

Volatility and the Welfare Costs of Financial Market Integration

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Abstract

This paper examines the effect of volatility on the costs and benefits of financial market integration. The basic framework combines the costly state verification model and the contract enforceability approach. The welfare effects of financial market integration are assessed by comparing welfare under financial autarky and financial openness—under which foreign banks, characterized by lower costs of intermediation and a lower markup rate, have free access to domestic capital markets. The analysis shows that financial integration may be welfare reducing if world interest rates under openness are highly volatile. The basic framework is then extended to consider the case of an upward-sloping domestic supply curve of funds and congestion externalities. It is shown, in particular, that opening the economy to unrestricted inflows of capital may magnify the welfare cost of existing distortions, such as congestion externalities or deposit insurance.

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1 Introduction

The view that international financial market integration brings significant long-term benefits is hardly a controversial one among mainstream economists. Financial openness, for instance, increases opportunities for portfolio risk diversification and consumption smoothing through borrowing and lending; and producers who are able to diversify risks on world capital markets may invest in more risky (and higher-yield) projects, thereby raising the country's rate of economic growth (Obstfeld, 1994, 1998). Increased access to the domestic financial system by foreign banks is often viewed as raising the efficiency of the intermediation process between savers and borrowers, thereby lowering the cost of investment. Higher foreign direct investment flows often have a direct, positive effect on productivity and the efficiency of domestic resource utilization (through transfers of technology and other intangible assets), thereby raising the rate of economic growth.

But it is increasingly recognized that a high degree of financial openness may entail significant short-term costs as well. The magnitude of the capital flows recorded by some developing countries in recent years and the abrupt reversals that such flows have displayed at times have raised serious concerns among policymakers. The Mexican peso crisis of December 1994 led to financial instability throughout Latin America, particularly so in Argentina. More recently, the collapse of the pegged exchange rate regime in Thailand on July 2, 1997 led to currency turmoil throughout Asia, particularly in Indonesia, Korea, Malaysia, and the Philippines. Both events illustrated the growing tendency for a crisis in one country to have contagion or spillover effects on other countries where similar risk and vulnerability factors are perceived by financial markets as being present—notably real exchange rate appreciation and growing current account deficits, large stocks of short-term foreign-currency denominated liabilities, banking sector weaknesses, and rapid growth in money and domestic credit.¹ As illustrated in Figure 1, external interest rate spreads rose sharply after the collapse of the Mexican peso and the Thai baht.²

¹Although economic fundamentals in some of the Asian countries that suffered from contagion appeared stronger than in Thailand (notably in Korea, Malaysia, and the Philippines), banking sector weaknesses were a key characteristic of all of them.

²Evidence that movements in external spreads depend mainly on shifts in market sentiment rather than shifts in fundamentals is provided by Eichengreen and Mody (1998), in an analysis of data on a large number of developing-country bonds (public and private)

Several observers have noted that the magnitude and depth of the economic crisis that erupted in Argentina in the aftermath of the peso crisis, and in Asia after the collapse of the Thai baht, were compounded by domestic banking sector weaknesses. These weaknesses include inefficient intermediation, inadequate lending practices, large volumes of nonperforming loans, excessive exposure to the property sector (as was the case in Thailand), unhedged short-term liabilities in foreign currency, limited and inaccurate disclosure of financial statements by borrowers, and ineffective supervision. In a previous paper (Agénor and Aizenman, 1998) we examined the implications of domestic capital market imperfections by considering an economy characterized by a direct link between bank credit and the supply side (through firms' working capital needs) and a two-level financial intermediation process: domestic banks were assumed to borrow at a premium on world capital markets, and domestic agents to borrow at a premium from domestic banks. We showed that both domestic and external financial intermediation spreads are related to default probabilities and underlying domestic shocks. We then defined contagion as a mean-preserving increase in the volatility of aggregate shocks impinging on the domestic economy and argued that, to the extent that such an increase translates into a rise in the probability of default on existing loan commitments, domestic and foreign interest rate spreads will tend to rise, leading to a fall in output. Thus, our analysis helped to identify a mechanism through which financial market imperfections may magnify an initial exogenous shock. It also helped to understand the effects of measures aimed at reducing inefficiencies in the intermediation process, such as a reduction in the cost of contract enforcement.

This paper extends our previous work to examine the role played by volatility in assessing the costs and benefits of financial market integration. As in our earlier analysis, it combines the costly state verification approach pioneered by Townsend (1979) and the model of limited enforceability of contracts used frequently in the external debt literature, as in Eaton et al. (1986), Bulow and Rogoff (1989), and Helpman (1989).³ Section II presents the basic framework. Section III considers the case of autarky, in which domestic banks have access only to domestic savings as a source of loanable

launched during Jan. 1991-Dec. 1996.

³Limitations in the ability of banks to enforce the provisions of loan contracts (including seizure of collateral) has been viewed by some observers as one of the key weaknesses of the legal infrastructure that characterizes many of the Asian countries that suffered from contagion in the aftermath of the Thai baht crisis.

funds. Section IV focuses on the case in which financial openness leads to free access to domestic capital markets by foreign banks and to lower costs of intermediation. Section V derives the welfare effects of capital market integration by comparing welfare under financial autarky and financial openness. Sections VI and VII extend the basic framework to consider the case of an upward-sloping domestic supply curve of funds. Section VIII summarizes the main results of the analysis and offers some concluding remarks.

2 The Basic Framework

Our basic framework considers an economy in which risk-neutral banks provide intermediation services to domestic agents—producers which demand credit to finance their investment projects.⁴ The project’s future productivity is random. The realized productivity shock is revealed to banks only at a cost. If a producer chooses to default on its loan repayment obligations, the bank seizes any collateral set as part of the loan contract, plus a fraction κ of the project’s value. Seizing involves two types of costs. First, verifying the net worth of the project is costly; second, enforcing repayment requires costly recourse to the legal system.

We start with the simplest case, in which all projects are identical *ex ante*, and of the same scale. Investment H in project i yields (future) output of

$$y_i = M(1 + \varepsilon_i), \quad |\varepsilon_i| \leq U < 1, \quad i = 1, \dots, n, \quad (1)$$

where ε_i is the realized productivity shock.⁵ Equation (1) can be viewed as a reduced form which relates a variable input, M , to output. For simplicity, we assume a Ricardian technology, and take the price of input M is as constant and normalized to unity.

