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Abstract

We explore the possible role of interdependence of expectations in emerging market economies and analyze the crisis transmission mechanism within the "pure" contagion framework. We consider the cases of Russia, Turkey, and Brazil, and assess whether the fundamentals of these countries allowed for the possibility of "pure" contagion effects from each other. In particular, we look at Russia - Turkey and Brazil - Russia pairs in year 1997 to see whether Brazilian and the Turkish economies exhibited vulnarability to pure contagion before the 1998 Russian crisis We also repeat the same exercise with the most recent 1999 data. The rationale for choosing these pairings is the huge volume of (luggage) trade between geographical neighbors Russia and Turkey, and the similar export structures of Russia and Brazil (predominantly raw materials) which are continents apart. Our results clearly indicate vulnerability of Brazilian and Turkish economies to high probability of crisis in Russia even in the face of improving fundamentals. In isolation, Brazilian and Turkish fundamentals were not weak enough to place them in a sure-crisis situation. With the incorporation of the Russian link, the multiple equilibria setting disappeared for both countries, rendering sure-crisis as the single equilibrium solution.

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1 Introduction

It had been a well established fact for some time that countries could be resorting to overly restrictive monetary policies while figthing inflation in order not to end up with a depreciating currency which would hinder their disinflation efforts. In a setting of no policy coordination or coordination failures of that nature, wide spread recessions become inevitable. Such worries had indeed been behind the role assigned to the IMF by nations participating in the global system.

The world financial markets have witnessed increasing turmoil in recent years and emerging economies have felt the intermittent crises perhaps more than others. The crisis in global financial markets that started in East Asia in 1997 subsequently spread to other parts of the world and culminated in Russia's default on its debt in the Summer of 1998. Russia's default has led to loss of international investor confidence in the performance of risky markets all around the world. International capital started to flee the emerging markets, leaving behind financial and economic turmoil in emerging market economies and developed economies alike. The financial crisis spread to Latin America after the Russian devaluation and debt restructuring. Brazil was especially affected. The LTCM, a colossal U.S. hedge fund which had invested heavily in risky emerging markets, collapsed and had to be rescued by the U.S. Federal Reserve Bank. In short, international capital markets displayed excessive volatility as well as susceptibility to contagion of ill effects from one market to the others. Emerging market economies suffered most from this volatility and the concomitant contagious effects.

The latest turmoil in the Turkish markets in early December 2000 in the form of a liquidity crisis shook not only the local markets but created considerable jitters in the Russia and even in Argentina where IMF support had been awaited anxiously even prior to the Turkish financial debacle. The liquidity crisis in Turkey led to skyrocketing interest rates and fuelled all kinds of rumors about devaluation, default of government debt, "sand in the wheels" capital controls, etc. The stock market in Turkey plunged to year-lows, and soon the Russian market followed. Fear of contagion became rampant, and IMF acted with an unprecedented speed and volume of assistance to put an end to tremors. All these countries need to strengthen their fundamentals drastically, fulfill the long-delayed structural reforms, and become somewhat less vulnerable to the volatilities in the international markets. Their weaknesses in this respect make them prone to contagion effects excessively as illustrated by the latest crisis in Turkey. Following the announcement of the sizeable USD 10.4 billion IMF package that abruptly reversed the panic mood, the markets in Turkey calmed down, and so did other emerging markets, at least for the time being. Still, some market watchers, bankers, and institutions are keen on a possible devaluation, although for the time being this remains a remote possibility. Nevertheless, the fragility of equilibiria in the Turkish markets are not only under close monitoring by the locals, but by other emerging markets as well. Naturally, the same is true for all emerging markets in the current setting of increasingly fluid international environment.

The extent and different forms of contagion among international financial markets have been well documented.(Corsetti et al.[7]; Goldstein [11]; Radelet and Sachs [22]; Sachs et al. [23]; IMF [12]). There is also a growing literature on understanding the theoretical nature and causes of contagion (Calvo [1]; Calvo [2]; Chang and Velasco [3], [4]; Krugman [14], [15]). Recent debate on the need for reshaping the international financial structure points to reduction of the extent of financial contagion as one of the main goals (Fischer [9]). Dornbusch et al. [8] argue that minimizing financial contagion would require action by governments and the private sector in both emerging markets and the leading industrialized countries, as well as judicial interference when necessary by multilateral institutions.

