to the steady state with capital mobility. Formally, for each agent  $j$ , who is identified by initial states  $(\epsilon, a)$ , the welfare gain from capital markets liberalization is the value of  $g^j$  that solves:





**Figure 6.5**  
Welfare gains of liberalization

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

where  $c_t^{FA}$  is agent  $j$ 's consumption under the autarky steady state and  $c_t^{FI}$  is agent  $j$ 's consumption when the economy is liberalized at time 0, starting from the autarky steady state. Because of the homotheticity of the utility function, the previous equation can also be written as:

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

where  $V^{FA}$  and  $V_0^{FI}$  are the value functions under financial autarky and financial integration.

As shown in figure 6.5, 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 previously, these welfare findings are 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 raises the cost of servicing the debt. On the other hand, richer agents in country 2 benefit from the higher interest 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, a 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 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:

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

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 nontrivial loss for country 2.

To understand these aggregate welfare results, it is useful to look back at the preliberalization distributions of wealth plotted in figure 6.4. Because most of the agents are concentrated on the left-hand side of the

distributions, 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, and 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 well-being 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.

We conclude the welfare analysis by decomposing the welfare effects caused by capital reallocation, which also arise in representative agent models, from those caused by the distributional effects of financial globalization. To make the decomposition, 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 reoptimize 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.

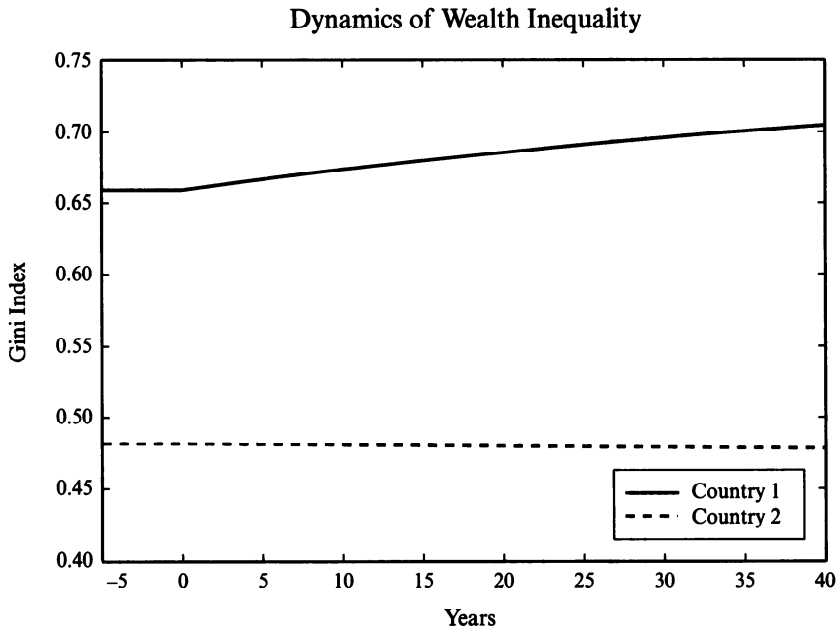
Although the stocks of capital in the two countries remain the same, the interest rates are equalized immediately. This leads to a change in savings similar to the one obtained in the previous section. Therefore, country 1 starts borrowing from country 2 and accumulates foreign asset liabilities. The 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 percent and for country 2 is  $-0.74$  percent. 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 redistributive impact of globalization dominate the welfare consequences from capital reallocation.

### 6.3.3 *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 6.6 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 high concentration of wealth. Agents in country 2 have tighter borrowing constraints, and therefore, they cannot accumulate very large liabilities.

As the two countries liberalize, the concentration of wealth increases gradually in country 1 and in the long run the Gini index reaches the



**Figure 6.6**  
Implications of liberalization for the dynamics of the distributions of wealth

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 U.S. economy in recent years, at least for the part generated by the higher indebtedness 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 twenty 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 through 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.