Again for simplicity, we assume that producers cannot issue claims on future output and cannot pledge collateral.⁶ Let r_L^i be the contractual interest

⁴More specifically, only producers who lack access to the equity market rely on bank credit to finance their projects.

⁵Note that there is no aggregate risk in our model. All firms are identical and the productivity shock ε_i is uncorrelated among them.

⁶We also ignore the possibility of randomized monitoring. The key results of our analysis would continue to hold in this case as long as implementation and enforcement of loan contracts involves real costs, as implied by the results of Bernanke and Gertler (1989) and Boyd and Smith (1994). In the Bernanke-Gertler framework, for instance,

rate; producer i will default if repayment in the event of default, $\kappa M(1 + \varepsilon_i)$, is less than contractual repayment, $(1 + r_L^i)H$:

$$\kappa M(1 + \varepsilon_i) < (1 + r_L^i)H. \quad (2)$$

Let ε_i^* denote the highest value of the productivity shock leading to default, that is

$$\kappa M(1 + \varepsilon_i^*) = (1 + r_L^i)H, \quad (3)$$

which implies that

$$\varepsilon_i^* = (1 + r_L^i)H/\kappa M - 1, \quad (4)$$

which shows that, for ε_i^* to be negative, expected output, M , times κ , must exceed contractual repayment.

If default never occurs, ε_i^* is set at the lower end of the support ($\varepsilon_i^* = -U$). In case of default, the bank's revenue on its loan to producer i , Π_i , is the producer's repayment minus the state verification and contract enforcement cost, C_i ,⁷

$$\Pi_i = \kappa M(1 + \varepsilon_i) - C_i. \quad (5)$$

3 Financial Autarky

Under financial autarky, domestic banks have access to only a given amount of domestic funds, S , at a real cost of r_A . More specifically, we assume that the domestic supply of funds is perfectly elastic up to a given ceiling. We are also assuming that the demand for credit is never constrained. These assumptions rule out the possibility of credit rationing due to supply shortage, a possibility

loan contracts under random monitoring involve also a schedule specifying the probability of monitoring as a function of the output announced by the borrower. They show that the monitoring probability is positive for a low value of declared output, depending negatively on the announced output. Thus, random monitoring does not negate the need to engage in costly verification of the realized state of nature.

⁷ C is a lump-sum cost paid by banks in order to identify the productivity shock ε_i , and to enforce proper repayment. The analysis would be more involved if some costs were paid *after* obtaining the information about ε_i . In these circumstances, banks would refrain from forcing debt repayment when the realized productivity is below an "enforcement threshold." For simplicity of exposition, we refrain from modeling this possibility. We ignore also all other real costs associated with financial intermediation. Adding these considerations would not modify the key insight of our analysis.

modeled by Williamson (1986, 1987).⁸ Banks are risk neutral, and compete in a manner akin to monopolistic competition. This assumption about market structure is captured by postulating a mark-up pricing rule, whereby banks demand the expected yield on their loanable funds (net of enforcement costs) to be $\theta_A(1 + r_A)$, where $\theta_A \geq 1$.⁹ Consequently, the contractual interest rate is determined by the break-even condition:

$$\theta_A(1 + r_A)H = \int_{\varepsilon_i^*}^U [(1 + r_L^i)H]f(\varepsilon)d\varepsilon + \int_{-U}^{\varepsilon_i^*} [\kappa M(1 + \varepsilon_i) - C_i]f(\varepsilon)d\varepsilon, \quad (6)$$

where $f(\varepsilon)$ is the density function of ε . Equation (6) can be rewritten as

$$\theta_A(1 + r_A)H = (1 + r_L^i)H - \int_{-U}^{\varepsilon_i^*} [(1 + r_L^i)H - \kappa M(1 + \varepsilon_i)]f(\varepsilon)d\varepsilon - C_i \int_{-U}^{\varepsilon_i^*} f(\varepsilon)d\varepsilon.$$

Substituting (3) for $(1 + r_L^i)H$ in the second term on the right-hand side of the above equation and rearranging yields the interest rate spread as

$$1 + r_L^i = \theta_A(1 + r_A) + \frac{\kappa M \int_{-U}^{\varepsilon_i^*} (\varepsilon_i^* - \varepsilon)f(\varepsilon)d\varepsilon}{H} + \frac{C_i \int_{-U}^{\varepsilon_i^*} f(\varepsilon)d\varepsilon}{H}. \quad (7)$$

Equation (7) shows that the (gross) contractual interest rate is determined by a mark-up rule, which exceeds the bank's net return on its funds by the sum of two terms. The first term, $\kappa M \int_{-U}^{\varepsilon_i^*} (\varepsilon_i^* - \varepsilon)f(\varepsilon)d\varepsilon/H$, is the expected revenue lost due to partial default in bad states of nature. The second term, $C_i \int_{-U}^{\varepsilon_i^*} f(\varepsilon)d\varepsilon/H$, measures the expected state verification and contract enforcement costs.

The producer's expected net income under autarky is equal to expected output, M , minus expected repayment in "good" and "bad" states of nature:

$$M - \int_{\varepsilon_i^*}^U [(1 + r_L^i)H]f(\varepsilon)d\varepsilon - \kappa M \int_{-U}^{\varepsilon_i^*} (1 + \varepsilon_i)f(\varepsilon)d\varepsilon. \quad (8)$$

⁸The key results in Sections III to V can be shown to hold even if the supply of saving is upward sloping, as long as it is sufficient to finance existing projects at an interest rate r_A that is not prohibitively high. Sections VI and VII extend our discussion to consider the case in which the supply curve of domestic funds is positively related to interest rates.

⁹See Sussman (1993) for a model where the markup is derived endogenously for an economy where the cost of financial intermediation increases with the producer's distance from the bank.