An outstanding feature of the crises in 1990s is that the timing of their occurrance and their severity seem to be unrelated to the fundamentals of the countries concerned. For example, the 1994-95 crisis in Mexico started right after the devaluation of December 1994, which should have corrected the misalignment of the exchange rate and reduced the large current account deficit. Despite this improvement in Mexican fundamentals, there ensued a loss of investor confidence, the exchange rate collapsed, and Mexico found itself on the verge of default on its foreign debt. Moreover, the crises, once they started in a particular country, spread to other countries with not particularly strong trade and capital flow links with the country in which the crisis had started. This was the case in the contagion of Mexican crisis to Argentina and Brazil, in the concurrent crises in most East Asian countries in 1997, and in the spread of the effects of the Russian default in 1998.

These observations have stimulated interest in models which admit multiple equilibria, i.e. models in which both a no-crisis situation and a sure-crisis situation can emerge as equilibrium phenomenon, and where jumps between equilibria may be initiated by events unrelated to the fundamentals incorporated in the model (Jeanne [13]; Masson [18], [19]). If such multiple equilibria are indeed a possibility for a given country, rational investors will recognize the possibility of jumps, and form their expectations accordingly. Volatility introduced through dependence on such expectations may lead to investors' expectations of a crisis becoming self-fulfilling. Thus, if events seemingly unrelated to fundamentals in a particular country are what steer investors' expectations, we may indeed observe contagion of a crisis for no other reason than the degeneration of investors's expectations on a "bad" equilibrium.

In this paper we adopt a model introduced in Masson [18] to look at the possible role of interdependence of expectations formed by international investors regarding the performance of emerging markets. We consider the cases of Russia, Turkey, and Brazil, and assess whether the fundamentals of these countries allowed for the possibility of such "pure" contagion effects from each other. In particular, we look at Russia - Turkey and Brazil - Russia pairs in year 1997 to see whether Brazilian and the Turkish economies exhibited vulnarability to pure contagion before the 1998 Russian crisis We also repeat the same exercise with the most recent 1999 data. The rationale for choosing these pairings is the huge volume of (luggage) trade between geographical neighbors Russia and

Turkey, and the similar export structures of Russia and Brazil (predominantly raw materials) which are continents apart.

Masson [18] proposes a classification of reasons why we might observe contemporaneous crises in developing countries. A common cause, such as a change in the U.S. monetary policy, may affect all developing countries, which Masson calls the "monsoonal" effect. Macroeconomic linkages, such as trade links among developing countries, may lead to spreading of crises among them, which may be termed as "spillover" effects. Finally, we have the case of "pure" contagion, where the increased likelihood of crisis in one country precipitates another country into crisis with no actual crisis having taken place in the former country.[1]

In a model that allows for possibility of contagion through a number of channels, we concentrate on the case of pure contagion whereby a crisis may arise in an emerging market with 'sound' fundamentals solely because of an impending crisis in another emerging market.

In Section 2 we briefly overview the model that allows us to consider the issues mentioned above. Empirical applications follow in Section 3. Section 4 includes a brief discussion and conclusion regarding the role multilateral institutions like IMF might play by developing policies and tools that will bestow credibility on coordinated commitment efforts by emerging economies.

2 The Model

We consider a simple balance of payments model with two emerging market countries.[2] Let $D_t^1$and D_t^2 denote the external debt stock of Country 1 and 2 in peiod t, respectively. The (risk-neutral) international investors demand to be compensated by an amount equal to the risk-free (foreign) rate r^* plus the expected rate of devaluation. Let π_t^i stand for the probability of a devaluation occurring in Country i in period t, and θ^i stand for the extent of expected devaluation in Country i. It follows that

$$r = r^* + \pi_t^i \theta^i \tag{1}$$

will be the expected rate of return demanded by international investors in period t when lending to Country i. We assume that the risk-free (foreign) interest rate r^*, which we take as given and constant, summarizes the external environment for the emerging economies.