#### 6.4 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 want to show now that the results are robust to using a standard adjustment cost function  $\phi(k_t, k_{t+1}) = \phi \cdot (k_{t+1}/k_t - 1)^2$ , where  $k_t$  is the *individual* stock of capital. The optimization problem is 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:

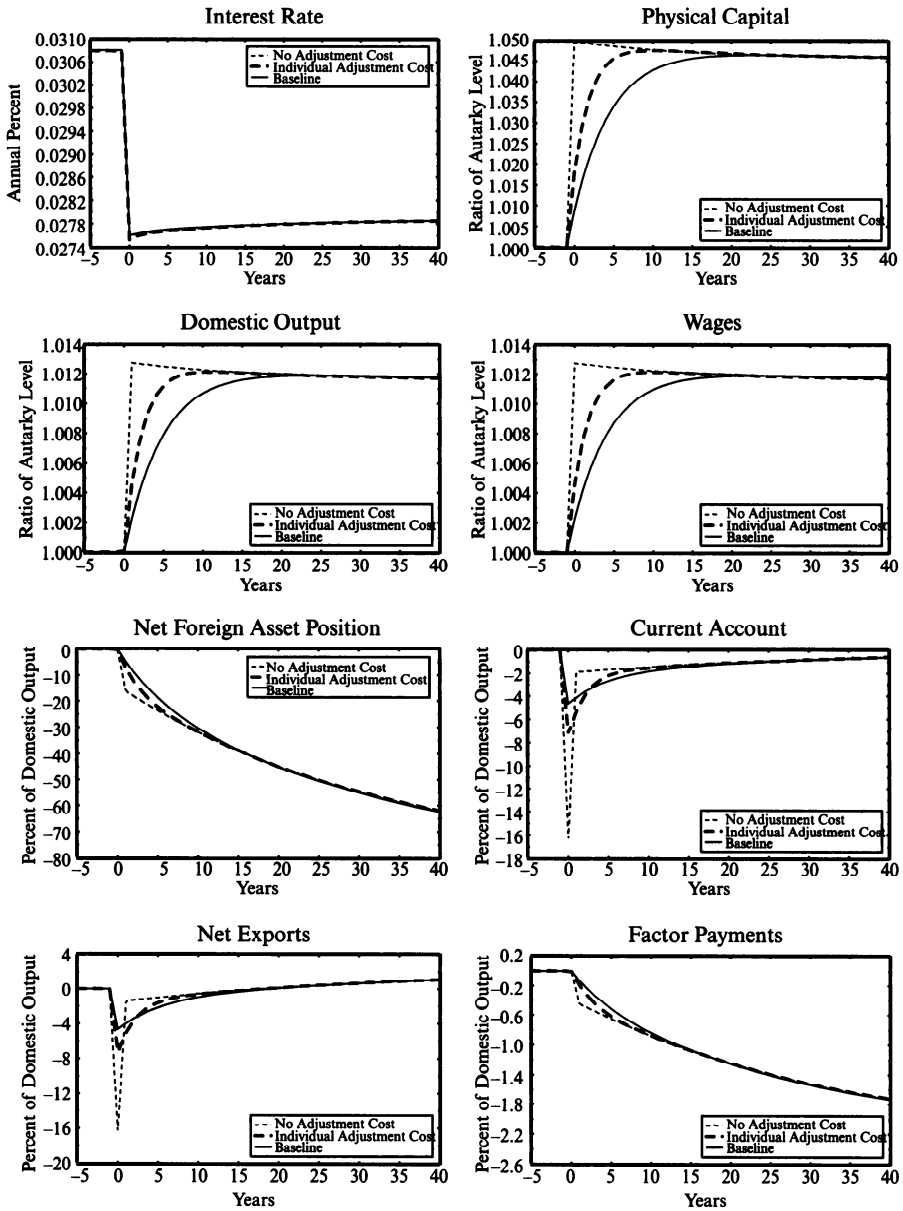
$$U'(c_t) = \frac{F_k(k_{t+1}, l_{t+1})}{1 + \varphi_{k_{t+1}}(k_t, k_{t+1})} \beta E\{U'[c(\varepsilon_{t+1})] + \lambda(\varepsilon_{t+1})\} \\ - \frac{\varphi_{k_{t+1}}(k_{t+1}, k_{t+2})}{1 + \varphi_{k_{t+1}}(k_t, k_{t+1})} \beta E U'[c(\varepsilon_{t+1})].$$