Applying (6), we can simplify (8) to

$$M - \theta_A(1 + r_A)H - C \int_{-U}^{\varepsilon_i^*} f(\varepsilon)d\varepsilon. \quad (9)$$

Using (5), the domestic bank’s expected net income is equal to expected repayment in “good” and “bad” states of nature, minus the cost of enforcement in bad states of nature and minus repayment of principal with interest at the rate r_A to lenders of funds:

$$(1 + r_L^i)H \int_{\varepsilon_i^*}^U f(\varepsilon)d\varepsilon + \int_{-U}^{\varepsilon_i^*} [\kappa M(1 + \varepsilon_i) - C]f(\varepsilon)d\varepsilon - (1 + r_A)H. \quad (10)$$

Using (6) and (10) the bank’s expected net income can be written as

$$(1 + r_A)(\theta_A - 1)H. \quad (11)$$

4 Financial Openness

Economists often claim that financial openness, by providing free access by foreign banks to domestic capital markets, often lead to an increase in the degree of efficiency of the financial intermediation process (by lowering costs and “excessive” profits)—thereby lowering the cost of investment and improving resource allocation. Levine (1996), for instance, has argued that foreign banks may

- improve the quality and availability of financial services in the domestic financial market by increasing bank competition, and enabling the application of more sophisticated banking techniques and technology;
- serve to stimulate the development of the underlying bank supervisory and legal framework;
- enhance a country’s access to international capital.

Surprisingly enough, there is relatively limited evidence supporting these claims. A recent study by Claessens, Demirguc-Kunt and Huizinga (1998) provides the most systematic attempt to date to analyze empirically the cost and profitability effects of foreign banks, in both developed and developing countries. Some of the data used by Claessens, Demirguc-Kunt and Huizinga

is summarized in Figures 2 to 5.¹⁰ Figures 2, 3 and 4 suggest that in developed countries foreign banks have lower net interest margins—defined as net interest income divided by total assets—lower overhead costs, and lower profitability than domestic banks. The evidence for developing countries, however, is somewhat mixed. Figure 5 suggests that increased penetration of foreign banks in the domestic banking system of developing countries—as measured by either the importance of foreign banks in terms of numbers or in terms of assets—is associated with a reduction in both profitability and overhead costs for domestic banks.¹¹ The econometric evidence provided by Claessens, Demirguc-Kunt and Huizinga corroborate these last two findings in a more rigorous way.

To capture in a formal sense the evidence that foreign banks are more efficient than domestic banks (due to either experience or scale effects) we assume that the loan enforcement and supervision costs faced by foreign banks, measured by C^* , may differ from the costs faced by domestic banks, C . Financial openness is also assumed to be associated with more intense competition, which leads to a drop in the markup from θ_A to $\theta_O < \theta_A$, and to a change in the supply cost of savings from r_A to r_O . Hence,¹²

$$\theta = \begin{cases} \theta_A & \text{in autarky} \\ \theta_O < \theta_A & \text{under openness} \end{cases}, \quad r = \begin{cases} r_A & \text{in autarky} \\ r_O & \text{under openness} \end{cases}.$$

With financial openness, the break-even condition of foreign banks operating in the domestic economy is given by an equation analogous to (6):

$$\theta_O(1 + r_O)H = \int_{\varepsilon_i^*}^U [(1 + r_L^i)H]f(\varepsilon)d\varepsilon + \int_{-U}^{\varepsilon_i^*} [\kappa M(1 + \varepsilon_i) - C^*]f(\varepsilon)d\varepsilon, \quad (12)$$

and the interest rate spread analogous to (7) is given by

$$1 + r_L^i = \theta_O(1 + r_O) + \frac{\kappa M \int_{-U}^{\varepsilon_i^*} (\varepsilon_i^* - \varepsilon)f(\varepsilon)d\varepsilon}{H} + \frac{C^* \int_{-U}^{\varepsilon_i^*} f(\varepsilon)d\varepsilon}{H}. \quad (13)$$

¹⁰The sample considered by Claessens, Demirguc-Kunt and Huizinga in their study relates to bank-level data for 80 countries (developed and developing) covering the period 1988-95, with about 7900 individual commercial bank observations. The source of the data is IBCA, Europe's largest credit rating agency. The data shown in Figures 2-5 exclude transition countries from the original sample. A bank is said to be foreign-owned if 50 percent or more of its capital is owned by foreign residents.

¹¹The effect on net interest margins, by contrast, is not significant.

¹²Note that we do not make any assumption regarding the value of C^* relative to the costs faced by domestic banks, C . See the discussion below.

We assume that, in line with the literature on limit-pricing theory (see for instance, Milgrom and Roberts, 1982), the threat of entry by foreign banks forces domestic banks to charge to domestic borrowers the interest rate that foreign banks would potentially charge them. Hence, the contractual interest rate r_L is determined by (the threat of entry of) foreign banks. The domestic bank's expected net income is now

$$(1 + r_L^i)H \int_{\varepsilon_i^*}^U f(\varepsilon)d\varepsilon + \int_{-U}^{\varepsilon_i^*} [\kappa M(1 + \varepsilon_i) - C]f(\varepsilon)d\varepsilon - (1 + r_O)H, \quad (14)$$

with r_L determined by (13), instead of the break-even condition (6).

The producer's expected net income equals

$$M - \int_{\varepsilon_i^*}^U [(1 + r_L^i)H]f(\varepsilon)d\varepsilon - \kappa M \int_{-U}^{\varepsilon_i^*} (1 + \varepsilon_i)f(\varepsilon)d\varepsilon. \quad (15)$$

Applying (12), we can simplify (15) to

$$M - \theta_O(1 + r_O)H - C^* \int_{-U}^{\varepsilon_i^*} f(\varepsilon)d\varepsilon. \quad (16)$$

Suppose that the shock ε follows a uniform distribution, so that $-U \leq \varepsilon \leq U$. The spread (13) is in this case characterized by a quadratic equation

$$1 + r_L^i = \theta_O(1 + r_O) + \frac{U\kappa M}{H}\Phi_i^2 + \frac{C^*}{H}\Phi_i, \quad (17)$$

where Φ_i , given by $\Phi_i = \int_{-U}^{\varepsilon_i^*} f(\varepsilon)d\varepsilon = (U + \varepsilon_i^*)/2U$, is the probability of default.

