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By PHILIPPE MARTIN AND HÉLÈNE REY*

We analyze the effects of financial and trade globalization on the likelihood of financial crashes in emerging markets. While trade globalization always makes crashes less likely, financial globalization may make them more likely, especially when trade costs are high. Pessimistic expectations can be self-fulfilling and lead to a collapse in demand for goods and assets. Such a crash comes with a current account reversal and drops in income and investment. Lower-income countries are more prone to such demand-based financial crises. A quantitative evaluation shows our model is consistent with the main stylized facts of financial crashes in emerging markets. (*JEL* F12, F32, F37, F41, O16)

Do emerging markets reap the benefits of financial globalization, enjoying increased investment and a better ability to diversify risk? Or do they face a higher likelihood of financial crash as more capital flows in? The empirical literature supports both possibilities. On the one hand, a number of papers in finance show that financial opening in emerging markets leads to a decrease in the cost of equity capital and can have a positive effect on domestic investment.[1] On the other hand, a voluminous literature surveyed by Joshua Aizenman (2004) emphasizes the risks of liberalization and the vulnerability of emerging market financial systems to capital mobility. Charles Wyplosz (2001) finds that external financial liberalization is considerably more destabilizing in developing countries than in developed economies. Graciela Kaminski and Sergio Schmukler (2001) show that stock markets become more volatile in the three years following financial liberalization but stabilize in the longer run.

Interestingly, recent empirical work shows that goods trade openness also influences the frequency of crashes in emerging markets, but in the *opposite* direction to financial openness. Eduardo A. Cavallo and Jeffrey A. Frankel (2004) find that trade openness (instrumented by gravity variables) reduces the vulnerability of countries to sudden stops. The Argentina of the 1990s is often presented as a typical example of a financially open economy relatively closed to goods trade. It has suffered heavily from sudden stops (see Guillermo A. Calvo et al., 2003; Calvo and Ernesto Talvi, 2004).

These contradictory effects of financial and trade globalizations are illustrated in Table 1. We report the average number of financial crashes per year for developed and emerging economies, dividing each group along the dimensions of financial and trade openness.[2]

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[1] See, for example, Geert Bekaert et al. (2005), Peter Blair Henry (2000), and Anusha Chari and Henry (2002). The macroeconomic literature finds more tenuous evidence that financial opening contributes to long-term growth. See Sebastian Edwards (2001), for example.

[2] More precisely, emerging markets are defined as those with GDP per capita equal or below that of South Korea. The sample coverage for those countries starts at the earliest in 1975 and ends in 2001. A crash is defined as a monthly drop in the stock index (in dollars) larger than two standard deviations of the average monthly change. We divided the sample into periods for which countries were financially

TABLE 1—FREQUENCY OF CRASHES AND OPENNESS

	Trade in goods						
	Emerging				Developed		
	Closed		Open		Closed	Open	
Financially closed	0.40[a]	0.35[b]	0.09[a]	0.15[b]	0.07[b]	0.09[a]	0.10[b]
Financially open	0.78[a]	0.76[b]	0.55[a]	0.57[b]	0.05[b]	0.06[a]	0.14[b]

[a] Sachs-Warner measure of openness.
[b] Trade/GDP measure of openness.

Table 1 suggests that opening to capital movements is very positively correlated with the frequency of crashes for emerging markets, but not for industrialized countries. Trade openness (whether measured by the trade-to-GDP ratio or following Jeffrey Sachs and Andrew Warner, 1995), however, is associated with a large decrease in the frequency of crashes for emerging markets.[3] Hence, according to Table 1, being an emerging market open to financial flows while closed to goods flows maximizes the frequency of crashes.

The contribution of our paper is to present a general framework in which these contradictory effects of financial and trade liberalizations can be reconciled. We can also make sense of the differential impact of financial globalization on emerging markets and developed economies. We emphasize the key role of demand and market size in driving both the positive effect of financial integration on an emerging economy and its negative consequences.

In our model, the world consists of one emerging market and one developed economy which differ only in their productivity level. In both countries, entrepreneurs operating in monopolistic goods markets decide whether to finance risky fixed-sized investments, sell shares of these investments on the stock exchange, and acquire shares in other risky ventures developed at home or abroad. Entrepreneurs may turn pessimistic and expect low levels of aggregate investment. Due to home bias in goods trade, negative prospects regarding investment translate into low expected income and demand for goods, low profits, and hence low demand for domestic assets. This validates their pessimistic priors and deters them from developing risky investments. The home bias in financial markets in turn implies that the fall in income in the emerging market also leads to a fall in domestic asset demand and prices. In this equilibrium, asset prices and investment collapse, income decreases, and a capital flight occurs since domestic agents buy shares in the developed country stock exchange. The circular causality is magnified if trade costs are high, since firms' profits and dividends in more closed economies are more dependent on the level of *local demand.* They are therefore more at risk when expectations turn pessimistic.

The likelihood of a crash is higher at an intermediate degree of financial segmentation. When financial markets are perfectly integrated, no financial home bias exists and arbitrage equates asset prices, so that local income conditions do not alter the cost of capital in the

open and financially closed, following Kaminsky and Schmukler (2001). Hence, among our 62 countries (34 emerging countries), 31 appear twice as they changed status during the sample years. We also classified countries in terms of their openness to trade. We chose two widely used measures of trade openness: (a) The classification by Sachs and Warner (1995) extended to the 1990s by Romain Wacziarg and Karen H. Welch (2003), who provide liberalization dates for a broad set of countries. This measure of openness is based on trade policies. Some countries have liberalized financial and trade flows at different dates and hence appear in different cells of the table. (b) The average of exports plus imports over GDP during the period considered. This measure of openness captures the degree of independence of the economy on local demand. We call open (respectively closed) a country whose openness ratio is above (respectively below) the median of its group. The trade openness ratio cutoff for financially open emerging countries is 63 percent of GDP. For the group of financially closed countries, the trade openness ratio cutoff is 54 percent. For more details, see the Data Appendix at http://team.univ-paris1.fr/teamperso/martinp/table.pdf.

[3] This is not the case for developed countries, for which the frequency of crashes is low overall. For developed economies, we use the ratio of trade to GDP as our measure of openness. According to the Sachs-Warner measure, only two industrialized countries are classified as closed at some point, so we do not report the result.

emerging market. Symmetrically, if financial asset markets are very segmented internationally, emerging market agents have no choice but to invest at home. This rules out capital flight and multiple equilibria, at the cost of inefficiency in capital markets.

In our setting, financial globalization increases asset prices, investment, and income in the emerging market, but only when international trade costs are low. When emerging markets start opening their financial account but are closed to trade in goods, they are more prone to financial crashes. This comes chiefly from their having a lower income than developed countries and from their dependence on local demand due to market segmentation. The demand-based mechanism also implies that our model has the potential of generating quick recovery in the aftermath of crises.

Our work is related to the literature on financial crises in emerging markets and sudden stops. Calvo (1998) explores the role of credit frictions to explain sudden stops. Enrique Mendoza (2004) and Mendoza and Katherine A. Smith (2002, 2004) show within an equilibrium business cycle framework that small productivity shocks can trigger sudden stops in the presence of credit constraints when an economy is highly leveraged.[4] Philippe Aghion et al. (2004) also use a model with credit frictions and find that countries with intermediate levels of domestic financial development and free capital movements are more prone to macroeconomic volatility. In contrast to these papers and most of the existing literature, however, a financial crisis in our model does not come from the existence of credit constraints on capital markets and/or balance sheet effects.[5] Neither is it caused by moral hazard (as in Ronald I. McKinnon and Huw Pill, 1999, and Giancarlo Corsetti et al., 2001). Instead, in our setup, the crisis is driven by a collapse in demand when goods and financial markets are segmented by trading costs and asset markets are incomplete. Our theory is therefore complementary to the existing literature on financial crisis.[6] Our model has multiple rational expectations equilibria, like in Chang and Velasco (2001), for example, where internationally illiquid banks may be subject to a run. But in our setup, self-fulfilling expectations operate through investment behavior and endogenously incomplete asset markets. Our framework has potentially important policy implications: only once emerging markets are well integrated in world goods markets should they increase significantly their degree of financial openness. We make this point in a formal model, where any degree of frictions on the goods and financial markets and their interactions can be analyzed.

We present the model in Section I. Section II describes the properties of the equilibrium in "normal times," while Section III investigates the conditions necessary for a financial crash to occur. Section IV performs a quantitative evaluation of our model. Finally, we draw some conclusions in Section V.