The last term captures the effect of capital accumulation on future adjustment costs. In the previous formulation this term was ignored by individual agents because it was external to their optimization problem. 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 nondegenerate distribution of physical capital in addition to net worth and earning abilities.

Figure 6.7 reports the transition dynamics after capital markets liberalization when we use this new specification of the adjustment cost. The parameter  $\phi$  is set to the same value used in the baseline model (i.e., 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 adjustment is faster. Without adjustment cost 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 6.1, the welfare numbers are very similar.

Another sensitivity exercise we conduct involves the lower bound  $\underline{a}$ , which represents differences in financial markets development. Table 6.2 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.



**Figure 6.7**  
Transition dynamics for different adjustment costs in country 1

**Table 6.1**

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

**Table 6.2**

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
(-2.6, 0.00)	3.08	2.59	1.76	-0.43
(-2.6, 0.23)	3.08	2.14	3.00	-0.50
(-2.6, 0.30)	3.08	1.95	4.00	-0.36
(-2.6, 0.46)	3.08	1.53	5.60	-0.08

Larger differences between the lower bounds lead to larger 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 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.<sup>10</sup> So, in general, what matters is how much the borrowing limits differ across countries.

We should also point out that the welfare consequences for the less developed country do not change monotonically with the tightness of the financial constraint. As shown in the lower section of table 6.2, after a certain point, the welfare losses for country 2 start to decline with tighter constraints.

This result is easy to understand if we use the law of motion for wealth (equation [2]) to rewrite the financial constraint as follows:

$$\varepsilon_{t+1}w_{t+1} + F(k_{t+1}, l_{t+1}) - l_{t+1}w_{t+1} + b_{t+1} \geq \underline{a}.$$

From this expression, it is easy to see that the lower limit on  $a_{t+1}$  imposes a lower limit on  $b_{t+1}$ . Because all agents choose the same production in-



puts  $k_{t+1}$  and  $l_{t+1}$ , high values of  $\underline{a}$  reduce the maximum leverage. Then, an increase in the interest rate in country 2 following the liberalization of capital markets cannot have large welfare costs for poor agents because they are not very leveraged. Effectively, higher values of  $\underline{a}$  reduce the inequality in the distribution of wealth with consequent reduction in the redistributive consequences of capital markets liberalization. In the extreme case in which  $\underline{a}$  is so high that  $b_{t+1}$  is zero for all agents, the welfare consequences of liberalization become positive also for country 2. In this case only the efficiency gains from capital reallocation arise. Of course, this is an extreme case of limited empirical relevance.

Regarding country 1, the welfare gains increase monotonically with the reduction in the financial deepness of country 2. This is because the integration with less financially developed countries implies a larger drop in the interest rate.

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,  $\Delta_e$ , was set to 0.6 in both countries. We now allow the two countries to have different volatilities of earnings. Table 6.3 reports the welfare consequences when the two economies are characterized by different values of  $\Delta_e$ . In the first row we report the baseline model. In the second and third rows we change the earnings volatility in country 1, and in the fourth and fifth rows we change the earnings volatility in country 2.

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.

**Table 6.3**  
Welfare gains for different volatility of earnings (percent of consumption)

Volatility of earnings ( $\Delta_1^e, \Delta_2^e$ )	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

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 constraint). 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 with 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, Quadrini, and Ríos-Rull (2007), where the availability of insurance is determined endogenously by the degree of contract enforceability.