The second term of (17) is illustrative of how producers pay for the information asymmetry through the banks' mark-up rule. Combining equations (3), (15) and (17), the contractual interest rate can be solved for as a function of the banks' cost of funds. In general, this curve is nonlinear, and in the case of a uniform distribution for ε it is quadratic:

$$\theta_O(1 + r_O) + \Psi g(r_L^i)^2 + \frac{C^*}{H}g(r_L^i) - (1 + r_L^i) = 0, \quad (18)$$

where $\Psi = U\kappa M/H$ and

$$g(r_L^i) = \frac{1}{2} - \frac{1}{2U} + \frac{1 + r_L^i}{2\Psi}.$$

It can be inferred from (18) that

$$\frac{dr_L^i}{dr_O} = -\frac{\theta_O}{\Phi_i + (C^*/2H\Psi) - 1}. \quad (19)$$

Further insight regarding (19) can be inferred from Figure 6, which relates repayment to the value of the productivity shock, ε . Curve BB (respectively AA) corresponds to the left-hand side (respectively right-hand side) of equation (2). The intersection of these curves determines ε^* . The probability of repayment is determined by the length of the segment $U\varepsilon^*$, normalized by $2U$. Curve $A'A'$ corresponds to a marginal increase in the contractual interest rate by Δr_L . A higher interest rate affects the bank's expected repayment in two opposite directions. On the one hand, expected repayment increases by the shaded area (which represents the increase in the value to be repaid in good states of nature, at a given level of the demand for loans) normalized by $2U$ —an area which is also equal to the probability of repayment, $1 - \Phi_i$, because Φ_i is the probability of default—times $H\Delta r_L$. On the other, expected repayment falls as a result of the increase in expected intermediation costs, which is equal to C^* times $[(d\varepsilon^*/dr_L)/2U]\Delta r_L$.¹³ The net increase in expected repayment is thus given by

$$\left\{ (1 - \Phi_i)H - \frac{C^*}{2U} \frac{d\varepsilon^*}{dr_L} \right\} \Delta r_L.$$

From (4), $d\varepsilon^*/dr_L = H/\kappa M > 0$. Substituting this result in the above expression yields

$$\left\{ (1 - \Phi_i) - \frac{C^*}{2U\kappa M} \right\} H\Delta r_L. \quad (20)$$

Hence, the condition for observing $\Delta r_L/\Delta r_O > 0$ is that, for $\Phi_i = 0$:

$$1 - \frac{C^*}{2U\kappa M} > 0,$$

or equivalently $C^*/2U < \kappa M$. Thus, if the foregoing condition is satisfied, we will observe an upward-sloping portion for the contractual interest rate/cost of loanable funds curve.

Suppose that this condition is met. If $\kappa M(1 - U) < H\theta_O(1 + r_O)$, then (given the definition of ε_i^* given above) $U + \varepsilon_i^* > 0$ and the probability of

¹³Recall from the previous discussion that $\Phi_i = (U + \varepsilon_i^*)/2U$. Thus, $d\Phi_i/dr_L = (2U)^{-1}d\varepsilon^*/dr_L$.

default, Φ_i , will be positive. In these circumstances the interest rate/cost of credit curve is backward bending, as shown in Figure 7. In this figure, point M is reached when the term in brackets in (20) is zero.

With a low level of bank funding cost, if we also have $\kappa M(1 - U) > H\theta_O(1 + r_O)$, then Φ_i , the probability of default, will be zero—as is the case along portion KL in Figure 7 where, as implied by the break-even condition (17) with $\Phi_i = 0$,

$$1 + r_L^i = \theta_O(1 + r_O).$$

At a high enough level of the banks' funding cost (and thus of the contractual lending rate), producers will default in the worst states of nature, as is the case if

$$r_O \geq \tilde{r}_O = \kappa M(1 - U)/\theta H - 1.$$

The point at which $r_O = \tilde{r}_O$ corresponds to point L in Figure 7. Beyond \tilde{r}_O , a further increase in the banks' funding cost would increase the probability of default, leading to an increasing risk premium and a higher contractual rate, moving along portion LM . Equation (19) implies that, moving above point L , the slope of the curve increases as the probability of default rise. At a high enough cost of funding on world capital markets, the economy would reach point M (at which point $r_O = \hat{r}_O$), where further rises in the banks' funding cost would make the project unfeasible. This will happen because a higher contractual lending rate reduces the probability of repayment, and at point M further increases in this rate raises the probability of default at a rate that is high enough to reduce expected repayment. It can be verified that interest rates at point M are given by¹⁴

$$\hat{r}_L = \frac{\kappa M(1 + U) - C^*}{H} - 1, \quad \hat{r}_O = \frac{(C^{*2}/4U\kappa M) + \kappa M - C^*}{\theta H} - 1. \quad (21)$$

In general, given that changes in the cost of funds affects expected repayment in two opposite directions (as discussed earlier) there are two domestic contractual rates associated with each level of r_O . The high interest rate is

¹⁴It can be inferred from (21) that

$$sg\left(\frac{d\hat{r}_O}{dC^*}\right) = sg\left(\frac{C^*}{2U\kappa M} - 1\right) < 0, \quad sg\left(\frac{d\hat{r}_O}{d\kappa}\right) = -sg\left(\left[\frac{C^*}{2U\kappa M}\right]^2 U - 1\right) > 0,$$

given the condition derived earlier for generating an upward-sloping portion for the curve linking r_L and r_O . Higher enforcement and verification costs, for instance, lower the threshold level of the funding cost above which lending becomes unfeasible.

also associated with a low probability of repayment. We will assume that competitive forces will prevent the inefficient equilibrium associated with operating on the backward-bending portion of the curve (segment MN). Equation (21) implies that higher domestic volatility—an increase in U —would shift point M upward and to the left. This is confirmed by the dotted curve in Figure 7, with point M shifting to point M' .¹⁵

5 Welfare Effects of Financial Integration

We turn now to an evaluation of the dependency of domestic welfare on the foreign interest rate. Our welfare criterion is the sum of the expected net income of domestic producers and domestic banks, and the net surplus of domestic savers. We assume throughout this section that domestic saving is exogenously given at a level S , with $S \geq H$ with a reservation price of saving of $1 + r_A$. These assumptions imply that the supply of saving and the demand for credit have inverted L-shapes, elastic up to a ceiling. In the next section we focus on the more general case of upward-sloping supply and downward-sloping demand curves.

