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Globalization and Emerging Markets: With or Without Crash?

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**ABSTRACT**

This paper develops a theory of crisis based on the demand side of the economy. We analyze the impact of financial and trade globalizations on asset prices, investment and the possibility of self-fulfilling financial crashes. In a two-country model, we show that financial and trade globalizations have different effects on asset prices, investment and income in the emerging market and in the industrialized country. Whereas trade globalization always has a positive effect on the emerging market, financial globalization may not, especially when trade costs are high. For intermediate levels of financial transaction costs and high levels of trade costs, pessimistic expectations can be self-fulfilling and may lead to a collapse in demand for goods and assets of the emerging market. Such a crash in asset prices is accompanied by a current account reversal, a drop in income and investment and more market incompleteness. We show that countries with lower income are more prone to such demand-based financial crashes. Our model can replicate the main stylized facts of financial crashes in emerging markets. Our results suggest that, to reduce the risk of financial crashes, emerging markets should liberalize trade in goods before trade in assets.

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# 1 Introduction

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<sup>1</sup> 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. On the other hand, a voluminous literature surveyed by Aizenman (2002) emphasizes the risks of liberalization and the vulnerability of emerging market financial systems to capital mobility<sup>2</sup>. Wyplosz (2001) finds that external financial liberalization is considerably more destabilizing in developing countries than in developed economies. Kaminski and 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. Cavallo and 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 Calvo *et al.* (2003), Calvo and Talvi (2004) and Cavallo (2004)).

These contradictory effects of financial and trade globalizations are illustrated in Table A. 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<sup>3</sup>. It is noteworthy that all Latin American countries (except Panama and Jamaica), whether financially open or not, are in the closed trade group. Table A 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, however, is associated with a large decrease in the frequency of crashes for emerging markets<sup>4</sup>. Hence, according to Table A, being an emerging market open to financial flows while closed to goods flows maximizes the frequency of crashes.

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<sup>1</sup>See for example Bekaert et al. (2001), Henry (2000) and Chari and Henry (2002). The macroeconomic literature finds more tenuous evidence that financial opening contributes to long-term growth. See Edwards (2001) and McKenzie (2001), for example.

<sup>2</sup>See for example Rossi (1999), Demirgüç-Kunt and Detragiache (1998), Kaminsky and Reinhart (1999).

<sup>3</sup>More precisely, developed countries are defined as those with GDP per capita above South Korea. 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 in periods for which countries were financially 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 then divided each group in terms of their openness to trade. We define the average openness ratio during the period considered as the average of exports plus imports over GDP. We call open (respectively closed) a country whose openness ratio is above (respectively below) the median of its group. The trade openness ratio cut-off for financially open emerging countries is 63% of GDP. For the group of financially closed countries, the trade openness ratio cut-off is 54%. The Appendix posted at <http://www.princeton.edu/~hrey/> provides more details on the data, the periods considered and the way we classify financially open and financially closed economies.

<sup>4</sup>This is not the case for developed countries, but for them the frequency of crises remains low overall.

Table A: Frequency of crashes, financial and trade openness

	Developed		Emerging	
	Trade in goods			
	more closed	more open	more closed	more open
Financially closed	.07	.10	.35	.15
Financially open	.05	.14	.76	.57

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 or not 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 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. Mendoza (2004) and Mendoza and 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<sup>5</sup>. 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 (as in Krugman (1999), Caballero and Krishnamurthy (1998), Christiano et al. (2000), Schneider and Tornell (2004), Chang and Velasco (2001), Paasche (2001) and Cespedes et al. (2004)). Neither is it caused by moral hazard (as in McKinnon and Pill (1999) and Corsetti et al. (1999)). Instead, in our set up, 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<sup>6</sup>. 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 set up self-fulfilling expectations operate through investment behavior and endogenously incomplete asset markets. Our framework has clear and important policy implications: only once emerging markets are well-integrated in world goods market 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 2. Section 3 describes the properties of the equilibrium in "normal times" while Section 4 investigates the conditions necessary for a financial crash to occur. Section 5 performs a quantitative evaluation of our model. Finally, we draw some conclusions in Section 6.