The case of cross-country differences in the volatility of earnings is also relevant for understanding the international flow of capital between industrialized and emerging economies. The economic transformation experienced by emerging economies allowed these countries to experience faster growth. At the same time, rapid transformations are also likely to induce greater uncertainty at the individual level. Therefore, we have two opposing effects on the international flows of capital. On the one hand emerging economies should be net importers of capital because faster growth induces higher investments. On the other, they should be net exporters because the economic transformations that allow for faster growth also induce higher savings. Together with the poor development of their financial markets, the saving effect is likely to dominate the investment effect in these countries. It is then not surprising to see a net flow of capital going from emerging economies toward industrialized countries. See also endnote 9 on this point.

## 6.5 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 once-and-for-all redistributive tax on wealth.

**Table 6.4**

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

Suppose that at time zero, just before liberalization, the government imposes a tax on net worth  $a$  and redistributes the revenues as lump-sum transfers. Formally,  $T^i = \int_{\epsilon,a} \tau^i a M^i(\epsilon, a)$ , where  $T^i$  is the lump-sum transfer,  $\tau^i$  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. We tried different tax rates for country 2 and the aggregate welfare results are reported in table 6.4.

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

## 6.6 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, it can result in adverse effects for the social welfare of the less developed countries. The quantitative analysis shows that these effects are large and may justify policy intervention.

These conclusions were obtained by studying the quantitative implications of a two-country model with heterogeneous agents and uninsurable idiosyncratic risks. Market incompleteness derives from the unavailability of state-contingent contracts and limits to the amount of borrowing. Countries are heterogeneous in the degree of financial development captured by the tightness of the borrowing limits. A baseline

simulation calibrated to the United States and an aggregate of the rest of the OECD countries plus emerging economies, 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 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 policies 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.

### Acknowledgments

This paper was prepared for the NBER's International Seminar on Macroeconomics (ISOM), Istanbul, June 15–16, 2007. We would like to thank Giancarlo Corsetti and Mehmet Yorokoglu for insightful comments. Financial support from the National Science Foundation is gratefully acknowledged.

### Notes

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.
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 that are constrained by an enforcement constraint. Here, instead, we allow only for nonstate-contingent assets. With earnings shocks only, the two market structures lead to similar results. With investment shocks, however, the two 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.
3. The savings supply curves in figure 6.1 correspond to the well-known aggregate savings curve from the closed-economy heterogeneous 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 nonstochastic consumption profile. The demand of savings is downward sloping because of the diminishing marginal productivity of capital.

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.

5. With proper rescaling of the limited liability constraints,  $a^i$ , different combinations of populations and productivities that keep the same relative aggregate GDP of the two countries constant do not affect the autarky interest rates. The postliberalization interest rate will be closer to the autarky interest rate of the country with the larger economy, independently of whether this derives from a larger population or a higher productivity.

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

7. In reality, the process of financial globalization has been gradual. However, the effects of gradual financial integration are easy to infer from those of the immediate liberalization. The transitional dynamics of the gradual liberalization would spread over time the impact of the immediate liberalization.

8. 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.

9. The model's predictions are again in line with the current situation in the world economy where poorer and less financially developed countries are net lenders to more developed countries, particularly the United States. We should also notice, however, that these countries are experiencing faster growth than industrialized countries. With growth differences, the predictions of our model are similar to those of a typical open economy neoclassical model; that is, fast growing countries should be net importers of capital. Therefore, once we consider growth differences between emerging and industrialized countries, the net flow of capital will be determined by two opposing forces: growth differences lead to an inflow toward emerging economies while financial markets differences lead to an inflow toward industrialized countries. Given that the degree of financial development in emerging economies is so far behind the one in industrialized economies, we believe that the financial channel still dominates the growth channel so that the net flow continues to be directed toward industrialized countries.