The source of uncertainty in the model is shocks to the trade balance. We let TB_t^i stand for the trade balance of Country i in period t. Up to an event that triggers a crisis, the authorities in each country finance changes in the current account balance with reserves. Let R_t^i stand for the reserves in Country i in period t. If shocks to the trade balance are large enough so that R_t^i falls below

[1] See Masson [19] for an application of this model. For a review of papers that consider other forms of "pure" contagion, see Masson [20].

[2] We closely follow the model developed by Masson [18]. For further technical details of the model, see Jeanne [13].

a critical level $\overline{R}^i$, then a devaluation follows.[3] It follows that the change in reserves from period t to $t+1$ is given by

$$R^i_{t+1} - R^i_t = TB^i_{t+1} - \left(r^* + \pi^i_t \theta^i\right) D^i_t. \tag{2}$$

A crises occurs in period $t+1$ if

$$R^i_{t+1} < \overline{R}^i. \tag{3}$$

This implies that the probability, as of period t, of a crisis in period $t+1$ will be

$$\pi^i_t = \Pr_t \left[TB^i_{t+1} - \left(r^* + \pi^i_t \theta^i\right) D^i_t + R^i_t - \overline{R}^i < 0 \right]. \tag{4}$$

Let

$$b^i_t \equiv TB^i_t - r^* D^i_{t-1} + R^i_{t-1} - \overline{R}^i, \tag{5}$$

and $\alpha^i_t \equiv \theta^i D^i_t$. This allows us to express (4) above as

$$\pi^i_t = \Pr_t \left[b^i_{t+1} < \pi^i_t \alpha^i_t \right] \tag{6}$$

A $\overline{\pi}^i_t$ that solves this equation gives us the probability of a crisis that will be *self-fulfilling*. That is to say, if the expected probability of a crisis is $\overline{\pi}^i_t > 0$, this will lead to a deterioration of the fundamentals of the economy so that the probability that the reserves will fall below the critical reserve level $\overline{R}^i$; hence, the probability of a crisis will indeed become $\overline{\pi}^i_t$. For example, if $\overline{\pi}^i_t \approx 1$, this means that investors are expecting a crisis almost for sure, and these expectations will turn out to be fulfilled. The interest rate premium, $\overline{\pi}^i_t \alpha^i_t$, that will be commensurate with such high expectation of crisis will be so high that it will indeed force the reserves to fall below the critical level and, hence, trigger the crisis.

Let

$$\Psi^i_t \equiv E_t \left[b^i_{t+1} \right], \tag{7}$$

where $E_t[\cdot]$ is the expectation operator calculated at time t. Note that Ψ^i_t serves as a composite fundamental that incorporates the expected trade balance, existing external debt and reserves, the risk free foreign interest rate r^*, and the critical reserve level $\overline{R}^i$. The innovation in variable b^i_t, which here is the consequence of the shocks to the trade balance, is equal to $\varepsilon^i_t = b^i_t - \Psi^i_{t-1}$. We assume that ε^i_t is normally distributed with mean zero and variance $\left(\sigma^i\right)^2$. We can express π^i_t in terms of the cumulative distribution function of the innovation in b^i_t as

$$\pi^i_t = F_{\sigma^i} \left[\pi^i_t \alpha^i_t - \Psi^i_t \right] \tag{8}$$

[3] As Masson [18] indicates, the model applies to risk of default on liabilities in foreign currency as well. By inflating the value in domestic currency of foreign debt, a devaluation makes repayment more difficult and hence increases default probability. On the other hand, a default on foreign debt will most likely lead to a fall in capital inflows, leaving devaluation to increase net exports as the only option to restore current account balance. Hence, there is a considerable link between risk of devaluation and risk of default.

where $F_{\sigma^i}[\cdot]$ is the c.d.f. of a normal distribution with variance $\left(\sigma^i\right)^2$.

Equation (8) succinctly expresses the formation of expectations of a crisis in Country i by investors. Both the left-hand-side (LHS) and the right hand side (RHS) of (8) depend positively on π_t^i, which implies that there may be multiple solutions.[4] The necessary condition for the existence of multiple equilibria is given by

$$\eta_t^i = \frac{\alpha_t^i}{\sqrt{2\pi}\sigma^i} > 1. \tag{9}$$

Recalling that $\alpha_t^i \equiv \theta^i D_t^i$, this condition highlights the importance of the size of foreign debt and the extent of devaluation (or default) in the case of a crisis. If the ratio of their product to the standard deviation of shocks to the current account balance exceeds a certain level, the economy will be in the region of multiple equilibria. The implication of this is that an economy can jump from a low crisis expectation equilibrium to high crisis expectation equilibrium on mere speculation even if there is no change in the 'fundamentals'. Since expectations are self-fulfilling, worsening expectations lead to deterioration of fundamentals and crisis becomes an actuality.