Consider first the case of financial autarky. Net expected income of domestic producers is given by Equation (9), that is, under the assumption of a uniform distribution, by

$$M - \theta_A(1 + r_A)H - C\Phi_A, \quad (22)$$

where $\Phi_A = \int_{-U}^{\varepsilon_i^*} d\varepsilon/2U$ is the probability of default under autarky.

Using (10), expected net income of domestic banks under the assumption of a uniform distribution is given by

$$(1 - \Phi_A)(1 + r_L^i)H + \frac{1}{2U} \int_{-U}^{\varepsilon_i^*} [\kappa M(1 + \varepsilon_i) - C]d\varepsilon - (1 + r_A)H,$$

where $1 - \Phi_A = \int_{\varepsilon_i^*}^U d\varepsilon/2U$ is the probability of repayment under autarky.

¹⁵As noted earlier, banks are assumed to operate only (as a result of efficiency considerations) on the upward-sloping portion of this curve. It can be verified that if $C^*/2U > \kappa M$, a credit ceiling will be reached at the lowest level of loans associated with default. In these circumstances the supply curve has an inverted L shape. This would occur if verification costs are too large to be recovered, in which case banks would not supply credit levels that would lead to default in some states of nature.

As shown earlier (equation (11)), expected income of banks under autarky is given by $(1 + r_A)(\theta_A - 1)H$. Finally, the net surplus of domestic savers under autarky, given the assumption of a reservation gross rate of return of $1 + r_A$, is $(1 + r_A)H - (1 + r_A)H = 0$. Collecting terms, domestic welfare in autarky can be written as:

$$W_A = \begin{cases} M - \theta_A(1 + r_A)H - C\Phi_A \\ +(1 + r_A)(\theta_A - 1)H \\ +0 \end{cases} = M - (1 + r_A)H - C\Phi_A. \quad (23)$$

Consider now the case of financial openness. As indicated earlier, we assume that, following financial integration, competitive forces bid up the interest rate facing domestic savers to the international level of r_O . Suppose first that following the liberalization all projects are still financed domestically, at an interest rate that reflects the integrated equilibrium. Hence, the threat of foreign intermediation suffices to reduce the contractual interest rate that prevails in the financially-closed economy to the level dictated by international market conditions.

Net expected income of domestic producers is now

$$M - \theta_O(1 + r_O)H - C^*\Phi_O,$$

where Φ_O is the probability of default under openness. It is easy to verify that, as long as the assumption that $(1 + r_A)(1 + \theta_A) > (1 + r_O)(1 + \theta_O)$ holds initially, the incidence of default is lower under openness than under autarky ($\Phi_O < \Phi_A$).

To calculate the net expected income of domestic banks under openness proceeds as follows. If all the effective financial intermediation is done by domestic banks, then the cost C is the effective cost of intermediation for welfare calculation (see equation (14)). As also noted above, under financial openness the cost of credit facing domestic borrowers is determined by the entry threat of foreign banks; as a result, domestic banks will charge the interest rate determined by (13). Using equations (13) and (14), we have

$$\{\theta_O(1 + r_O) - (1 + r_O)\}H - (C - C^*)\Phi_O.$$

Note that the threat of foreign competition induces banks to absorb the gap between their intermediation cost and that of foreign banks; this implies that their expected profits will be lower than that of foreign banks by the quantity $(C - C^*)\Phi_O$.

Finally, the net surplus of domestic savers is now

$$(1 + r_O)S - (1 + r_A)S = (r_O - r_A)S.$$

Collecting terms, domestic welfare under openness is thus

$$W_O = \begin{cases} M - \theta_O(1 + r_O)H - C^*\Phi_O \\ +\{\theta_O(1 + r_O) - (1 + r_O)\}H - (C - C^*)\Phi_O \\ + (r_O - r_A)S & \text{if } r_O < \hat{r}_O, \\ 0 \\ +0 \\ + (r_O - r_A)S & \text{if } r_O > \hat{r}_O. \end{cases} \quad (24)$$

or, after rearranging terms,

$$W_O = \begin{cases} M - (1 + r_O)H - C\Phi_O + (r_O - r_A)S & \text{if } r_O < \hat{r}_O, \\ (r_O - r_A)S & \text{if } r_O > \hat{r}_O. \end{cases} \quad (25)$$

The first three panels in Figure 8 depict the relationship between net expected income for each category of agents and the foreign interest rate, r_O .¹⁶ The figures show that higher bank funding costs reduce the net expected income of domestic producers, as this implies both higher cost of credit and more frequent incidence of costly default. Banks' welfare has an inverted U shape with a linear segment—higher interest rates raise net expected income for a given incidence of default, and increases the frequency of default. Savers are unambiguously better off.

The change in domestic welfare under openness resulting from an increase in the world interest rate is given by, from (25):

$$\frac{\partial W_O}{\partial r_O} = \begin{cases} (S - H) - C(\partial\Phi_O/\partial r_O) & \text{if } r_O < \hat{r}_O, \\ S & \text{if } r_O > \hat{r}_O. \end{cases},$$

where it can be verified that $\partial\Phi_O/\partial r_O > 0$. The lower panel on the right in Figure 8 illustrates the relation between net welfare and the banks' funding cost, under the assumption that $(S - H) - C(\partial\Phi_O/\partial r_O) < 0$. The figure

¹⁶In Drawing Figure 8, we assume that $r_A = 0$.

shows that welfare is concave in r_O for $r_O < \hat{r}_O$ and experiences a discrete downward jump for $r_O = \hat{r}_O$.

We infer the welfare effects of financial integration by comparing the welfare levels under financial autarky to those achieved under openness, as defined above. Applying (24) and (23) we infer that the welfare gain from financial integration, $\Delta W = W_O - W_A$, is

$$\Delta W = \begin{cases} C(\Phi_A - \Phi_O) + (r_O - r_A)(S - H) & \text{if } r_O < \hat{r}_O, \\ -(M - (1 + r_A)H - C\Phi_A) + (r_O - r_A)S & \text{if } r_O > \hat{r}_O. \end{cases} \quad (26)$$

The above expression shows that if the interest rate facing the country is sufficiently low, financial integration will be accompanied with a welfare gain due to the fall in (expected) intermediation costs associated with a lower probability of default, as well as the increase in the net surplus of domestic savers attributed to the higher interest rate on saving net of investment. However, if the interest rate facing the country is relatively high, projects will become unfeasible, leading to a loss of the entire expected net income of domestic producers in that state of nature. The limited ability of lenders to enforce the provisions of loan contracts prevents the financing of domestic projects, despite the fact that they may lead to a large expected net income.