## 2 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.

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<sup>5</sup>See also Mendoza (2002) and the survey of Arellano and Mendoza (2003). For a view of Asian crises based on implicit fiscal liabilities, see Burnside et al (2001). Matsuyama (2004) presents a model in which borrowing constraints interact with financial globalization to produce an endogenous degree of inequality across otherwise identical countries.

<sup>6</sup>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.

### 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 competitive constant returns to scale sector with zero trade cost, which serves as the numeraire, and a monopolistically competitive sector with iceberg trade costs  $\tau_T$ . Transport costs and trade policies both affect  $\tau_T$ . 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 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 CRS 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 both at the national and the international level, we introduce a simple source of uncertainty. This will induce agents to diversify in equilibrium their ownership of firms<sup>7</sup>. 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 which is a claim to risky profits is given by  $p_E$ . The total cost of investment is  $F + \frac{1}{2}z_E^2Q$ , 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<sup>8</sup>. 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<sup>9</sup>. The value of a firm is therefore the expected payoff of the investment  $\pi_E = p_E z_E - \frac{1}{2}z_E^2Q - F$ . 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 Acemoglu and 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

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<sup>7</sup>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 (see below).

<sup>8</sup>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.

<sup>9</sup>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.

investment in country  $E$  yields  $d_E$  if the corresponding state of the world is realized and 0 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<sup>10</sup>. This modelling introduces a simple incentive for agents to diversify their portfolios across firms in an otherwise standard 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 translate into a home bias in asset transactions and holdings<sup>11</sup>. We denote the transaction costs on financial assets  $\tau_F$  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<sup>12</sup>. We interpret financial globalization as a process through which these transaction costs are reduced.

### Utility and budget constraints

We assume that the utility of an agent in each country is given by the non-expected utility function introduced by Epstein and Zin (1989) and Weil (1990). This allows the intertemporal elasticity of substitution (which we assume to be 1 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:

$$\mathcal{E}(U_E) = \ln \left[ c_{EY}^{1-\mu} C_{E1}^\mu \right] + \beta \ln \left[ \sum_{n=1}^N \frac{1}{N} c_{E2}(n)^{1-1/\varepsilon} \right]^{\frac{1}{1-1/\varepsilon}} \quad (1)$$

where  $c_{E2}(n)$  denotes the second period consumption in one of the  $N$  states of the world and  $\mathcal{E}$  is the

<sup>10</sup>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.

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

<sup>12</sup>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. Gordon and Bovenberg (1996) use a similar type of proportional transaction cost on capital flows and focus on the cost of acquiring information about foreign countries.

expectation sign.  $c_{EY}$  is the consumption of the CRS good with a share  $1 - \mu$  in the utility function while  $\mu$  is the share of the composite good  $C_{E1}$  made of all varieties produced in the world:

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

$\sigma > 1$  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:

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

where  $y_E$  is the emerging market per-capita income of the first period,  $v_{Ei}$  is the price of the  $i$ th variety produced in the  $E$  market and  $v_{Ij}$  is the price of the  $j$ th variety produced in the  $I$  market and  $\pi_E$  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:

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

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

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

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 Dixit and Stiglitz to represent preferences for differentiated products. In fact,  $\varepsilon$  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<sup>13</sup>. This restriction on  $\varepsilon$  mirrors the standard assumption in the differentiated products literature that the elasticity of substitution between different varieties  $\sigma$  is greater than 1. This restriction also implies that assets are substitutes rather than complements as in Acemoglu and Zilibotti

<sup>13</sup>See Section 3 below. The demand for foreign assets decreases with transaction costs  $\tau_F$  for any  $\varepsilon$ . 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  $\tau_F$  if  $\varepsilon$  were to be smaller than 1.



(1997).<sup>14</sup> 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.<sup>15</sup>

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<sup>16</sup>. 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 1 in both countries, and the elasticity of substitution between varieties  $\sigma$  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 mark-up, is given by  $v_E = v_I = \sigma/(\sigma - 1)$ . For notational simplicity, we drop the expectational sign in what follows.