In addition to condition (9), which is only a necessary condition, multiple equilibria will arise if Ψ_t^i, the level of fundamentals of the economy in period $t+1$ as perceived in period t, falls within a certain range. Note that the solutions of (8) are obtained at the intersection of the 45^0 line from the origin, the LHS of (8), with the c.d.f. given on the RHS of (8) (see, for example, any of the Figures 1 - 6 below). These two curves will be tangent to each other at two points. Let $\omega_t^i \equiv \sqrt{2\ln\eta_t^i}$, and define the following two critical states for the fundamentals: $\underline{\Psi}_t^i = \alpha_t^i F_1\left(-\omega_t^i\right) + \sigma^i\omega_t^i$ and $\overline{\Psi}_t^i = \alpha_t^i F_1\left(\omega_t^i\right) - \sigma^i\omega_t^i$. Then multiple equilibria are possible following range for Ψ_t^i:

$$\underline{\Psi}_t^i < \Psi_t^i < \overline{\Psi}_t^i. \tag{10}$$

If the expected fundamentals are very good, i.e. if $\Psi_t^i \geq \overline{\Psi}_t^i$, the c.d.f. on the RHS of (8) falls to the right and there will be only one intersection with the 45^0 line, giving a low equilibrium value for π_t^i (a low probability of crisis). If, on the other hand, fundamentals are poor, i.e. if $\Psi_t^i \leq \underline{\Psi}_t^i$, the c.d.f. on the RHS of (8) falls to the left and there will again only be one intersection with the 45^0 line, giving this time a high equilibrium value for π_t^i (a high probability of crisis). In between, multiple equilibria can occur.

The existence of multiple equilibria brings out the possibility of a country jumping from a 'good' expectations equilibrium, where crisis is not likely, to a 'bad' expectations equilibrium, where crisis becomes very likely, when there is a crisis in another emerging market economy. If international investors' expectations regarding emerging economies are correlated enough, the result will be contagion of crisis from one emerging economy to the other even if there has been no change in the fundamentals of the latter.

[4] See Jeanne [13] for details.

Looking at (7) and (10), we observe that vulnerability to pure contagion is greater when there is a large debt, when reserves are low, when the trade balance is in deficit, and the risk free foreign interest rate is high.. In addition, the extent of expected devaluation, i.e. θ^i can also be a significant determinant of equilibrium expectations.

2.1 Contagion Links among Emerging Economies

There may be a number of different channels linking one emerging economy with another emerging economy. We assume here that the trade balances of Country i and Country j will be linked because of trade competition between these two countries. Let the equations for the trade balance and real exchange rate (RER) be given respectively by

$$TB_t^i = T^i - \beta^i RER_t^i + \varepsilon_t^i, \tag{11}$$

and

$$RER_t^i = S_t^i - w^i S_t^j - u^i \overline{S}_t, \tag{12}$$

whereS_t^i is the nominal exchange rate (expressed as the dollar price of the domestic currency) in Country i, $\overline{S}_t$ is the exchange rate (assumed fixed) of the rest of the world, and w^i and u^i are related weights. The assessment of probability of devaluation, hence that of crisis, for Country i now depends on the possibility of devaluation, hence crisis, in Country j ($i \neq j$). That is, the probability that $R_t^i < \overline{R}^i$ will be different depending on whether Country j is expected to devalue (have a crisis) and how much it will devalue. Therefore, the probability of crisis in Country i becomes

$$\pi_t^i = \left(1 - \pi_t^j\right) F_{\sigma_i}\left[\pi_t^i \alpha_t^i - \widetilde{\Psi}_t^i\right] + \pi_t^j F_{\sigma_i}\left[\pi_t^i \alpha_t^i - \widetilde{\Psi}_t^i + \beta^i w^i \theta^j\right], \quad i \neq j, \tag{13}$$