To illustrate the impact of volatility on welfare, suppose that the only source of macroeconomic uncertainty is fluctuations in the world interest rate, r_O , whose degree of volatility may be affected by global conditions, as well as contagion effects induced by events occurring in, say, neighboring countries. Specifically, suppose that the foreign interest rate fluctuates between $r_O^* + \delta$ and $r_O^* - \delta$, each state with probability one half, that is,

$$r_O = \begin{cases} r_O^* + \delta & \text{with prob. } 0.5 \\ r_O^* - \delta & \text{with prob. } 0.5 \end{cases}.$$

This specification implies a monotonic relationship between changes in δ and increased volatility. Let $\Phi_O|_{r_O=r_O^*+\delta}$ (respectively $\Phi_O|_{r_O=r_O^*-\delta}$) denote the value of the probability of default when $r_O = r_O^* + \delta$ (respectively $r_O = r_O^* - \delta$). The expected value of Φ_O , $\mathbf{E}\Phi_O$, is given by

$$\mathbf{E}\Phi_O = 0.5(\Phi_O|_{r_O=r_O^*+\delta} + \Phi_O|_{r_O=r_O^*-\delta}).$$

Using (25), we have

$$W_O = \begin{cases} M - (1 + r_O^*)H - C\mathbf{E}\Phi_O + (r_O^* - r_A)S & \text{if } \delta < \hat{r}_O - r_O^* \\ 0.5[M - (1 + r_O^* - \delta)H - C\Phi_O|_{r_O=r_O^*-\delta}] + (r_O^* - r_A)S & \text{if } \delta > \hat{r}_O - r_O^* \end{cases}.$$

This equation implies that, at $\delta = \hat{r}_O - r_O^*$, welfare drops by

$$0.5[M - (1 + r_O^* + \delta)H - C\Phi_O|_{r_O=r_O^*+\delta}].$$

Domestic welfare is plotted in Figure 9. As shown in the figure, as long as $\delta < \hat{r}_O - r_O^*$, higher volatility reduces welfare by a second-order magnitude due to the convexity of the welfare function. If $\delta > \hat{r}_O - r_O^*$, by contrast, volatility induces a potentially large welfare loss, as it leads to a fall in domestic investment in bad states of nature, when the foreign interest rate is high. This is because, as indicated earlier, projects become unfeasible in bad states of nature, leading to a loss of the entire expected net income of domestic producers. Figure 9 shows that if welfare under financial autarky is at level FA , financial openness is welfare improving only if the volatility of the foreign interest rate is sufficiently low.

The foregoing discussion can thus be summarized by the following proposition:

Proposition 1 *Financial integration may be welfare reducing if the foreign interest rate facing the economy under openness is more volatile than the interest rate that prevails under financial autarky.*

It is worth emphasizing that the above results do not depend on C^* being either greater or lower than C , the enforcement and verification costs faced by domestic banks. For instance, the welfare gain from financial integration, as given by (26), does not depend on C^* . This is important because, in the present model—in which, despite the threat of entry by foreign banks, financial intermediation is actually conducted by domestic banks—whether C^* is greater or lower than C cannot be established a priori. It may be argued, in particular, that although foreign banks may face lower *monitoring* costs than domestic banks (as a result of, say, better screening technologies for loan applications), domestic banks may face lower *enforcement* costs as a result of a privileged relationship with domestic law enforcement agencies.

6 Endogenous Supply of Funds

Our framework can be extended to allow for an upward-sloping domestic supply curve of saving, and by assuming *ex ante* heterogeneity of projects—which translates into heterogeneity of loan contracts as well. Specifically, suppose that the domestic saving function is given by

$$S = S(r), \quad S' \geq 0. \quad (27)$$

The production function is now given by a modified version of (1). Specifically, we now assume that although projects continue to be of the same scale—requiring a lump-sum investment of H to be implemented—they are *ex ante* heterogeneous, and are ranked according to their productivity:

$$Y_i = M(i)(1 + \varepsilon_i); \quad M(i) \geq M(i + 1), \quad (28)$$

where n is the total number of projects, which is determined endogenously below. We assume that, *ex ante*, banks do not observe the productivity of producer i . Hence, banks cannot discriminate among producers and are offering the same interest rate for. Consequently, the probability of default from the point of view of the various producers varies, being higher for higher i . To simplify notations, we will denote by $\Phi(i)$ the probability of default of producer i , and by Φ the average probability of default. This average probability of default is the one that determines the expected repayment from the point of view of domestic banks.

The closed-economy equilibrium is characterized by two conditions. First, the expected rent of the marginal producer (denoted by n_A) is dissipated. Second, the domestic supply of saving finances the investment. These two conditions are

$$M(n_A) = \theta_A(1 + r_A)H + C\Phi_A(n_A), \quad S(r_A) = n_A H, \quad (29)$$

or, alternatively,

$$\frac{M(n_A) - C\Phi_A(n_A)}{\theta_A H} = 1 + r_A, \quad S(r_A) = n_A H, \quad (30)$$

where $S(r_A)$ is the supply curve of domestic savings, denoted SS in what follows.

For simplicity of exposition, we normalize H to unity and ignore integer constraints implied by the ranking procedure used in (28). Figure 10 provides

a diagrammatic analysis of welfare under financial autarky. Curve DD plots the combinations of $(n, 1 + r_A)$ that satisfy the left-hand side of the first equation in (30), the marginal producer's expected output net of enforcement costs, divided (with $H = 1$) by the markup, that is $[M(n_A) - C\Phi_A(n_A)]/\theta_A$. It defines the demand for saving (or loanable funds) by domestic banks. Curve AA magnifies DD by the markup—that is, it is the marginal producer's expected output net of enforcement costs, $M(n_A) - C\Phi_A(n_A)$. The area BS corresponds to expected banks' rents, PS to the producers' surplus, and DS to savers' surplus.