### 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:

- i)  $[C_{E1}, c_{EY}, s_{EE}, s_{EI}, c_{E2}(n)]$  maximize  $U_E$  subject to  $E$ 's budget constraints (equations (3) and (4)) taking prices as given.
- ii)  $[C_{I1}, c_{IY}, s_{II}, s_{IE}, c_{I2}(n)]$  maximize  $U_I$  subject to  $I$ 's budget constraints (the analogue of equations (3) and (4)) taking prices as given.
- iii)  $[v_E, v_I, z_E, z_I]$  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 non-negative for  $i = \{E, I\}$ <sup>17</sup>.
- iv) Asset markets clear:  $Ls_{EE} + L(1 + \tau_F)s_{IE} = 1$  and  $Ls_{II} + L(1 + \tau_F)s_{EI} = 1$ .
- v) The world resource constraint is verified which implies:

$$L [c_{EY} + c_{IY} + Lc_{EE} + Lc_{EI}(1 + \tau_T) + Lc_{II} + Lc_{IE}(1 + \tau_T) + \frac{1}{2}(z_E^2 + z_I^2)Q \left(\frac{\sigma - a}{\sigma}\right) + d_E + d_I] = L(w_E + w_I)$$
<sup>18</sup>

- vi) Expectations are rational.

<sup>14</sup>In section 5, we review the existing empirical estimates for  $\varepsilon$ : they range from 1 to 12.

<sup>15</sup>When we introduce a safe asset (see Section 5) this issue of course does not arise any longer.

<sup>16</sup>In each country, agents are different in the sense that they hold different assets but they choose identical portfolios and consumption patterns.

<sup>17</sup>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 Martin and Rey (2002).

<sup>18</sup>We have used the cost minimization programme of firms to derive their demands for the investment good.

### 3 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:

$$\begin{aligned} c_{EY} &= \frac{(1-\mu)y_E}{(1+\beta)} \\ c_{EE} &= \frac{\mu(\sigma-1)y_E}{L\sigma(1+\beta)[1+\phi_T]}; \quad c_{EI} = \frac{\mu(\sigma-1)y_E(1+\tau_T)^{-\sigma}}{L\sigma(1+\beta)[1+\phi_T]} \\ s_{EE} &= \frac{\beta y_E}{1+\beta} \frac{1}{L p_E} [z_E + \phi_F z_I (q/d)^{\varepsilon-1}]^{-1}; \quad s_{EI} = \frac{\beta y_E}{1+\beta} \frac{(1+\tau_F)^{-\varepsilon} (q/d)^{\varepsilon-1}}{L p_I [z_E + \phi_F z_I (q/d)^{\varepsilon-1}]} \end{aligned} \quad (6)$$

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:  $z_E Q = p_E$ <sup>19</sup>. 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:  $p_E z_E - \frac{1}{2} z_E^2 Q = \frac{1}{2} p_E^2 / Q \geq F$ .

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:

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

There are  $L(z_E + z_I)$  such equilibrium conditions. In the parenthesis, 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  $\phi_F$  is less than 1, 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 as in any model of monopolistic competition:

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

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<sup>19</sup>  $Q = a^{-\alpha}(1-a)^{\alpha-1} \left( \frac{\sigma}{\sigma-1} \right)^{\alpha} [L(1+\phi_T)]^{\frac{-\alpha}{\sigma-1}}$  is the price of the investment good.

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  $\phi_T$  is less than 1, 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 only requires labor,  $Q = 1$  and profits only come 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.

### 3.1 Equilibrium relationship between asset prices, dividends and income shares

As world income is fixed<sup>20</sup>, and the two countries have the same size, 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:

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

where  $s_w = w_E/(w_E + w_I) < 1/2$  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:

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

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:

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

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  $s_Y < 1/2$ .

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<sup>20</sup>From the stock market equilibria we obtain that  $p_E z_E + p_I z_I = \frac{\beta}{1+\beta}(y_E + y_I)$ . Using the optimal investment rule and the definition of world income, we therefore have  $L(y_E + y_I) = \frac{2L(1+\beta)}{2+\beta}(w_E + w_I)$ . Hence total world income in the first period is fixed.