I. Model

Ours is the only model known to us that analyzes jointly home market effects in goods and asset markets and their interactions. Firms sell a monopolistic good in international markets where trade is costly. They also sell claims on their expected (risky) profits on international stock markets segmented by financial trading costs. Our modeling strategy is simple enough to handle *both* types of frictions in a tractable way.

A. *Technology and Trading Costs*

There are two countries, E (emerging) and I (industrialized), and two periods. All decisions are taken in the first period. At the beginning of the first period, L identical agents per country are each endowed with one unit of labor and one firm. There are two sectors: a perfectly

[4] See also Mendoza (2002) and the survey of Cristina Arellano and Mendoza (2003). For a view of Asian crises based on implicit fiscal liabilities, see Craig Burnside et al. (2001). Kiminori Matsuyama (2004) presents a model in which borrowing constraints interact with financial globalization to produce an endogenous degree of inequality across otherwise identical countries.

[5] See Paul Krugman (1999), Ricardo J. Caballero and Arvind Krishnamurthy (1998), Lawrence J. Christiano et al. (2004), Martin Schneider and Aaron Tornell (2004), Roberto Chang and Andres Velasco (2001), Bernhard Paasche (2001), and Luis Felipe Cespedes et al. (2004).

[6] We emphasize that the other channels studied in the literature may be important, as well, to explain emerging market crises. Our model is certainly compatible with all of them.

competitive constant returns-to-scale sector with zero trade cost, which serves as the numeraire, and a monopolistically competitive sector with iceberg trade costs τ_T. Transport costs and trade policies both affect τ_T. Each firm corresponds to one variety, so that the total number of varieties in the world is $2L$. Both sectors use labor as their only input. The only difference between the two countries is labor productivity, which we assume is equal in both sectors and higher in the industrialized country than in the emerging market. Free intersectoral labor mobility, perfect competition, and free trade in the constant returns to scale good imply that wage rates w_I (in the industrialized country) and w_E (in the emerging market) are equal to the marginal productivity of labor. In the monopolistic good sector, labor productivity is also given by w_I and w_E, so that the marginal cost of production in numeraire units is equal in both countries.

In the monopolistically competitive sector, firms earn operating profits in the first period. To create a diversification incentive at both the national and international level, we introduce a simple source of uncertainty. This will induce agents to diversify in equilibrium their ownership of firms.[7] We assume that first-period profits of monopolistic firms do not always materialize in dividends to shareholders in the second period. Without firm-specific investments, these profits vanish, due, for example, to mismanagement at the firm level. When investment is performed by the firm, profits are distributed to shareholders with some positive probability. The price of a share that is a claim to risky profits is given by p_E. The total cost of investment is $F + \frac{1}{2} z_E^2 Q$, where z_E is the number of investments undertaken by a firm in the emerging market and Q is the price of the investment good.[8] The marginal cost of undertaking investments rises as the firm decides to do more investments. In addition, a fixed cost F has to be paid to start investing. We assume that this fixed cost is paid individually by each investor to all other agents in the economy so that aggregate income is not affected by it.[9] The value of a firm is therefore the expected payoff of the investment $\pi_E = p_E z_E - 1/2\, z_E^2 Q - F$. The investment good is produced with a Cobb-Douglas production function with a share $(1 - a)$ for labor and a for the composite good made of all varieties of the monopolistic sector (see below).

In the second period, there are N exogenous and equally likely states of nature, and the realization is revealed at the beginning of that period after all decisions have been taken. As in Daron Acemoglu and Fabrizio Zilibotti (1997) and Martin and Rey (2004), the technology implies that each investment gives dividends (the operating profits of the first period) in only one state of nature. In all other states of nature, the operating profits of the first period become zero. The payoff structure is such that an investment in country E yields d_E if the corresponding state of the world is realized, and zero otherwise. Hence, investments in the two countries have ex ante expected dividends, d_E/N and d_I/N. All risky claims to operating profits are traded on the stock market at the end of period one, so that each claim corresponds to an Arrow-Debreu asset. This gives agents in both countries a strong incentive to diversify and buy shares of both foreign and domestic investments. We assume that the number of states of nature N is large enough so that $N > Z^w$ where $Z^w = L(z_E + z_I)$ is the total number of investments/assets issued in the world. $N - Z^w$ is therefore the endogenous degree of incompleteness of financial markets. No duplication occurs in equilibrium, so that each investment/asset in the world is unique.[10] This modelling introduces a simple incentive for agents to diversify their portfolios across firms in an otherwise standard

[7] Foreign agents cannot operate production technologies in the domestic country; hence, there is no FDI in our model. They can, however, invest in claims to domestic risky profits.

[8] Industrialized country agents face a similar investment cost function. We discuss in the working paper version (Martin and Rey, 2002) how our results would be affected by a more general convex cost function.

[9] If the fixed cost has an impact on aggregate income, the main results of the model are unaffected. However, the results are analytically less tractable.

[10] This is because as long as some states of nature have not been covered, the price of an asset associated with these states will always be higher than if the agent were to replicate an existing investment/asset. This could obviously lead to some exercise of monopolistic power in the asset market, but we assume that investment developers do not exploit it. The issue of "financial" monopolistic competition in this type of framework is dealt with in Martin and Rey (2004), who show that it creates another source of financial home bias.

monopolistic competition framework in the goods market.

At the end of the first period, consumption takes place and shares are sold on each of the stock markets. These shares can be traded internationally, but an agent in either country who wants to buy assets in the other market must pay a financial trading cost. This cost, essential for our results, may capture government regulations on capital flows, differences in regulations in accounting, banking and commission fees, exchange rate transaction fees, and information costs. The presence of these costs translates into a home bias in asset transactions and holdings.[11] We denote the transaction costs on financial assets τ_F and assume that they take the form of an iceberg cost. This implies that the transaction fee is paid in shares. Agents have to buy $(1 + \tau_F) > 1$ units of shares to receive one share.[12] We interpret financial globalization as a process through which these transaction costs are reduced.

B. *Utility and Budget Constraints*

We assume that the utility of an agent in each country is given by the nonexpected utility function introduced by Larry G. Epstein and Stanley E. Zin (1989) and Philippe Weil (1990). This allows the intertemporal elasticity of substitution (which we assume to be one for simplicity) to be different from the coefficient of relative risk aversion $1/\varepsilon$. In the emerging market, the utility of a representative agent is given by:

$$(1)\quad \mathcal{E}(U_E) = \ln[c_{EY}^{1-\mu} C_{E1}^{\mu}] + \beta \ln\left[\sum_{n=1}^{N} \frac{1}{N} c_{E_2}(n)^{1-1/\varepsilon}\right]^{1/(1-1/\varepsilon)},$$

where $c_{E_2}(n)$ denotes the second-period consumption in one of the N states of the world and $\mathcal{E}$ is the expectation sign. c_{EY} is the consumption of the CRS good with a share $1 - \mu$ in the utility function while μ is the share of the composite good C_{E1} made of all varieties produced in the world:

$$(2)\quad C_{E1} = \left[\sum_{i=1}^{L} c_{Ei_1}^{1-1/\sigma} + \sum_{j=1}^{L} c_{Ej_1}^{1-1/\sigma}\right]^{1/(1-1/\sigma)}.$$

$\sigma > 1$ is the elasticity of substitution between goods, while c_{Ei_1} and c_{Ej_1} are the consumptions of domestic and imported varieties in period 1. This composite good is used both for consumption and investment in projects.

The first-period budget constraint of an agent in E is

$$(3)\quad y_E = c_{EY_1} + \sum_{i=1}^{L} v_{Ei} c_{Ei_1} + \sum_{j=1}^{L} (1 + \tau_T) v_{Ij} c_{Ej_1} + \sum_{k=1}^{Lz_E} p_{Ek} s_{Ek} + \sum_{l=1}^{Lz_I} (1 + \tau_F) p_{Il} s_{El} = w_E + \pi_E + T,$$

where y_E is the emerging market per capita income of the first period, v_{Ei} is the price of the ith variety produced in the E market, v_{Ij} is the price of the jth variety produced in the I market, and π_E is the investment payoff. Asset prices are denoted by p_{Ek} and p_{Il}, and s_{Ek} and s_{El} are demands for shares of risky investments developed in the emerging market and in the industrialized country, respectively. T is the transfer (in equilibrium equal to F). The budget constraint in the industrialized country is analogous. In period 2, income and consumption come only from dividends of shares purchased in the first period. Hence, the budget constraint for an agent in E is:

$$(4)\quad c_{E_2} = d_E s_{Ek}, \quad \text{if } k \in [1, Lz_E]; \quad d_I s_{El} \quad \text{if } l \in [1, Lz_I]; \quad 0 \text{ otherwise.}$$

[11] There is strong empirical evidence for home bias and for the role of such costs in generating at least part of the bias. See Richard Portes and Rey (2005) for the importance of information costs, and Mendoza and Smith (2004) for another model featuring trading costs on asset markets.