10. The lower bound for country 2 is not directly comparable to country 1 because country 1 has a higher per capita income. To make the bound comparable, we should rescale it by the per capita income ratio of the two countries. Because the ratio is 0.152, the bound for country 2,  $a^2 = -0.3$ , corresponds to  $-0.3/0.152 = -1.97$  in country 1. Hence, financial

integration would be neutral if  $\underline{a}^2 = -0.3952$ , because this corresponds to  $-0.3952/0.152 = -2.6$ , which is the limit for country 1 in the baseline calibration.

## References

- Aiyagari, S. R. 1994. Uninsured idiosyncratic risk, and aggregate saving. *Quarterly Journal of Economics* 109:659–84.
- Backus, D. K., P. J. Kehoe, and F. Kydland. 1992. International business cycles. *Journal of Political Economy* 100 (4): 745–75.
- Baxter, M., and M. J. Crucini. 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 *Contributions to Mathematical Economics in Honor of Gérard Debreu*, ed. W. Hildenbrand, and A. Mas-Colell, pp. 79–102. Amsterdam: North Holland.
- Bhagwati, J. 2004. *In defense of globalization*. New York: Oxford University Press.
- Carroll, C. D. 1997. Buffer-stock saving and the lifecycle/permanent income hypothesis. *Quarterly Journal of Economics* 112 (1): 1–55.
- Chari, V. V., P. Kehoe, and E. McGrattan. 2000. Sticky price models of the business cycle: Can the contract multiplier solve the persistence problem? *Econometrica* 68 (5): 1151–80.
- Clarida, R. H. 1990. International lending and borrowing in a stochastic stationary equilibrium. *International Economic Review* 31 (3): 543–58.
- Davila, J., J. H. Hong, P. Krusell, and J.-V. Ríos-Rull. 2005. Constrained efficiency in the neoclassical growth model with uninsurable idiosyncratic shocks. Cahiers de la Maison des Sciences Economiques b05066, Université Panthéon-Sorbonne.
- Frankel, J. 2007. New perspectives on financial globalization. Panel presentation at International Monetary Fund (IMF) conference, 27 April.
- Gourinchas, P.-O., and O. Jeanne. 2006. The elusive gains from international financial integration. *Review of Economic Studies* 73 (3): 1–31.
- Huggett, M. 1993. The risk free rate in heterogeneous-agents, incomplete insurance economies. *Journal of Economic Dynamics and Control* 17 (5/6): 953–70.
- Kehoe, P. J., and F. Perri. 2002. International business cycles with endogenous incomplete markets. *Econometrica* 70 (3): 907–28.
- Mendoza, E. 1991. Capital controls and the dynamic gains from trade in a business cycle model of a small open economy. *IMF Staff Papers* 38 (September): 480–505. Washington, D.C.: International Monetary Fund.
- Mendoza, E. G., V. Quadrini, and J.-V. Ríos-Rull. 2007. Financial integration, financial deepness, and global imbalances. NBER Working Paper no. 12909. Cambridge, MA: National Bureau of Economic Research, February.
- Mendoza, E. G. and L. L. Tesar. 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, N.J.: Princeton University Press.

Obstfeld, M., and A. M. Taylor. 2004. *Global capital markets: Integration, crisis, and growth*. New York: Cambridge University Press.

Quadrini, V. 2005. Policy commitment and the welfare gains from capital market liberalization. *European Economic Review* 49 (8): 1927–51.

Rajan, R., and L. Zingales. 2003. *Saving capitalism from the capitalists: Unleashing the power of financial markets to create wealth and spread opportunity*. New York: Crown Business.

Soros, G. 2002. *On globalization*. New York: Public Affairs Books.

Stiglitz, J. E. 2002. *Globalization and its discontents*. New York: W. W. Norton and Company.

Storesletten, K., C. Telmer, and A. Yaron. 2004. Cyclical dynamics in idiosyncratic labor-market risk. *Journal of Political Economy* 112 (3): 695–717.

## 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 nonnegative 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  $\beta(1 + r) < 1$ . 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  $a^l$  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.