Together, (10) and (11) provide a non-linear 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.

### 3.2 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.

On Figure 1, we illustrate the equilibrium as the intersection of the  $yy$  and  $qq$  schedules. The relative price of assets  $q$  is less than 1 as long as the financial or goods markets are not perfectly integrated ( $\phi_F \neq 1$  or  $\phi_T \neq 1$ ) and  $s_w < 1/2$ . 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  $\phi_T$ ) is easily analyzed. As long as  $s_w < 1/2$ , 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 on 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  $s_Y < 1/2$ . This in turn increases the demand for emerging market assets and their relative price, which generates a rise in relative income. Due to the 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. We give in Appendix I the exact condition for which an increase in  $\phi_F$  (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 1. 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 markets 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

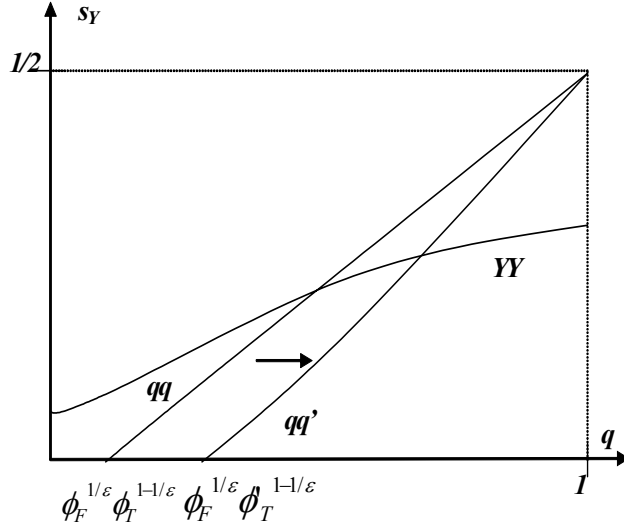


Figure 1: Trade liberalization, income and asset prices

decrease in the demand for emerging market assets (capital outflows), a decrease of their price and more market incompleteness. These two possibilities are illustrated in Figure 2.

Trade and financial integration have potentially opposite effects in the emerging market, and they interact in an interesting way. Weak trade integration generates lower asset prices and income in the emerging market and may imply a depressing effect of financial integration on asset prices.

### 3.3 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 :

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

The current account deteriorates as the relative asset price in the emerging market increases. Hence trade integration (an increase in  $\phi_T$ ) always implies an increase in the current account deficit. Financial integration (an increase in  $\phi_F$ ) 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.