[12] Iceberg transaction costs are borrowed from the trade and geography literature. See Martin and Rey (2004) for a more precise description. This modelling allows the elasticity of substitution between assets to be the same for all agents, and does not require the formal introduction of an intermediation sector. Roger H. Gordon and Lans Bovenberg (1996) use a similar type of proportional transaction cost on capital flows, and focus on the cost of acquiring information about foreign countries.

We can therefore rewrite the utility of an agent in the emerging market as

$$\mathcal{E}(U_E) = \ln[c_{EY}^{1-\mu} C_{E1}^{\mu}] + \beta \ln \frac{1}{N^{1/(1-1/\varepsilon)}} + \beta \ln \left[\sum_{k=1}^{Lz_E} (d_E s_{Ek})^{1-1/\varepsilon} + \sum_{l=1}^{Lz_I} (d_I s_{El})^{1-1/\varepsilon} \right]^{1/(1-1/\varepsilon)}. \tag{5}$$

The utility and budget constraint of an agent in the industrialized country are symmetric. In the second period, this utility function is similar to the one introduced by Avinash K. Dixit and Joseph E. Stiglitz to represent preferences for differentiated products. In fact, ε can be interpreted as the elasticity of substitution between assets. In what follows, we impose $\varepsilon > 1$ to have financial home bias and realistic asset demands.[13] This restriction on ε mirrors the standard assumption in the differentiated products literature that the elasticity of substitution between different varieties σ is greater than one. This restriction also implies that assets are substitutes rather than complements, as in Acemoglu and Zilibotti (1997).[14] Imposing $\varepsilon > 1$ has the additional benefit of ruling out any problem for the states in which consumption is zero in the second period due to market incompleteness.[15]

Agents in both countries choose consumption (c_{EY}, C_{E1} and c_{IY}, C_{I1}), and firms choose investment (the number of investments per firm are z_E and z_I) at the beginning of the first period. They form expectations about the number of investments in which other firms will engage, since this will have an impact on the price of the assets they will sell at the end of the first period. As investments are ex ante symmetric, the demands for each asset in a given country are identical.[16] We call s_{EE} (s_{EI}) the demand for shares of a "typical" asset in the E (I) market by an emerging market agent. Similarly, we denote by c_{EE} and c_{EI} the first-period demand by an emerging market agent for a good produced in E and I, respectively. Because of symmetry, within each country, all assets have the same price, denoted by p_E and p_I, respectively. Since marginal costs in units of the numeraire are equal to one in both countries, and the elasticity of substitution between varieties σ is the same for consumers and firms, all firms in the world choose the same price for the monopolistically competitive goods. That price, equal to the marginal cost multiplied by the markup, is given by $v_E = v_I = \sigma/(\sigma - 1)$. For notational simplicity, we drop the expectational sign in what follows.

C. *Definition of Equilibrium*

An equilibrium is defined by a set of good and asset prices $[v_E, v_I, p_E, p_I]$, consumption and investment allocations $[C_{E1}, C_{I1}, c_{EY}, c_{IY}, z_E, z_I, c_{E2}(n), c_{I2}(n)]$, and portfolio shares $[s_{EE}, s_{EI}, s_{II}, s_{IE}]$ such that:

(a) $[C_{E1}, c_{EY}, s_{EE}, s_{EI}, c_{E2}(n)]$ maximize U_E subject to E's budget constraints (equations (3) and (4)) taking prices as given.
(b) $[C_{I1}, c_{IY}, s_{II}, s_{IE}, c_{I2}(n)]$ maximize U_I subject to I's budget constraints (the analogue of equations (3) and (4)) taking prices as given.
(c) $[v_E, v_I, z_E, z_I]$ maximize profits and the investment payoffs of firms taking prices and investment decisions of other firms as given. A firm invests if and only if its expected investment payoff $\pi_i = p_i z_i - \frac{1}{2} z_i^2 Q - F$ is nonnegative for $i = \{E, I\}$.[17]
(d) Asset markets clear: $Ls_{EE} + L(1 + \tau_F)s_{IE} = 1$ and $Ls_{II} + L(1 + \tau_F)s_{EI} = 1$.
(e) The world resource constraint is verified, which implies: $L[c_{EY} + c_{IY} + Lc_{EE} +$

[13] See Section II. The demand for foreign assets decreases with transaction costs τ_F for any ε. But using iceberg trading costs (paid for in shares) implies that the demand inclusive of transaction costs (which determines the equilibrium on the stock market) would increase with τ_F if ε were to be smaller than one.

[14] In Section IV, we review the existing empirical estimates for ε: they range from 1 to 12.

[15] When we introduce a safe asset (see Section IV), this issue of course does not arise any longer.

[16] In each country, agents are different in the sense that they hold different assets but they choose identical portfolios and consumption patterns.

[17] We focus on symmetric equilibria in which all or no firms in a country invest. Equilibria in which only a portion of firms invest are studied in the working paper version of Martin and Rey (2002).

$Lc_{EI}(1 + \tau_T) + Lc_{II} + Lc_{IE}(1 + \tau_T) + \frac{1}{2}(z_E^2 + z_I^2)Q(\sigma - a)/\sigma + d_E + d_I] = L(w_E + w_I)$.[18]

(f) Expectations are rational.

II. When Things Go Well

We first solve the model in the optimistic case, when firms of the emerging market expect others to invest in a positive number of projects. We define $q = p_E/p_I$ as the relative asset price, and $d = d_E/d_I$ as the relative dividend. The budget constraints and the first-order conditions of an emerging market agent imply the optimal consumption demands:

$$(6)\quad c_{EY} = \frac{(1-\mu)y_E}{(1+\beta)};$$

$$c_{EE} = \frac{\mu(\sigma - 1)y_E}{L\sigma(1+\beta)[1+\phi_T]};$$

$$c_{EI} = \frac{\mu(\sigma - 1)y_E(1+\tau_T)^{-\sigma}}{L\sigma(1+\beta)[1+\phi_T]};$$

$$s_{EE} = \frac{\beta y_E}{1+\beta}\frac{1}{Lp_E\,[z_E + \phi_F z_I(q/d)^{\varepsilon - 1}]};$$

$$s_{EI} = \frac{\beta y_E}{1+\beta}\frac{(1+\tau_F)^{-\varepsilon}(q/d)^{\varepsilon - 1}}{Lp_I[z_E + \phi_F z_I(q/d)^{\varepsilon - 1}]},$$

where $0 \leq \phi_T = (1 + \tau_T)^{1-\sigma} \leq 1$ is a measure of trade openness and $\phi_F = (1 + \tau_F)^{1-\varepsilon} \leq 1$ is a measure of financial openness. The demand for foreign shares (s_{EI}) decreases with financial transaction costs.

At the optimum, the marginal cost of investing equals the marginal benefit: $z_E Q = p_E$.[19] The demands for shares s_{EE} and s_{EI} increase with income and decrease with the total number of investments/assets. Analogous conditions hold for the industrialized country. For all firms in the economy to invest, the expected payoff must be positive: $p_E z_E - ½ z_E^2 Q = ½ p_E^2/Q \geq F$.

We normalize the number of shares so that the stock market equilibria in the two countries (inclusive of shares that are used to pay the transaction costs) can be written for each asset as:

$$(7)\quad 1 = \frac{1}{p_E}\frac{\beta}{1+\beta}\left(\frac{y_E}{z_E + z_I\phi_F(q/d)^{\varepsilon-1}} + \frac{y_I\phi_F(q/d)^{1-\varepsilon}}{z_I + z_E\phi_F(q/d)^{1-\varepsilon}}\right);$$

$$1 = \frac{1}{p_I}\frac{\beta}{1+\beta}\left(\frac{y_I}{z_I + z_E\phi_F(q/d)^{1-\varepsilon}} + \frac{y_E\phi_F(q/d)^{\varepsilon-1}}{z_E + z_I\phi_F(q/d)^{\varepsilon-1}}\right).$$

There are $L(z_E + z_I)$ such equilibrium conditions. In the parentheses, the first term represents the demand coming from domestic agents and the second term foreigners' demand (inclusive of transaction costs). These equations imply a *financial home-market effect:* local income has a more important impact on the local asset market than foreign income, as long as ϕ_F is less than one, i.e. as long as some transaction costs exist.