where $\widetilde{\Psi}_t^i = E_t\left[\widetilde{b}_{t+1}^i\right]$, with $\widetilde{b}_{t+1}^i = TB_t^i - r^* D_t^i + R_t^i - \overline{R}^i$, incorporates the interlinkages between Country i and Country j. In our empirical assessments below, we concentrate exclusively on the impact of the extent of expected devaluation in each country. This is the "pure" contagion case, where crises spread solely because of a worsening of expectations in another emerging economy without necessarily a worsening of fundamentals in the country in question. Alternatively, one could consider the impact of a change in r^*, the parameter describing the external world, on the probability of crises in emerging markets. This is the so called "mansoonal" effect. The direct spillovers of changes in the real exchange rates of interlinked emerging economies would be another type of contagion. In this paper, we deal exclusively with the case of pure contagion.

3 Empirical Results

We utilize the model discussed in the previous section to analyze in retrospect the crisis potential in Turkey, Russia, and Brazil; separately for each without

any pure contagion effects and subject to pure contagion for Russia - Turkey and Brazil - Russia pairs.

The years selected for analysis are 1997 and 1999. The rationale for the selection of 1997 is to gain an insight within our framework, if possible, for the infamous Russian crisis in 1998, which put both Turkey and Brazil in predicaments of similar nature. Brazil virtually had to float its currency in the aftermath of the crisis, and Turkey suffered a huge capital outflow while trying to protect its currency. The year 1999 was chosen for the practical reason of being the most recent data period available.

Below we present the summary data that was utilized in calculations for each country.[5] The values for variables are expressed as per cent of GDP. To obtain an estimate of the variance of the shocks to the trade balance σ^2, an AR(1) process was estimated for the Trade Balance/GDP ratio. The standard error of the estimate of this regression was utilized as the estimate of σ.[6]

Country	**Date**	$\mathbf{D}_t^i$	$\mathbf{R}_t^i$	$\overline{R}_t^i$	$\mathbf{T}_t^i$
Brazil	1997	0.280	0.063	0.036	-0.008
($\sigma = 0.0158$)	1999	0.450	0.062	0.029	-0.002
Russia	1997	0.340	0.030	0.048	0.039
($\sigma = 0.0572$)	1999	0.872	0.046	0.052	0.182
Turkey	1997	0.470	0.097	0.061	-0.08
($\sigma = 0.0162$)	1999	0.558	0.126	0.067	-0.76

The value for θ, the parameter reflecting the extent of expected devaluation is chosen as 0.25 for all years and all countries. Considering that interventions in the form of a devaluation would mostly be "gross" devaluations with a huge initial loss in the value of the currency to be followed by appropriate appreciation, expectation of a 25% devaluation seems to be a modest assumption. Higher values for θ would accentuate all the conclusions to be derived below. The annual 1-year U.S. T-bill rates (secondary market) were used as the risk free foreign rate r^*.[7]

We adopt here a definition of $\overline{R}^i$ which takes into account the maturity structure of the external debt. We take the position that half of the Short Term External Debt/ GDP ratio is a reasonable benchmark value for $\overline{R}^i$.[8] This we

[5] The sources for data used are IFS, IIF documents, and authors' own calculations.

[6] Estimation periods for Brazil, Russia, and Turkey are 1980-1999, 1990-1999, and 1991-1999, respectively.

[7] The annual 1-year U.S. T-bill rates are 5.32% and 4.81% for years 1997 and 1999, respectively (source: http://www.federalreserve.gov/releases/h15/data.htm).

[8] Cole and Kehoe [6] considers short-term debt to be the key variable behind vulnerability to self-fulfilling attacks.

find to be more plausible than chosing $\overline{R}^i$ as zero[9], implying that no devaluation will be undertaken until the reserves are fully exhausted. With our notion of the critical reserve level, it becomes possible to distinguish between crisis exposures of two almost identical economies with the same magnitude of reserves and external debt, who differ only in the maturity structure of the external debt. Our choice would make a country with a shorter debt maturity much more crisis prone than one that has a longer term maturity structure, whereas $\overline{R}^i = 0$ measure would fail to accomplish this.