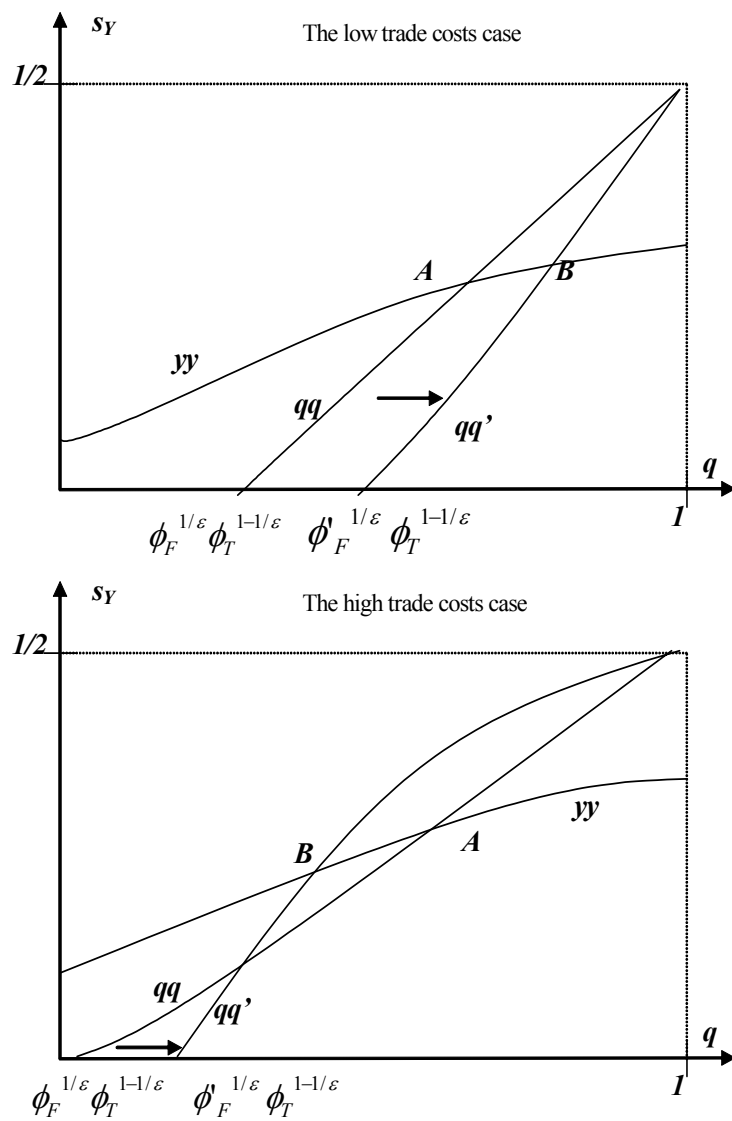


Figure 2: Financial liberalization, income and asset prices

## 4 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. However, the decision to invest depends 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<sup>21</sup>.

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:

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

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

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

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:

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

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

Multiple equilibria exist if and only if:

$$q_c^2 < \frac{q^2}{1+q^2} \quad (16)$$

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<sup>21</sup>  $z_{Ec}$  in this condition is the investment that would be done 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.

This guarantees that, for a given set of parameter values, a “good” equilibrium exists whenever  $z_E > 0$  and a crash equilibrium exists whenever  $z_{Ec} = 0$ .<sup>22</sup><sup>23</sup>

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<sup>24</sup>. 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 ( $\phi_F = \phi_T = 1$ ), then  $q_c = 1$ , so arbitrage implies that agents in the industrialized country would rush to buy the 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 financial 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  $\phi_T$  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 A.

The analysis of asset prices in a crash also shows that countries more open to trade in goods (larger  $\phi_T$ ) are less vulnerable to financial crashes. Indeed, these countries’ operating profits and dividends

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<sup>22</sup>As mentioned before, we are limiting our analysis to symmetric equilibria in which all investors in each country behave similarly.

<sup>23</sup>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.

<sup>24</sup>This also implies that an equilibrium where both countries are in crash is not possible.



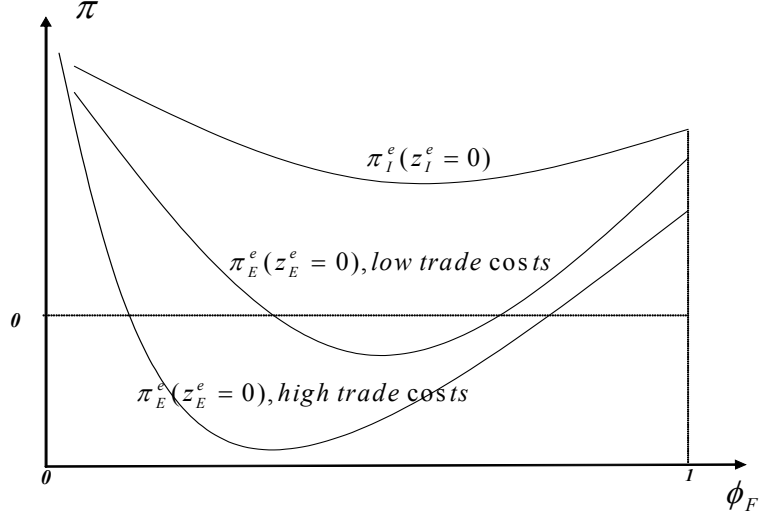


Figure 3: The possibility of a crash and transaction costs

(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 3 depicts payoff functions in crash as a function of financial openness  $\phi_F$ . 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.