The dividends of the second period are the operational profits of the first period. Hence, they are equal to sales (to consumers and firms) divided by the elasticity of substitution:

$$(8)\quad d_E = \frac{\mu(y_E + y_I\phi_T)}{\sigma(1+\beta)(1+\phi_T)} + \frac{1}{2}\frac{a(z_E^2 + \phi_T z_I^2)Q}{\sigma(1+\phi_T)};$$

$$d_I = \frac{\mu(y_I + y_E\phi_T)}{\sigma(1+\beta)(1+\phi_T)} + \frac{1}{2}\frac{a(z_I^2 + \phi_T z_E^2)Q}{\sigma(1+\phi_T)}.$$

These equations imply a *trade home-market effect:* local income and investment have a more important impact on sales and profits of local firms than foreign income and investment, as long as ϕ_T is less than one, i.e., as long as trade costs exist. Because our theoretical argument requires only one source of trade home-market effect, we assume from now on that $a = 0$, so that the investment good requires only labor, $Q = 1$, and profits come only from sales to consumers. This allows us to derive all results analytically. We come back to the more general case with $a > 0$ in the quantitative section.

[18] We have used the cost minimization program of firms to derive their demands for the investment good.

[19] $Q = a^{-a}(1 - a)^{a-1}[\sigma/(\sigma - 1)]^a[L(1 + \phi_T)]^{-a/(\sigma-1)}$ is the price of the investment good.

A. *Equilibrium Relationship between Asset Prices, Dividends, and Income Shares*

As world income is fixed,[20] it proves convenient to define $s_Y = y_E/(y_E + y_I)$ as the share of the emerging market in world income. From the budget constraint and the optimal investment rule, we get the first equilibrium relation between the relative income and the relative asset price q, which we call the *yy* schedule:

$$(9) \qquad s_Y = \frac{s_w(2+\beta)}{2(1+\beta)} + \frac{\beta}{2(1+\beta)(1+q^{-2})},$$

where $s_w = w_E/(w_E + w_I) < ½$ is the share of the emerging market wage income in the world wage income. The equilibrium *yy* relation implies that an increase in the relative asset price q generates an increase in relative income s_Y. The reason is that emerging market investments are sold at a higher price and more investments are started.

Using the optimal investment rule, equation (7) of the stock market equilibrium gives

$$(10) \qquad q = \frac{s_Y(1-\phi_F^2) + q\phi_F(q/d)^{1-\varepsilon} + \phi_F^2}{\phi_F(q/d)^{\varepsilon-1} + q - s_Y q(1-\phi_F^2)}.$$

If $\phi_F = 1$ (zero transaction costs on asset trade), then $q = d^{1-1/\varepsilon}$. This implies quite intuitively that without any financial segmentation, the relative price of assets depends only on the relative dividend and the elasticity of substitution but not on local demand.

Using (8), we can derive the relative dividend as

$$(11) \qquad d = \frac{s_Y(1-\phi_T) + \phi_T}{1 - s_Y(1-\phi_T)}.$$

If $\phi_T = 1$ (zero transaction costs on goods trade), then $d = 1$. This implies, also quite intuitively, that in the case of perfect goods, market integration operating profits and therefore dividends do not depend on local incomes. An increase in the relative income of the emerging market raises local demand more if there is home bias in goods. In turn, the surge in local demand increases relative operating profits and dividends. Lower trade costs raise relative profits and d as long as $s_Y < ½$.

Together, (10) and (11) provide a nonlinear relation between the share of income in the emerging market s_Y and the relative asset price q. We call this positively sloped relation the *qq* schedule. Two effects are at work: first, an increase in income raises demand (mostly) for locally produced goods due to home bias in trade ($\phi_T < 1$), thereby increasing profits and dividends (trade home-market effect). This, in turn, increases the demand for assets and their relative price. Second, an increase in income in the emerging market leads to an increase in saving which, as long as markets are segmented ($\phi_F < 1$), falls disproportionately on domestic assets (financial home-market effect). This also increases the relative price of emerging market assets.

B. *Globalization and Asset Prices*

In this section, we show that trade and financial liberalizations may have very different effects on asset prices and income. Whereas increasing trade openness is always positive, opening the capital account has an ambiguous effect.

In Figure 1, we illustrate the equilibrium as the intersection of the *yy* and *qq* schedules. The relative price of assets q is less than one as long as the financial or goods markets are not perfectly integrated ($\phi_F \neq 1$ or $\phi_T \neq 1$) and $s_w < ½$. The difference in asset price is higher, the larger the differential in productivity. The two curves cross only once, so that only one "good" equilibrium exists. Trade integration (an increase in ϕ_T) is easily analyzed. As long as $s_w < ½$, the fall in trade costs implies a rightward shift of the *qq* curve ($\partial s_Y/\partial \phi_T < 0$ for a given q along the *qq* curve). The *yy* curve, meanwhile, is unaffected. The effect, shown in panel A of Figure 1, is an increase of the emerging market relative asset price and income share, for any level of financial integration.

Intuitively, lower trade costs increase profits and dividends of firms in the emerging market: from (11), $\partial d/\partial \phi_T > 0$ as long as $s_Y < ½$. This in turn increases the demand for emerging market assets and their relative price, which generates a rise in relative income. Due to the

[20] From the stock market equilibria we obtain that $p_E z_E + p_I z_I = \beta(y_E + y_I)/(1 + \beta)$. Using the optimal investment rule and the definition of world income, we therefore have $L(y_E + y_I) = 2L(1 + \beta)(w_E + w_I)/(2 + \beta)$.

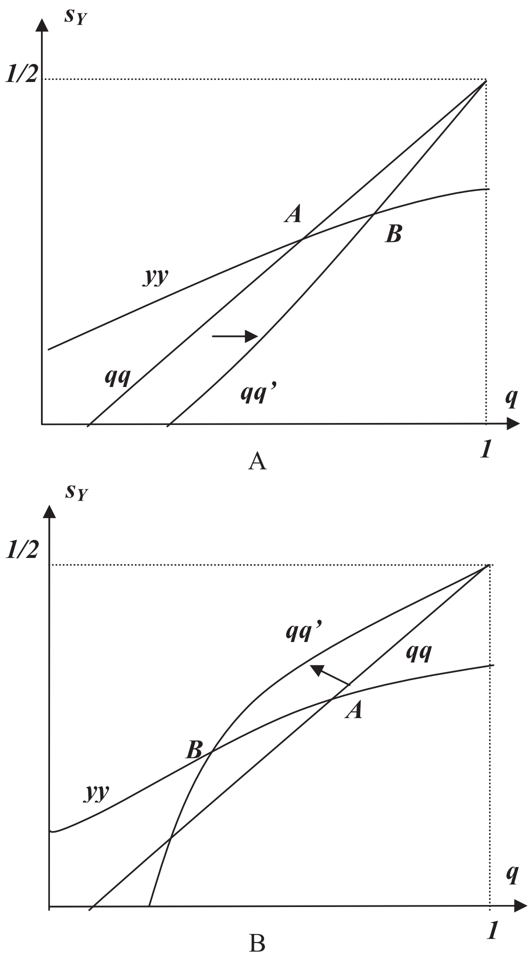

FIGURE 1. LIBERALIZATION IN THE EMERGING MARKET

convexity of the investment cost function, the total number of assets is increasing in q. Hence trade integration also alleviates financial market incompleteness, as measured by $N - Z^w$, and therefore reduces the volatility of consumption in the second period.

In contrast, a fall in financial transaction costs has an ambiguous effect on asset prices, relative income, and market incompleteness. In Appendix A we give the exact condition for which an increase in ϕ_F (increase in financial openness) leads to a rise in q. A sufficient condition is that the relative return of the emerging market asset d/q is more than one. Interestingly, this will be the case for low enough trade costs. The condition is verified, for example, in the extreme case of perfect goods market integration, as $d = 1$ and $q < 1$ (whenever financial integration is not perfect). Intuitively, in that case, financial opening enables agents in the industrialized country to buy the cheaper emerging market assets. For high trade costs, however, the profits of emerging market firms are lower than in the industrialized country, making emerging market assets relatively unattractive. The relation between asset prices and financial liberalization is U-shaped, so that financial opening may actually lead to a decrease in the demand for emerging market assets (capital outflows), a decrease of their price, and more market incompleteness. Financial liberalization with low trade costs has the same positive effects on asset prices and income as trade integration. It can also, therefore, be illustrated by panel A in Figure 1. In contrast, when trade costs are high, financial liberalization leads to lower asset prices and income in the emerging market, as illustrated in panel B.