3.1 Countries in Isolation with No Pure Contagion Effects

3.1.1 Russia

Figure 1 reveals that the fundamentals in Russia enforce a single bad equilibrium with a very high probability of crisis ($\pi^* \approx 0.97$). Indeed, when we compute (9) using Russian data from above, we get $\eta_{1997}^{Russia} = 0.67 < 1$, indicating that the Russian economy is not even in the region of multiple equlibria. The main culprit behind this conclusion is the very high variance of innovations to the Russian trade balance.

The situation in 1999 (see Figure 2) is not much different as the economy is still stuck with a single bad equilibrium ($\pi^* = 1$, i.e. "sure crisis" equilibrium). Fundamentals have meanwhile deteriorated, with the External Debt/GDP ratio surging to 87.2% from 38.4% in 1997 and the level of actual reserves are still less than the threshold level $\overline{R}_{1999}^{Russia}$.

3.1.2 Turkey

As Figure 3 depicts, the Turkish economy is in multiple equilibrium region in 1997. However, a slight deterioration in the fundamentals could eliminate the good equilibrium and transform the scene into one of single bad equilibrium. Moreover, the knife-edge property of the good equilibrium hints at the possibility of jumping from the good equilibrium to the bad one with no change in the fundamentals but increased likelihood of crisis in another emerging market.

The situation in 1999 is still one of multiple equilibrium (see Figure 4), but the knife-edge property of the good equilibrium eased somewhat due to the substantial excess of actual reserves over the threshold level $\overline{R}_{1999}^{Turkey}$. Technically, the curve representing the RHS of (8) has shifted to the right as a result of the improvement in fundamentals.

3.1.3 Brazil

The situation in Brazil is very similar to that in Turkey in the sense that the economy is in the region of multiple equilibria in both periods, and there is improvement, although definetely less severe than in the Turkish case, in the fundamentals from 1997 to 1999 (see Figures 5 and 6). Note that the fall in the

[9] See, for example, Krugman [14] and Masson [18].

foreign interest rate r^* from 1997 to 1999 also contributed to the improvement in the fundamentals. The difference between the two countries lies in the knife-edge property of the good equilibrium which is more pronounced in the case of Brazil. This renders Brazil much more vulnerable to both spillover and pure contagion effects from other emerging markets.

3.2 Contagion of Crisis from Russia to Turkey and Brazil

Russia - Turkey and Russia - Brazil pairings in 1997 clearly display the vulnarability of Turkish and Brazilian economies to the pure contagion threat originating from Russia. The inclusion of Russia into the Turkish and Brazilian pictures as the source of contagion eliminates the multiple equilibria phenomenon in these countries, and both end up with a bad equilibrium in which the probability of crisis is pushed to unity. The fundamentals in Russia seem to be so poor that the incorporation of neither country into the Russian picture can have a favorable impact in the form of creating multiple equilibria possibility for Russia (see Figures 7 and 9).[10]

Although both Brazil and Turkey registered improvement in their fundamentals from 1997 to 1999, as indicated above in Sections 3.1.2 and 3.1.3, the Russian pure contagion link is enough to more than offset these improvements and put the two countries in a state of sure crisis in 1999 (see Figures 8 and 10). The fundamentals in Russia remain poor, and improved fundamentals of Brazil and Turkey fail to provide any positive feedback for the Russian economy.

4 Conclusions

The IMF emerged from the bitter experiences of competitive devaluations during the Inter-War period. The issue was perceived as an international collective action problem which individual countries, acting on their own, could not solve or solve poorly. Coordinated action was deemed welfare improving. In the early 1970s, the costs of maintaining fixed exchange rates turned out to be greater than the benefits, and the Bretton Woods system collapsed. In the early 1980s, the IMF was perceived as the institution to prevent the coordination problem that could arise between countries fighting off inflation. In order not to end up as the party with the depreciating currency, countries opted for excessively restrictive monetary policies which in turn led to widespreas recessions. The track record of the IMF on that front was not impressive, and since then the IMF has not had a coherent mission. Suggestions for a new mission to the IMF include the role of an international bankruptcy court and enforcement of accurate disclosure of financial and economic country data (Chari and Kehoe [5]).