## 5 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 I (taken from Mendoza and Smith (2004)) reproduces data for four emerging markets, Argentina, Korea, Mexico and Russia. Table II presents the parameter values used in the calibrations. Panel A of Table III provides the quantitative implications of the exact model we described in the 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 III): 1) Agents have access to a safe low return technology that gives a pay-off in a fraction  $\alpha$  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. 2) 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 II provides the key equations of this augmented model.<sup>2526</sup>

### 5.1 Calibration

The most important parameters of our model are the trade costs  $\tau_T$ , financial costs  $\tau_F$ , ratio of wages  $\frac{w_F}{w_T}$ , elasticities of substitution for goods  $\sigma$  and assets  $\varepsilon$  and the share of households participating in the stock market which we denote as  $\gamma$ . The interaction of trade costs and financial costs is key to get plausible quantitative results. A period is a quarter. The values of the parameters we use are discussed below and summarized in Table II.

#### 5.1.1 Trade costs

We base our estimates of trade costs  $\tau_T$  mainly on Anderson and van Wincoop (2004) (AW henceforth). 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% 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% transportation cost, a 8% policy barrier, a 7% language barrier, a 14% currency barrier, a 6% information cost barrier and a 3% security barrier. We pick 20% as the low estimate of our trading costs on the goods

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<sup>25</sup>They are not analytically solvable, unlike their counterparts of sections 2-4, 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.

<sup>26</sup>Ultimately, it could be of interest to quantify an infinite horizon version of the model, but this would require an equilibrium selection mechanism to pick the crash or no crash equilibrium in the multiple equilibrium region. We leave this for future work due to the complexity of the task.

market; this roughly corresponds to the pure transport cost estimate of AW. We choose 80% as our upper estimate and 40% 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<sup>27</sup>. We assume in our stylized model of Table III (Panel A, lines 1-3,5) that trade costs are invariant between normal and crisis times. Then, in the baseline model of Table III, Panel B and in Panel A, line 4 we assume that trade costs, both on imports and exports, increase in crisis time by 10 percentage points from their base value  $\tau_T$  in normal times. We call this the *trade disruption case*.

### 5.1.2 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, 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, Heaton and Lucas (1996 p. 467) argue that for the US equity market "transaction costs as high as 5% are reasonable". Given the lack of precise data for emerging markets, we choose again a wide interval of transaction costs ranging from 1% to 10% with a base case set at 5%.

During crises however, volatility on the foreign exchange market increases, there is more information asymmetry and adverse selection. International financial transaction costs are therefore also likely to increase<sup>28</sup>. 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% in normal times to 6%. 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 is not available for emerging markets. For the United States, Vissing-Jorgensen (2002) documents household participation rates in the stock market of 36% in 1994. We pick this number as our baseline case.

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<sup>27</sup>Ma and Cheng (2003) 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, Rose (2005) and Martinez and Sandleris (2004) also document a decrease in trade flows even after controlling for fundamentals.

<sup>28</sup>For example, for the forex market alone, the 1998 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".

### 5.1.3 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 AW. We calibrate the elasticity of substitution between assets using Wurgler and Zhuravskaya (2002). They report the results of several studies as well as their own estimates for US stocks. The elasticity ranges from 1 (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  $\frac{w_E}{w_I}$  between the emerging market and the industrialized country at 1/5. The Bureau of Statistics of the US 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% of the US. For Korea these amounted to 42% and for Asian NIEs, 34%. We experiment with 1/8 in the low case and 1/3 in the high case.

We choose  $\mu$  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 experiment with higher (0.6) and lower (0.3) values too<sup>29</sup>.

### 5.1.4 Safe technology

We set  $\alpha$  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 non-crash equilibrium. We also experiment with low levels of  $\alpha$  (0.1), implying that the "safe asset" gives a dividend in 10% of the states of the world covered in normal times. We also vary the degree of tradability of the safe asset, from non traded to subject to the same transaction costs as the other assets. We set the discount rate  $\beta$  to 0.99 in the base case. We calibrate the safe technology parameters in order to match the risk premium at 5% (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.

## 5.2 Results

We are interested by the change in three variables summarizing the state of the economy: equity prices in dollars, the current account relative to income, and income<sup>30</sup>.

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<sup>29</sup>The other constraint is that the non-manufacturing sector should always exist in both countries. This requires that  $\mu$  and  $a$  not be too large.