C. *Globalization and the Current Account*

We now study the impact of globalization on the first-period current account of the emerging market. The current account is the difference between the country's production and the market value of investment and consumption:

$$(12) \qquad CA_E = L\left(y_E - z_E^2 - \frac{y_E}{1+\beta}\right)$$

$$= L\,\frac{\beta}{1+\beta}\left(\frac{w_E - w_I q^2}{1+q^2}\right).$$

The current account deteriorates as the relative asset price in the emerging market increases. Hence, trade integration (an increase in ϕ_T) always implies an increase in the current account deficit. Financial integration (an increase in ϕ_F) also leads to a current account deficit if trade costs are not too high. In that case (see previous section), liberalizing capital movements generates net capital inflows in the emerging market as agents in the industrialized economy take advantage of the lower asset prices in the emerging market. If trade and financial transaction costs are sufficiently low, the emerging market current account is in deficit in normal times.

III. Self-Fulfilling Expectations and Financial Integration: When Things Go Wrong

Until now, we focused on the equilibrium in which there is positive investment in both countries. The decision to invest depends, however, on the expected price of assets at the end of the period, and therefore on the strategies of all other firms. We now investigate under what conditions a crash driven by self-fulfilling expectations can occur. We define a crash as an equilibrium in which no single firm has an incentive to invest, given that no other firm is investing. The condition for this to happen is $\mathcal{E}(\pi_{Ec}) = \mathcal{E}(p_{Ec}z_{Ec} - \frac{1}{2} z_{Ec}^2 - F) \leq 0$, where the index c denotes the crash equilibrium. In that case, the expected asset price is low enough that no firm deviates from the zero-investment equilibrium.[21]

Expected aggregate income in the emerging market in a crash is $\mathcal{E}(Ly_{Ec}) = Lw_E$, since expected financial wealth is zero. This affects the expected relative demands for assets in the emerging and industrialized economies. Using the stock market equilibrium (7), we show that the expected relative asset price in crash is

$$(13) \quad q_c = \left\{\frac{s_w(2+\beta)(\phi_F^{-1} - \phi_F) + 2(1+\beta)\phi_F}{2(1+\beta)}\right\}^{1/\varepsilon} d_c^{1-1/\varepsilon},$$

where we drop the expectation operator from now on. The relative price decreases with financial globalization at low levels of ϕ_F and then increases with globalization for higher levels of ϕ_F. The relative dividend is given by

$$(14) \quad d_c = \frac{s_w(2+\beta)(1-\phi_T) + 2(1+\beta)\phi_T}{2(1+\beta) - s_w(1-\phi_T)(2+\beta)}.$$

In a crash, the emerging market relative dividend increases with lower trade costs on goods markets and with labor productivity in the emerging market.

A crash occurs if the expected payoff of investing is negative:

$$(15) \quad \pi_{Ec} = \frac{\beta}{2+\beta}(w_E + w_I)q_c^2 - F < 0.$$

The investment payoff is U-shaped as a function of ϕ_F. Inequality (15) can therefore be satisfied for *intermediate* levels of financial transaction costs.

Multiple equilibria exist if and only if $q_c^2 < q^2/(1 + q^2)$. This guarantees that, for a given set of parameter values, a "good" equilibrium exists whenever $z_E > 0$ and a crash equilibrium exists whenever $z_{Ec} = 0$.[22, 23] For this condition to be verified, the fall in price during a crash must be large enough. Using (13), it can be checked that the crash equilibrium cannot occur in the absence of capital flows ($\phi_F = 0$), as q_c goes to infinity because agents can save only by buying domestic assets.[24] This puts a floor on the demand for domestic assets and on their expected price since capital flight is impossible. At the other end, in a situation without frictions ($\phi_F = \phi_T = 1$), $q_c = 1$, so arbitrage implies that agents in the industrialized country would rush to buy assets in the emerging market in the event of a crash. This rules out the possibility of a crash in the emerging market altogether. Hence, a crash is possible only for intermediate levels of the financial frictions and for high enough levels of trade costs.

Circular causation is at work. If firms believe that other firms will undertake no investment, then they expect aggregate income in the emerging market at the end of the period to be low. Lower expected income entails lower savings and a lower demand for assets. When fi-

[21] z_{Ec} in this condition is the investment that would be made by a single "pessimistic" firm if it anticipates that no other firm will invest. The optimal investment rule $z_{Ec} = \mathcal{E}(p_{Ec})$ still applies. This firm is small (L is large) so that its decision does not affect aggregate income or investment.

[22] As mentioned before, we are limiting our analysis to symmetric equilibria in which all investors in each country behave similarly.

[23] In the absence of an equilibrium selection device, our model has nothing to say about the transition between equilibria. We also cannot perform meaningful welfare comparisons. These drawbacks are common to all multiple equilibrium models.

[24] This also implies that an equilibrium where both countries are in crash is not possible.

nancial markets are segmented and assets are imperfect substitutes, this fall in demand for assets affects local assets disproportionately. This in turn generates a low relative asset price in the emerging market (*financial home bias effect*). Trade costs magnify this effect since a crash that lowers income in the emerging market also lowers demand for goods. This falls more than proportionately on goods produced in the emerging market, so that expected operating profits in the emerging market also fall. This *home bias in trade in goods* also contributes to the fall in dividends and asset prices.

Is the emerging market more vulnerable to a financial crash than the industrialized economy? We can compare the payoff level of a single "pessimistic" investor in the emerging market ($z_{Ec} = 0$) given in equation (15) to its analogue in the industrialized country ($z_{Ic} = 0$). We find that $\pi_{Ic} > \pi_{Ec}$ as long as ϕ_T or $\phi_F < 1$. The "pessimist" payoff function of the industrialized country is always above the emerging market one. Due to the dual home bias (in trade and finance), the demand for assets in the rich market, even when depressed by pessimistic expectations, is always higher than in the emerging market. This implies a higher price for assets even when bad times are expected: the industrialized country can never be as pessimistic about its own demand—and therefore its asset prices—as the emerging market. Hence, if the productivity differential is sufficiently high, the industrialized country can never experience a crash. The negative relation between income per capita and the vulnerability to crashes appears only when countries are sufficiently open to capital movements, a fact that accords well with Table 1.

The analysis of asset prices in a crash also shows that countries more open to trade in goods (larger ϕ_T) are less vulnerable to financial crashes. Indeed, these countries' operating profits and dividends (equation (14)) are less dependent on local income and therefore less affected by the crash. Hence, the crash itself is less likely. This implies that the set of parameters for which a crash occurs is smaller for countries more open to trade. We therefore find a fundamental asymmetry in the effect of trade and financial openness on the vulnerability of countries to financial crashes. Whereas trade openness unambiguously decreases this vulnerability, financial openness may increase it.

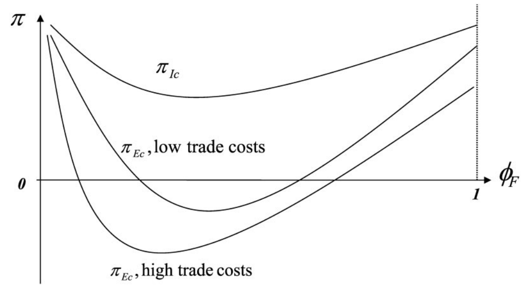

FIGURE 2. CRASH AND TRANSACTION COSTS

Figure 2 depicts payoff functions in crash as a function of financial openness ϕ_F. Crashes can occur in the area below the zero line, whose exact position depends on the level of F. For a given level of trade openness, countries with higher levels of productivity (higher wages) are less vulnerable to crashes. For a given level of productivity, countries that are more open to trade in goods are less vulnerable to crashes.

A financial crash in the emerging market is characterized by low asset prices, investment, income, and consumption (both in first and in second periods). The total number of assets at the world level decreases since it is an increasing function of q. Hence, both market incompleteness and the volatility of second-period consumption are higher. It can be shown that per capita income in the emerging market is lower in a financial crash (w_E) than in autarky.

Contrary to what occurs in the "good" equilibrium, the emerging market experiences a current account surplus given by $Lw_E/(1 + \beta)$. In a crash, agents can only buy foreign assets from the industrialized country to save and diversify risk, so that capital flight occurs.