The scale of production, n_A , is determined by the intersection of the demand for saving, DD , with the supply curve, SS . Note that the expected producers' surplus is given by

$$\int_0^{n_A} M(i)di - n_A[C\Phi_A + \theta_A(1 + r_A)]. \quad (31)$$

Hence, the expected surplus of producer i is $M(i) - C\Phi_A(i) - \theta_A(1 + r_A)$.

Under financial openness, the equilibrium condition (29) becomes (again, with $H = 1$):

$$M(n_O) = \theta_O(1 + r_O) + C^*\Phi_O(n_O). \quad (32)$$

Figure 11, drawn for the case in which all domestic intermediation is actually done by domestic banks (as assumed earlier), evaluates domestic welfare in the open economy. The upper panel corresponds to the case in which the cost of credit is relatively high, whereas the lower panel depicts the case in which the cost of credit is relatively low. Opening the economy to financial flows has the effect of shifting both AA and DD to new positions, which correspond to the dashed curves $A'A'$ and $D'D'$. The position of these curves relative to that in autarky is affected by the change in the probability of default. If the cost of foreign capital is relatively low, it will reduce the incidence of default, and will shift both curves upward. This is depicted in the lower panel. The availability of intermediation services at a lower monitoring cost shifts curve AA upward, to $A'A'$. The fall in the markup rate and the reduction in monitoring costs shift curve DD also upward, to $D'D'$. Assuming that banks have access to capital at a cost of $1 + r_O$, the domestic interest rate facing savers drops from $r = r_A$ to $r = r_O$. In this particular case, the surplus of domestic savers drops, as the interest rate falls. The net outcome for domestic banks is ambiguous—the volume of intermediation has increased but the markup has declined; and banks are

absorbing the domestic-foreign monitoring and enforcement cost gap. The net expected income of domestic producers unambiguously increases, as a result of the fall in the cost of financing and the rise in output.¹⁷ Overall, domestic welfare will increase.

Formally, from (31) we infer that the net expected income of producers under financial openness is

$$\int_0^{n_O} M(i)di - n_O[C^*\Phi_O + \theta_O(1 + r_O)].$$

Assuming again that all intermediation is actually done by domestic banks, their net expected income is

$$n_O[C^*\Phi_O + \theta_O(1 + r_O)] - n_O[C\Phi_O + (1 + r_O)].$$

Adding the net expected income of producers and banks yields

$$\int_0^{n_O} M(i)di - n_O[C\Phi_O + (1 + r_O)].$$

Hence, the marginal social benefit of project n , obtained by deriving the above expression with respect to n , is

$$-nC\frac{\partial\Phi}{\partial n} + M(n) - [C\Phi_O + (1 + r_O)]. \quad (33)$$

Thus, the socially-optimal number of projects, n_O , is determined by

$$M(n_O) - C\Phi_O - n_OC\frac{\partial\Phi}{\partial n} = 1 + r_O, \quad (34)$$

from which it can be shown that $n_O > n_A$ in the lower panel of Figure 11.

By contrast, if financial integration increases the cost of funds to a high level, it would ultimately increase the probability of partial default, shifting both curves inward; this is the case depicted in the upper panel of Figure 11. In this case, domestic welfare will unambiguously fall.

¹⁷As discussed below, however, in the presence of congestion effects the surplus of domestic producers would be also affected in an opposite direction: greater congestion would tend to reduce net expected income. Figure 11 assumes that $C = C^*$.

7 Congestion Externalities

The foregoing discussion can be further extended to consider jointly the case of endogenous domestic savings and congestion externalities. In the presence of such externalities, output is now determined by, instead of (28):

$$Y_i = M(i)n^{-\alpha}(1 + \varepsilon_i); \quad M(i) \geq M(i + 1), \quad (35)$$

where $\alpha > 0$ measures the intensity of congestion. The conditions that characterize the closed-economy equilibrium are now given by, with $H = 1$:

$$\frac{n_A^{-\alpha}M(n_A) - C\Phi_A(n_A)}{\theta_A} = 1 + r_A, \quad S(r_A) = n_A, \quad (36)$$

where $S(r_A)$ is again the supply curve of domestic savings under autarky.

The upper panel in Figure 12 provides a diagrammatic analysis of welfare in the closed economy. Curve DD plots, as before, the demand for saving by domestic banks, that is, the quantity $[n_A^{-\alpha}M(n_A) - C\Phi_A(n_A)]/\theta_A$. Curve AA magnifies DD by the markup, and is given by $n_A^{-\alpha}M(n_A) - C\Phi_A$. The scale of production, n_A , is again determined by the intersection of DD and SS .

The expected producers' surplus is now given by

$$n_A^{-\alpha} \int_0^{n_A} M(i)di - n_A[C\Phi_A + \theta_A(1 + r_A)]. \quad (37)$$

Hence, the expected surplus of producer i is $n_A^{-\alpha}M(i) - C\Phi_A(i) - \theta_A(1 + r_A)$, for $i = 1, \dots, n_A$. Curve OO depicts producer i 's expected output net of enforcement costs, plotted for the closed-economy equilibrium, where $n = n_A$ (it corresponds to $n_A^{-\alpha}M(n_A) - C\Phi_A(n_A) - \theta_A(1 + r_A)$). As before, area DS is the savers' (or depositors') surplus, area BS is the banks' surplus, and area PS is the expected producers' surplus.

Under financial openness, the equilibrium condition (29) becomes (again, with $H = 1$):

$$n_O^{-\alpha}M(n_O) = \theta_O(1 + r_O) + C^*\Phi_O(n_O). \quad (38)$$

The lower panel in Figure 12 evaluates domestic welfare in the open economy, drawn for the case in which all domestic intermediation is done by domestic banks. The availability of intermediation services at a lower monitoring cost again shifts curve AA upward, to $A'A'$. The fall in the markup

rate and the reduction in monitoring costs shift curve DD also upward, to $D'D'$. With banks' cost of capital equal to $1 + r_O$, the domestic interest rate facing savers drops from $r = r_A$ to $r = r_O$. The surplus of domestic savers drops, as the interest rate goes down.