<sup>30</sup>Quarterly data on GDP is 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

We start with a calibration of the exact stylized model described in sections 2 to 4 of the paper. There is no safe technology and no limited participation. All parameters are set to their base value of Table II.1. Furthermore, trading costs and financial costs are taken 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 III (line 1). The stylized model has qualitatively correct predictions. High enough trade costs insure that the emerging market assets dividends are dependent on local conditions, which in turn makes possible self-fulfilling demand collapses. Conversely when trade costs are reduced to 20%, for example, the possibility of a crash is eliminated. Also, multiple equilibria do not exist whenever financial costs are higher than 60%. These results confirm the interactions between trade and financial costs that we put forward in the theoretical section.

Quantitatively, the model is able to generate large drops in asset prices (-22.8%) but produces a far too large drop in income (-30.7%). 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% of GDP in normal times to +34.5% 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 2-5 of Table III, 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<sup>31</sup>. Adding limited participation to the stylized model (only 36% 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% of the economy is effectively insulated from the crash. In contrast, if we introduce trade disruption (line 4), we are now able to match the data as far as the drop in asset price is concerned (-29.5%) 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

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changes in consumption.

<sup>31</sup>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 alter however 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 non-traded.

effect is much smaller.

Our baseline model incorporates all these features. Panel B of Table III (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 II.1 and II.2. 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%, income by 13.1% and the current account goes from -4.1% in normal times to +11.3% in crisis times, i.e. a reversal of 15.4 pts of income<sup>32</sup>.

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% 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 11, we perform some sensitivity analysis on the magnitude of the frictions. Varying financial costs (high and low cases in Table II.2) affects mainly the magnitude of the current account reversal. Changing trade costs alters both the domain of existence of multiple equilibria and the magnitude of the crash. Because 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). However, lower trade costs always make the domain of multiple equilibria smaller: with trade costs at 20%, a crash is not possible (line 11). 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 12-13). 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% 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 16-17). 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  $\varepsilon$  is like an increase in  $\tau_F$ . An increase in  $\sigma$  is also analogous to an increase in  $\tau_T$  but it also decreases profits in the monopolistic sector and therefore the role of demand on dividends. Hence the effect of  $\sigma$  on the magnitude of the crash is ambiguous (lines 14-15).

In lines 18-19, 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

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<sup>32</sup>We have checked that the industrialized country cannot be subject to a crash with these parameters.

the safe technology,  $\alpha$  do not alter our results.

In lines 20-21, we find that higher participation on 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 I 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% to 60% in crash) would generate a 26.9% crash in asset prices. Similarly, a high degree of financial disruption (transaction costs increase from 5% to 15% in crash) also generates a larger crash (-23.7%). Finally, 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% in crisis time, this alone, would generate a crash of -25.8%. Domestic trade and international trade disruptions reinforce each other so that we can generate sharp drop in asset prices with relatively small levels of trade disruption in domestic and international markets. These results underline the necessity of doing more research investigating the time-varying dimension of goods and financial market trading costs across normal and crisis times. This is one the main lessons of our quantitative analysis.

## 6 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 analyses 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 shows 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<sup>33</sup>. The existing literature has logically recommended policies addressing the informational and institutional frictions at the origin of the credit market imperfections it describes. More transparency, better information, 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. An important 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. Our results suggest that, to reduce the risk of financial crashes, 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 a clear economic rationale to support it.

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<sup>33</sup>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. For an interesting investigation of the links between credit market frictions and moral hazard see Durdu and Mendoza (2004).



Table I: Crises in four Emerging Economies	<i>RealEquityPrices</i> (% change)	<i>Current Account/GDP</i> (% points change)	<i>Ind.Production</i> (% 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

Note: 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 (Source Mendoza and Smith 2004).