IV. Quantitative Analysis

This section assesses the potential of our demand-based theory of financial crisis to match key stylized facts of emerging market crashes, such as a drop in asset prices, income collapse, and current account reversal. Table 2 (taken from Mendoza and Smith, 2004) reproduces data for four emerging markets, Argentina, Korea, Mexico, and Russia. Table 3 presents the parameter values used in the calibrations. Panel A of Table 4 provides the quantitative implications of the exact model we described in the

Table 2—Crises in Four Emerging Economies

	Real equity prices (percent change)	Current account/GDP (percent points change)	Ind. production (percent change)
Argentina (94.4–95.1)	−27.82	4.05	−9.26
Korea (97.4–98.1)	−9.79	10.97	−7.20
Mexico (94.4–95.1)	−28.72	5.24	−9.52
Russia (98.3–98.4)	−59.37	9.46	−5.20

Notes: Real equity prices are deflated by the CPI, except Russian equity prices which are in U.S. dollar terms. The change in the current account to GDP ratio for Argentina corresponds to the second quarter of 1995. Industrial production for Korea and Russia are annual rates (Mendoza and Smith, 2004).

Table 3A—Parameters

	Wages w_E/w_I	Subst. goods σ	Subst. assets ε	Discount β	Risk premium	Safe α	Manuf. share μ, a
Base case	**1/5**	**5**	**5**	**0.99**	**1.05**	**1**	**0.4**
High	1/3	10	8	—	1.10	—	0.6
Low	1/8	4	3	0.95	1.02	0.1	0.3

Table 3B—Frictions

		Financial cost τ_F percent	Trade cost τ_T percent	Participation γ percent
No crisis	**Base case**	**5**	**40**	**36**
	High	10	80	50
	Low	1	20	10
Crisis	**Base case**	**6**	**50**	**36**
	High	12	10	50
	Low	1.2	25	10

previous sections. We call it the "stylized model." And, indeed, since our model is quite stylized, we augment it by adding two realistic features to get our "baseline model" (panel B of Table 4): (a) Agents have access to a safe low return technology that gives a payoff in a fraction α of the states of nature covered in normal times, i.e., without a crash. We experiment with different degrees of international tradability of this technology. We interpret our safe technology as any alternative way used by agents to save their income during financial crises, such as purchases of durable goods or cash hoardings. (b) We allow for limited participation in the stock market. Neither of these two new features alters significantly the *qualitative* properties of our model, nor do they change the fundamental mechanisms presented in the previous sections. But they notably improve the *quantitative* properties of our model. Appendix B provides the key equations of this augmented model.[25]

A. *Calibration*

The most important parameters of our model are the trade costs τ_T, financial costs τ_F, ratio of wages w_E/w_I, elasticities of substitution for goods σ and assets ε, and the share of households participating in the stock market which we denote as γ. The interaction of trade costs and

[25] They are not analytically solvable, unlike their counterparts of Sections II and III, but carry the same effects and intuitions. This is why we chose to discuss the more stylized model in the core of the paper and present this more general version in the quantitative section. The programme used to solve the model is available from the authors.

TABLE 4—QUANTITATIVE RESULTS

Panel A	Δq Asset price percent change	$\Delta CA_E/y_E$ Current account percent point change	Δy_E Income percent change
1 **Stylized model**	**−22.8**	**+46.2**	**−30.7**
2 With safe technology	−22.4	+36.5	−30.7
3 With limited participation	−12.1	+19.7	−13.1
4 With trade disruption	−29.5	+46.2	−30.7
5 With financial disruption	−23.2	+46.2	−30.7
Panel B			
6 **Baseline model**	**−20.5**	**+15.4**	**−13.1**
7 Tradable safe asset	−20.1	+8.8	−13.1
8 High τ_F	−20.8	+13.9	−12.7
9 Low τ_F	−20.2	+16.8	−13.5
10 High τ_T	−18.9	+8.1	−6.9
11 Low τ_T	no crash		
12 High τ_T (on imports)	−22.2	+17.1	−14.4
13 Low τ_T (on exports)	no crash		
14 Low w_E/w_I	−21.1	+20.3	−15.8
15 High w_E/w_I	−20.0	+11.7	−11.5
16 High ε	−20.9	+13.0	−11.8
17 Low ε	−18.3	+19.1	−15.6
18 High σ	−17.1	+5.9	−5.0
19 Low σ	−18.5	+19.0	−16.3
20 High μ, a	−20.5	+15.4	−13.1
21 Low μ, a	−20.6	+15.5	−13.1
22 High participation	−23.1	+20.8	−17.5
23 Low participation	−14.1	+4.6	−3.9

financial costs is key to getting plausible quantitative results. A period is a quarter. The values of the parameters we use are discussed below and summarized in Table 3.

Trade Costs.—We base our estimates of trade costs τ_T mainly on James E. Anderson and Eric van Wincoop (2004). According to these authors, "the pure international component of trade barriers, including transport costs and border barriers but not local distribution margins, is estimated to be in the range of 40–80 percent for industrialized countries." The estimate is based on both direct evidence and indirect evidence stemming from the gravity literature. This estimate roughly breaks down as a 21-percent transportation cost, an 8-percent policy barrier, a 7-percent language barrier, a 14-percent currency barrier, a 6-percent information cost barrier, and a 3-percent security barrier. We pick 20 percent as the low estimate of our trading costs on the goods market; this roughly corresponds to the pure transport cost estimate of Anderson and van Wincoop. We choose 80 percent as our upper estimate and 40 percent as our base case.

Crises are accompanied by the collapse of trade credits, increased exchange rate uncertainty, information asymmetries and higher insurance costs. All these elements are exogenous to our model. Unfortunately we do not have any reliable estimates of the increase in trade costs in crisis time to calibrate our model precisely.[26] We assume in our stylized model of Table 4 (panel A, lines 1–3, 5) that trade costs are invariant between normal and crisis times. Then, in the baseline model of Table 4, panel B, and in panel A, line 4, we assume that trade

[26] Zihui Ma and Leonard Cheng (2005) document the disruption of trade during a financial crisis. Using a gravity equation framework, they find a significant decline in trade flows, even after controlling for economic fundamentals. Their analysis does not allow a precise quantification of the effect, however. In the narrower case of sovereign defaults, Andrew K. Rose (2005) and José V. Martinez and Guido Sandleris (2004) also document a decrease in trade flows, even after controlling for fundamentals.

costs, both on imports and exports, increase in crisis time by 25 percent from their base value τ_T in normal times. We call this the *trade disruption case.*

Financial Costs and Limited Participation.—The choice of an estimate for financial transaction costs is more difficult, as there is no consensus in the literature. Financial costs should include the cost of government regulations on capital flows, the cost of differences in regulations in accounting, banking and commission fees, foreign exchange transaction fees, and, most importantly, information costs between emerging markets and industrialized countries. Reviewing the literature, John Heaton and Deborah J. Lucas (1996, p. 467) argue that for the U.S. equity market, "transaction costs as high as 5 percent are reasonable." Given the lack of precise data for emerging markets, we choose again a wide interval of transaction costs ranging from 1 percent to 10 percent, with a base case set at 5 percent.

During crises, however, volatility on the foreign exchange market increases, and there is more information asymmetry and adverse selection. International financial transaction costs are therefore also likely to increase.[27] We take this possibility into account and call it the *financial disruption case.* In that scenario, financial costs go from our baseline case of 5 percent in normal times to 6 percent. We also allow for the case of joint *financial and trade disruption,* where both financial and trade costs increase during a crash.

Data on limited stock market participation are not available for emerging markets. For the United States, Annette Vissing-Jorgensen (2002) documents household participation rates in the stock market of 36 percent in 1994. We pick this number as our baseline case.

Elasticities, Relative Wages, and Manufacturing Shares.—We pick an elasticity of substitution for goods of 5 in the base case, in the middle of the range of the estimates of the trade literature. We experiment with values of 4 and 10, thereby covering the estimates surveyed in Anderson and van Wincoop. We calibrate the elasticity of substitution between assets using Jeffrey A. Wurgler and Ekaterina V. Zhuravskaya (2002). They report the results of several studies, as well as their own estimates, for U.S. stocks. The elasticity ranges from 1 (Andrei Shleifer, 1986) to their own: 6, 8, and 12 depending whether stocks have close substitutes or not. Given that the important elasticity in our context is the one between equities of the emerging market and equities of the industrialized country, which are less substitutes than domestic ones, we choose a rather low elasticity for the base case, i.e., 5. We also experiment with 8 and 3.