The position of domestic banks is ambiguous—the volume of intermediation has increased, but the markup has declined, and banks are absorbing the domestic-foreign monitoring and enforcement cost gap. The surplus of domestic producers is now affected in two opposite directions: on the one hand, greater congestion reduces the surplus; on the other, the fall in the cost of financing and the rise in output increase the surplus. In the absence of congestion effects, as shown earlier, the expected surplus would unambiguously increase; but in the presence of such effects, the overall impact is ambiguous.

Figure 13 focuses on the production inefficiency contributed by congestion externalities. From (37) we infer that the expected producers' surplus under financial openness is

$$n_O^{-\alpha} \int_0^{n_O} M(i) di - n_O [C^* \Phi_O + \theta_O (1 + r_O)].$$

Assuming that all intermediation is done by domestic banks, their expected surplus is

$$n_O [C^* \Phi_O + \theta_O (1 + r_O)] - n_O [C \Phi_O + (1 + r_O)].$$

Adding the producers' and banks' surpluses, we infer that the combined surplus is

$$n_O^{-\alpha} \int_0^{n_O} M(i) di - n_O [C \Phi_O + (1 + r_O)].$$

Hence, the marginal social benefit of project n , obtained by deriving the above expression with respect to n , is

$$- \left[\alpha n^{-(1+\alpha)} \int_0^n M(i) di + n C \frac{\partial \Phi}{\partial n} \right] + n^{-\alpha} M(n) - [C \Phi_O + (1 + r_O)]. \quad (39)$$

Thus, the socially optimal level of n is determined by

$$n_O^{-\alpha} M(n_O) - C \Phi_O - \alpha n_O^{-(1+\alpha)} \int_0^{n_O} M(i) di - n_O C \frac{\partial \Phi}{\partial n} = 1 + r_O. \quad (40)$$

Curve SMB in Figure 13 traces the left-hand side of equation (34). In the financially-open economy the optimal level of investment (that is, the optimal number of projects) is where the SMB curve equals the cost of funds, $1 + r_O$. Borrowing under financial openness is determined by the intersection of curve $D'D'$ with the banks' funding cost, $1 + r_O$, determining n_O . Hence, unregulated foreign borrowing results in a welfare cost given by the shaded triangle. Recall that under financial autarky, $n = n_A$ (determined by the intersection of SS and DD). This implies that opening domestic capital markets may lead to a fall in welfare relative to financial autarky if congestion effects are relatively large (that is, if α is large). The implied welfare loss tends to be larger when the supply curve of domestic savings is relatively inelastic, and when the country faces a relatively elastic supply of credit with integrated capital markets.

Figure 13 illustrates a more general principle of second best theory, which can be summarized in the following proposition:

Proposition 2 *Increased financial integration may magnify the welfare cost of existing distortions.*

In autarky, the welfare cost of the distortion was, in a sense, “contained” by the limited pool of domestic saving. In our example, the distortion is due to congestion externalities, which are magnified by increased financial openness. A similar assessment would apply to other distortions, such as the implicit insurance (or bailout guarantee) that regulatory authorities may provide to domestic banks.

8 Summary and Conclusions

The events that followed the Mexican peso crisis in December 1994 and those of the past year in Asia have prompted many economists to reconsider the costs, benefits, and sustainability of capital account liberalization and financial integration with world capital markets. The contribution of this paper—which dwells on the analysis provided by Agénor and Aizenman (1998)—to this ongoing process has been to focus on the links between capital flows, the financial system, and the supply side of the economy, using a model in which state verification is costly and the enforcement of the provisions of loan contracts is limited. Section II presented the basic framework, which assumes that productivity shocks are random. We then considered the case

of financial autarky, in which domestic banks have access only to domestic savings as a source of loanable funds. Section IV focused on the case of financial openness, defined as a situation in which foreign banks (with lower costs of intermediation and a lower markup) have unrestricted access to domestic capital markets. We then measured the net cost of capital market integration in Section V by comparing welfare losses under financial autarky and financial openness. We showed that if the interest rate facing the country is not high, financial integration may lead to a welfare gain, as a result of the fall in expected intermediation costs as well as the increase in the net surplus of domestic savers attributed to the higher interest rate on saving. However, if the interest rate facing the country is high, it will render projects unfeasible, leading to a loss of the entire expected net income of domestic producers surplus in that state of nature. The limited enforcement of contracts prevents the financing of these projects, despite the fact that they may lead to a large expected net income. Thus, financial integration may lower welfare if the foreign interest rate facing the economy under openness is more volatile relative to the degree of volatility of interest rates under financial autarky.

Sections VI and VII extended the basic framework to consider the case of an upward-sloping domestic supply curve of funds, and the last part considered the case in which the domestic supply curve of funds is upward-sloping, projects are ex ante heterogeneous, and congestion externalities prevail. Our analysis showed that opening the economy to unrestricted inflows of capital may magnify the welfare cost of existing distortions. In autarky, the welfare cost of the distortion (congestion externalities in our example), is, in a sense, “contained” by the limited pool of domestic saving. However, in a financially open economy, such distortions are magnified by the inflow of capital. A similar assessment applies to other distortions, such as the implicit insurance provided by domestic authorities, as shown by Aizenman (1998) in a related framework in which moral hazard is modeled explicitly.

The analysis developed here can be further extended in various directions. First, in both Asia and Latin America, financial volatility has prompted policymakers to take various measures to strengthen prudential supervision, such as imposing limits on the open foreign exchange position of commercial banks and preventing banks from making foreign-currency denominated loans.¹⁸ Understanding the extent to which such measures may help reduce volatility

¹⁸Of course, whether some of these measures can be viewed as distinct from capital controls may be a matter of semantics.

and the cost of financial openness remains, however, to be explored. Second, extending the analysis to a multi-period model would allow us to consider the case where external shocks (such as, for instance, an increase in the cost of external funds, or a higher perceived volatility of shocks) would induce debt rescheduling. The presence of a backward-bending cost of funds-borrowers interest rate curve may imply multiple equilibria, where a given outstanding stock of debt is rescheduled at a relatively low or high interest rate. In these circumstances, coordination failure may lead the economy to the inefficient equilibrium, associated with the relatively high interest rate.

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