Table II.1 Parameters	<i>Wages</i> $w_E/w_I$	<i>Subst. Goods</i> $\sigma$	<i>Subst. assets</i> $\varepsilon$	<i>Discount</i> $\beta$	<i>Risk premium</i> $r_{pE}$	<i>safe</i> $\alpha$	<i>manuf. share</i> $\mu, a$
<b>Base case</b>	<b>1/5</b>	<b>5</b>	<b>5</b>	<b>0.99</b>	<b>1.05</b>	<b>1</b>	<b>0.4</b>
High	1/3	10	8	—	1.10	—	0.6
Low	1/8	4	3	0.95	1.02	0.1	0.3

Table II.2 Frictions		<i>Financial cost</i> $\tau_F$	<i>Trade cost</i> $\tau_T$	<i>Participation</i> $\gamma$
<b>NO CRISIS</b>	<b>Base case</b>	<b>5%</b>	<b>40%</b>	<b>36%</b>
	<i>High</i>	10%	80%	50%
	<i>Low</i>	1%	20%	10%
<b>CRISIS</b>	<b>Base case</b>	<b>6%</b>	<b>50%</b>	<b>36%</b>
	<i>High</i>	12%	100%	50%
	<i>Low</i>	1.2%	25%	10%

TABLE III: Quantitative Results

Panel A		$\Delta q$	$\Delta CA_E/y_E$	$\Delta y_E$
		<i>asset price</i>	<i>current account</i>	<i>income</i>
1	<b>Stylized model</b>	<b>-22.8%</b>	<b>+46.2 pts</b>	<b>-30.7%</b>
2	with safe technology	-22.4%	+36.5 pts	-30.7%
3	with limited participation	-12.1%	+19.7 pts	-13.1%
4	with trade disruption	-29.5%	+46.2 pts	-30.7%
5	with financial disruption	-23.2%	+46.2 pts	-30.7%
Panel B				
6	<b>Baseline model</b>	<b>-20.5%</b>	<b>+15.4 pts</b>	<b>-13.1%</b>
7	tradable safe asset	-20.1%	+8.8 pts	-13.1%
8	high $\tau_F$	-20.8%	+13.9 pts	-12.7%
9	low $\tau_F$	-20.2%	+16.8 pts	-13.5%
10	high $\tau_T$	-18.9%	+8.1 pts	-6.9%
11	low $\tau_T$	no crash		
12	low $w_E/w_I$	-21.1%	+20.3 pts	-15.8%
13	high $w_E/w_I$	-20.0%	+11.7 pts	-11.5%
14	high $\sigma$	-17.1%	+5.9 pts	-5.0%
15	low $\sigma$	-18.5%	+19.0 pts	-16.3%
16	high $\varepsilon$	-20.9%	+13.0 pts	-11.8%
17	low $\varepsilon$	-18.3%	+19.1 pts	-15.6%
18	high $\mu, a$	-20.5%	+15.4 pts	-13.1%
19	low $\mu, a$	-20.6%	+15.5 pts	-13.1%
20	high participation	-23.1%	+20.8 pts	-17.5%
21	low participation	-14.1%	+4.6 pts	-3.9%

Appendix I: The effect of financial liberalization on emerging market asset prices

An increase in  $\phi_F$  only affects 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  $\phi_F$  increases. This will be the case if :

$$\frac{\partial s_Y}{\partial \phi_F} \Big|_{q=\bar{q}} = \frac{q \left[ (q/d)^{\varepsilon-1} - (q/d)^{1-\varepsilon} \right] - 2\phi_F(1-s_Y)}{(1+q^2)(1-\phi_F^2) + (\varepsilon-1)\phi_F \left[ q^2 (q/d)^{-\varepsilon} + (q/d)^\varepsilon \right] \frac{(1-\phi_T^2)}{[1-s_Y(1-\phi_T)]^2}} < 0$$

A sufficient condition for this ratio to be negative and therefore  $q$  to increase with an increase in  $\phi_F$  is that  $q/d < 1$ .

Appendix II: Key equations of the model used in the quantitative section.

The model includes a safe asset which gives a dividend in a share  $\alpha$  of the states of the world covered in normal times, has a return  $r$  and a price  $p_{er}$ . We also introduce a parameter  $\gamma$  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:

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

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:

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

The value of the emerging market demand of the safe asset in a crash is:

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

The dividends are given by equation (8) adjusted for limited participation and its symmetric in crash.

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