We calibrate the wage ratio w_E/w_I between the emerging market and the industrialized country at 1/5. The Bureau of Statistics of the U.S. Department of Labor (2002) reports hourly compensation costs for production workers in manufacturing for a selected group of countries. For Mexico and Brazil, these were 12 percent of those of the United States. For Korea, these amounted to 42 percent and for Asian newly industrialized economies, 34 percent. We experiment with 1/8 in the low case and 1/3 in the high case.

We choose μ and a, the share of the manufactured good in the utility function and in the production function of the investment good, to be equal to 0.4. This number is usually the one picked in the trade literature for the share of the manufacturing sector. We also experiment with higher (0.6) and lower (0.3) values.[28]

Safe Technology.—We set α to 1 in the base case, implying that agents are able to use the safe technology to save during the crash for all states of nature covered in a noncrash equilibrium. We also experiment with low levels of α (0.1), implying that the "safe asset" gives a dividend in 10 percent of the states of the world covered in normal times. We also vary the

[27] For example, for the forex market alone, the 1998 International Monetary Fund (IMF) *International Capital Markets* report mentions that: "Prior to the crisis, bid-ask spreads on these (Asian) currencies had been similar, perhaps modestly higher, than those for the major currencies. Following the crisis, these spreads widened by factors of between 6 (ringgit) and 13 (rupiah), implying, for example, a hefty 1.7-percent average cost of carrying out a rupiah-dollar transaction on the spot market since the crisis, rising on occasion to as much as 10 percent. Higher volatility and transaction costs were also associated with a drying up of liquidity."

[28] The other constraint is that the nonmanufacturing sector should always exist in both countries. This requires that μ and a not be too large.

degree of tradability of the safe asset, from nontraded to a transaction cost as for the other assets. We set the discount rate β to 0.99 in the base case. We calibrate the safe technology parameters in order to match the risk premium at 5 percent (annualized). The latter is defined as the expected difference in return between a risky asset in the emerging market and the safe technology. The return of the safe technology is low enough that agents who have access to financial markets have no incentive to use it in absence of a crash.

B. *Results*

We are interested in the change in three variables summarizing the state of the economy: equity prices in dollars, the current account relative to income, and income.[29]

We start with a calibration of the exact stylized model described in Sections I to III. There is no safe technology and no limited participation. All parameters are set to their base value of Table 3A. Furthermore, trading costs and financial costs are equal in normal and crisis times. The only difference is that the investment sector uses manufactured goods so that a is not equal to zero. Results are displayed in Table 4 (line 1). The stylized model has qualitatively correct predictions. High enough trade costs insure that the emerging market asset dividends are dependent on local conditions, which in turn makes possible self-fulfilling demand collapses. Conversely, when trade costs are reduced to 20 percent, for example, the possibility of a crash is eliminated. Also, multiple equilibria do not exist whenever financial costs are higher than 60 percent. These results confirm the interactions between trade and financial costs we put forward in the theoretical section.

Quantitatively, the model is able to generate large drops in asset prices (−22.8 percent) but produces far too large a drop in income (−30.7 percent). The reason is that, in the crash, the entire financial wealth of the emerging market is wiped out. Since all our agents participate in the stock market, this generates a dramatic drop in aggregate income. The stylized model generates capital inflows into the emerging market in tranquil times and outflows in crisis times. But it produces too large current account reversals (from −11.7 percent of GDP in normal times to +34.5 percent in crisis times). This comes, in particular, from the absence of a safe technology: during the crisis, emerging market agents can save only by purchasing foreign risky assets, implying large capital outflows. In lines 2 to 5 of Table 4, we alter the stylized model by adding each time only one of the following features: safe technology; limited participation; increase in trade costs during the crisis (trade disruption); increase in financial costs during the crisis (financial disruption).

If we add the safe technology (line 2), we do not change much the drop in asset price nor the collapse in output; but the swing in the current account is lower, which helps bring the model somewhat closer to the data.[30] Adding limited participation to the stylized model (only 36 percent of households participate in the stock market) decreases the effect of financial wealth on the economy (line 3). The drop in asset price is smaller because, in this case, 64 percent of the economy is effectively insulated from the crash. In contrast, if we introduce trade disruption (line 4), we are able to match the data as far as the drop in asset price is concerned (−29.5 percent) but the drop in output and the current account reversal are still too extreme. This dramatic effect on the asset price comes from the decrease in profits of the emerging market firms, which have to rely even more on domestic demand in crisis times. The ensuing decrease in dividends is magnified by the income effect and creates a sharp drop in the emerging market asset price. The same type of mechanism, i.e., an increased reliance on domestic demand to sell assets in crisis times, explains the effect of financial disruption on asset prices (line 5), but quantitatively the effect is much smaller.

[29] Quarterly data on GDP are not available for these countries. Industrial production is therefore used as a proxy for income. In our model, income and consumption are perfectly correlated due to the log utility, so we do not report changes in consumption.

[30] Adding a safe technology makes possible the existence of crashes in autarky, since it may not be worthwhile for agents to invest in risky assets if everyone else coordinates on the safe technology. This does not, however, alter the logic behind the existence of multiple equilibria for intermediate levels of financial costs. Emerging market agents now invest both in foreign risky assets and in the safe asset during crashes. In this experiment, the safe technology is nontraded.

Our baseline model incorporates all these features. Panel B of Table 4 (line 6) presents the model when the safe technology, limited participation, trade, and financial disruption are all present at the same time. All the parameters have been set to their base value of Table 3A and 3B. As before, the only difference between the emerging market and the developed economy is their productivity level. This baseline model is closer to the data. Asset prices drop by 20.5 percent, income drops by 13.1 percent, and the current account goes from −4.1 percent in normal times to +11.3 percent in crisis times, i.e., a reversal of 15.4 points of income. We have checked that the industrialized country cannot be subject to a crash with these parameters.

We now subject the baseline model to sensitivity experiments. If the safe technology is internationally tradable, the current account reversal becomes smaller. For example, if 30 percent of the safe projects are internationally tradable (with the same transaction costs as other assets), then (see line 7) the current account reversal is only 8.8 points of GDP because the emerging market sells these assets to the industrialized country. The drops in asset price and income remain similar because the international tradability of the safe asset leads the industrialized country to buy less of both risky assets in a crash so that their relative price does not change much.

In lines 8 to 13, we perform some sensitivity analysis of the magnitude of the frictions. Varying financial costs (high and low cases in Table 3B) affect the magnitude of the current account reversal. If $\alpha < 1$ (the safe asset gives in less than 100 percent of states of nature covered in a noncrash equilibrium), then increasing financial costs sufficiently eliminate the possibility of a crash. Changing trade costs alter both the domain of existence of multiple equilibria and the magnitude of the crash. Because (symmetrically) higher trade costs in the goods market generate lower asset prices and income in both the no-crash and the crash equilibria, they may lead to a smaller crash (line 10). Lower trade costs, however, always make the domain of multiple equilibria smaller: with trade costs at 20 percent, a crash is not possible (line 11). But we can also investigate the impact of *asymmetric* trade costs. For high import costs (due to higher tariffs or less efficient port facilities, for example), the crash is more pronounced (−22.2 percent, line 12) because the asset price in E is higher in the no-crash equilibrium. Protectionism increases profits of firms in the good equilibrium when domestic income is large. It does not, however, sever the link between asset prices and pessimistic expectations affecting domestic demand. Hence, protectionism does not decrease the likelihood of a financial crash. On the other hand, lower export costs make sales of E firms more dependent on world income, which is more stable than domestic income and therefore weakens the circular causality mechanism at the origin of a crash. When export costs are down to 20 percent, the possibility of a crash is eliminated (line 13).

A higher productivity differential between the rich country and the emerging market exacerbates all the characteristics of the crash since our mechanisms are based on demand: a relatively poorer emerging market will experience, *ceteris paribus,* a sharper drop in asset prices and income and a larger current account reversal (lines 14 and 15). If the difference in wage between the emerging market and the industrialized country is small enough, the possibility of a crash disappears. This is the case if w_E is only 50 percent smaller than w_I. This confirms that our mechanism is able to explain why emerging markets are more prone to crashes than high-income countries.

A high elasticity of substitution across assets tends to increase the extent of the crash (lines 16 and 17). Since the transformations of the financial costs $\phi_F = (1 + \tau_F)^{1-\varepsilon}$ and of the trade costs $\phi_T = (1 + \tau_T)^{1-\sigma}$ are the effective measures of financial and trade openness in the model, an increase in ε is like an increase in τ_F. An increase in σ is analogous to a increase in τ_T, but it also decreases profits in the monopolistic sector and therefore the role of demand on dividends. Hence, the effect of σ on the magnitude of the crash is ambiguous (lines 18 and 19).

In lines 20 and 21, we check that the manufacturing sector share does not change the results. We have also checked that changing the risk premium, the discount factor, or the number of states covered by the safe technology, α, does not alter our results. In lines 22 and 23, we find that higher participation in stock markets, which can be interpreted as a higher dependence of the economy on financial wealth, leads to larger crashes, income drops, and current account reversals.

Overall, our baseline model matches the stylized facts of Table 2 reasonably well. In order to get a smaller current reversal, we would need some degree of international tradability of the safe technology (see line 7). There are different plausible mechanisms to get a larger drop in asset prices with similar drops in income and current account reversals. First, a larger trade disruption (trade costs increasing from 40 percent to 60 percent in crash) would generate a 26.9-percent crash in asset prices. Similarly, a high degree of financial disruption (transaction costs increase from 5 percent to 15 percent in crash) also generates a larger crash (−23.7 percent). The model is flexible enough to allow for domestic trade costs on goods markets. If we assume that those trade costs go from 0 to 20 percent in crisis time, this alone would generate a crash of −25.8 percent. Domestic trade and international trade disruptions reinforce each other so that we can generate a sharp drop in asset prices with relatively small levels of trade disruption in domestic and international markets.

The assumption that *all* assets give dividends in only one state of nature (as opposed to several) is immaterial for the results on relative asset prices. But relaxing the assumption that the risk of assets is *identical* in the two countries and/or across the no-crash and crash equilibria is interesting. If E assets are riskier (they give dividends in fewer states of nature), then the crash is less pronounced: the price of the asset in normal times is lower so that the difference between no-crash and crash is also lower.[31] If, however, during a crash assets become more risky in the sense that the number of states they cover is 10 percent lower than in the no-crash equilibrium, then the drop in asset price is more pronounced (−28.6 percent). The introduction of a *fixed cost in the production* of goods also makes the crash more pronounced. If the fixed cost is proportional to wage costs (at around 10 percent of the value of sales), this increases profitability in the E market, and the magnitude of the crash becomes larger at −26 percent.

V. Conclusion

Our model puts forward a demand-based mechanism of crisis in emerging markets where segmentation of the goods and asset markets plays a key role. Our framework is the first one, to our knowledge, that analyzes jointly home market effects in the financial and goods markets and their interactions. Relatively high trade costs on the goods market make profits and dividends very dependent on domestic demand. Financial globalization makes coordination on capital flight possible. Emerging market income itself depends on investment, which is affected by asset prices, in turn dependent on domestic income and demand. This circularity makes our demand channel quantitatively powerful. Our mechanism of financial crisis is very general, since it is at work whenever there is a sizable difference in income between countries and there are trading costs in goods and financial markets.

We see our approach as complementary to existing views on the links between financial globalization and crises. So far, the literature has emphasized that financial globalization, by making borrowing on world financial markets easier, strengthens market failures prevalent in emerging markets. In particular, moral hazard and credit constraints have been shown to facilitate the advent of financial crises. Our paper suggests that such market failures are not a necessary condition for emerging markets to become vulnerable to a crash when capital flows are liberalized. Trade costs on international trade in goods and assets will themselves generate that vulnerability.

Both the potential benefit of globalization (in terms of cost of capital, investment, and income) and the higher vulnerability of emerging markets to a crash come from the same factor that differentiates emerging markets and industrialized countries in our model: their productivity and income level. The higher vulnerability is not necessarily due to bad institutions, bad incentives (bailouts), or bad exchange rate regimes. This is not to say that these problems do not constitute important channels through which financial globalization can make emerging markets more vulnerable to a financial crisis.[32] The existing literature has logically recommended

[31] For example, if the number of states covered by E assets is 10 percent lower than in I, then the crash is 18.8 percent.

[32] The inclusion of credit constraints on investment in our model would certainly reinforce the possibility of a crash, as the fall in asset prices would reduce the value of collateral.

policies addressing the informational and institutional frictions at the origin of the credit market imperfections it describes. More transparency, better information, and better banking regulation have been advocated. Similarly, currency mismatches in fixed exchange rate regimes are listed as prime suspects to explain crises of these countries. Our paper shows that these policies and institutional changes may not be sufficient to prevent crises in intermediate-income countries and that financial crises may be a more general phenomenon for those economies. A possible policy implication of our model is that trade openness has a beneficial role, since it mitigates the dependence of the emerging market on domestic demand and decreases the domain of existence of multiple equilibria. This also suggests that emerging markets should liberalize their trade account before their capital account. Although such a prescription is sometimes heard in policy circles, we believe our paper is the first analytical work giving an economic rationale to support it. Ultimately, to analyze precisely policy implications on the timing of reforms, it would be necessary to quantify a dynamic infinite horizon version of the model. This would require, however, an equilibrium selection mechanism to pick the crash or no-crash equilibrium. We leave this for future work.

Appendix A: The Effect of Financial Liberalization on Emerging Market Asset Prices

An increase in ϕ_F affects only the qq curve. It will lead to an increase in q if the intersection point of the qq curve and the YY curve shifts right when ϕ_F increases. This will be the case if

$$\frac{\partial s_Y}{\partial \phi_{F_{q=\bar{q}}}} = \frac{q[(q/d)^{\varepsilon-1} - (q/d)^{1-\varepsilon}] - 2\phi_F(1-s_Y)}{(1+q^2)(1-\phi_F^2) + (\varepsilon-1)\phi_F[q^2(q/d)^{-\varepsilon} + (q/d)^{\varepsilon}]\dfrac{(1-\phi_T^2)}{[1-s_Y(1-\phi_T)]^2}} < 0.$$

A sufficient condition for this is that $q/d < 1$.

Appendix B: Key Equations of the Model Used in the Quantitative Section

The model includes a safe asset which gives a dividend in a share α of the states of the world covered in normal times, and has a return r. We also introduce a parameter γ describing the extent of participation in the stock market (only $1-\gamma$ households participate). The stock market equilibrium with limited participation in normal times becomes

$$p_E = \frac{\beta}{1+\beta}\left(\frac{y_E - \gamma w_E}{(1-\gamma)z_E + (1-\gamma)z_I\phi_F(q/d)^{\varepsilon-1}} + \frac{(y_I - \gamma w_I)\phi_F(q/d)^{1-\varepsilon}}{(1-\gamma)z_I + (1-\gamma)z_E\phi_F(q/d)^{1-\varepsilon}}\right);$$

$$p_I = \frac{\beta}{1+\beta}\left(\frac{y_I - \gamma w_I}{(1-\gamma)z_I + (1-\gamma)z_E\phi_F(q/d)^{1-\varepsilon}} + \frac{(y_E - \gamma w_E)\phi_F(q/d)^{\varepsilon-1}}{(1-\gamma)z_E + (1-\gamma)z_I\phi_F(q/d)^{\varepsilon-1}}\right).$$

Income in the emerging market in normal times is now given by $y_E = w_E + (1-\gamma)p_E^2/2$.

In crash, the stock market equilibrium becomes

$$p_{E_c} = \frac{\beta}{1+\beta}\left(\frac{(1-\gamma)w_E}{(1-\gamma)\alpha z_E(rp_{E_c}/d_{E_c})^{\varepsilon-1} + (1-\gamma)z_{Ic}\phi_F(q_c/d_c)^{\varepsilon-1}} + \frac{(y_{Ic} - \gamma w_I)\phi_F(q_c/d_c)^{1-\varepsilon}}{(1-\gamma)z_{Ic}}\right);$$

$$p_{Ic} = \frac{\beta}{1+\beta}\left(\frac{y_{Ic} - \gamma w_I}{(1-\gamma)z_{Ic}} + \frac{(1-\gamma)w_E\phi_F(q_c/d_c)^{\varepsilon-1}}{(1-\gamma)\alpha z_E(rp_{E_c}/d_{E_c})^{\varepsilon-1} + (1-\gamma)z_{Ic}\phi_F(q_c/d_c)^{\varepsilon-1}}\right).$$

The dividends are given by equation (8) adjusted for limited participation and its symmetric in a crash. The value of the emerging market demand of the safe asset in a crash is

$$\frac{\beta w_E}{1+\beta}\,\frac{(rp_{Ec})^{\varepsilon-1}}{(1-\gamma)\alpha z_E(rp_{E_c})^{\varepsilon-1} + (1-\gamma)z_{Ic}\phi_F(p_{E_c}d_{Ic}/p_{Ic})^{\varepsilon-1}}.$$

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