The current paper aims to illustrate the relevance of pure contagion effects for emerging market economies, and diagnoses as a by-product a collective action

[10] In solving for (13) we took $\beta w = 0.1$ in all cases considered. The simulations showed that results were very robust to changes in both directions.

problem regarding pure contagion that may imply a role for the IMF. Our results clearly indicate vulnerability of Brazilian and Turkish economies to high probability of crisis in Russia even in the face of improving fundamentals. In isolation, Brazilian and Turkish fundamentals were not weak enough to place them in a sure-crisis situation. With the incorporation of the Russian link, the multiple equilibria setting disappeared for both countries, rendering sure-crisis as the single equilibrium solution.

Very crudely, behind contagion lies instability of expectations. Can some rules, backed with incentives provided by an international agency such as the IMF reduce this instability? The idea can be characterized as "sanding the expectations" or" sand in the trigger" as opposed to "sand in the wheels" which envisage restrictions on international capital flows. If the system provides individual countries incentives to behave in a predetermined manner in case of crisis, expectations concerning the outcome of the crisis may be imploding, rather than exploding. This, in turn reduces the chances of crisis and contagion.

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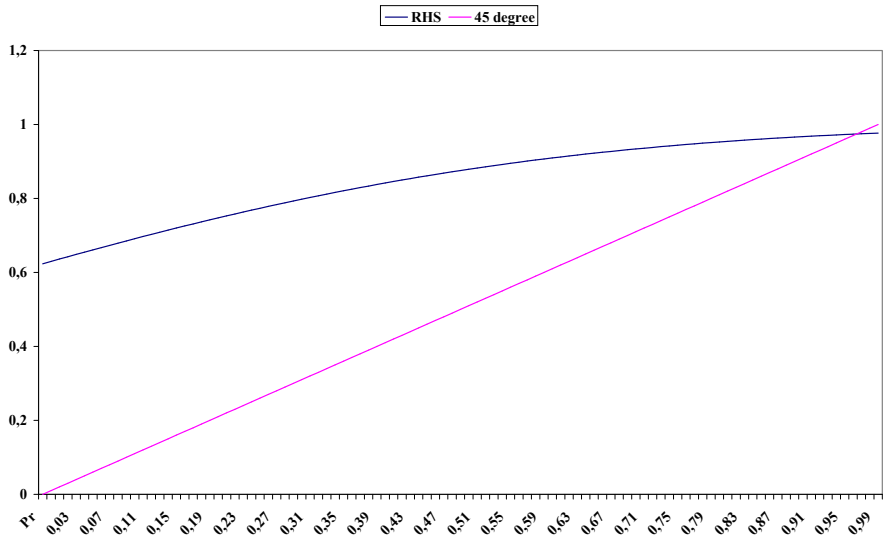

Figure 1: Russia 1997

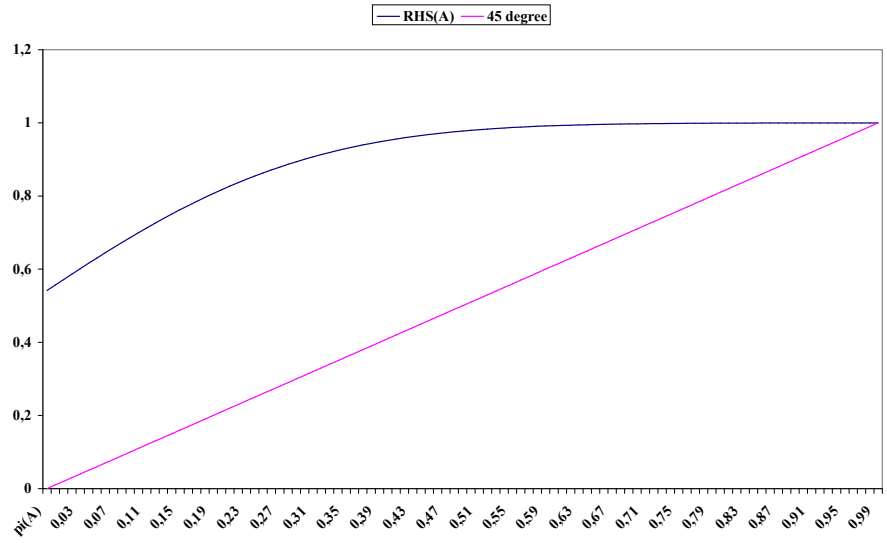

Figure 2: Russia 1999

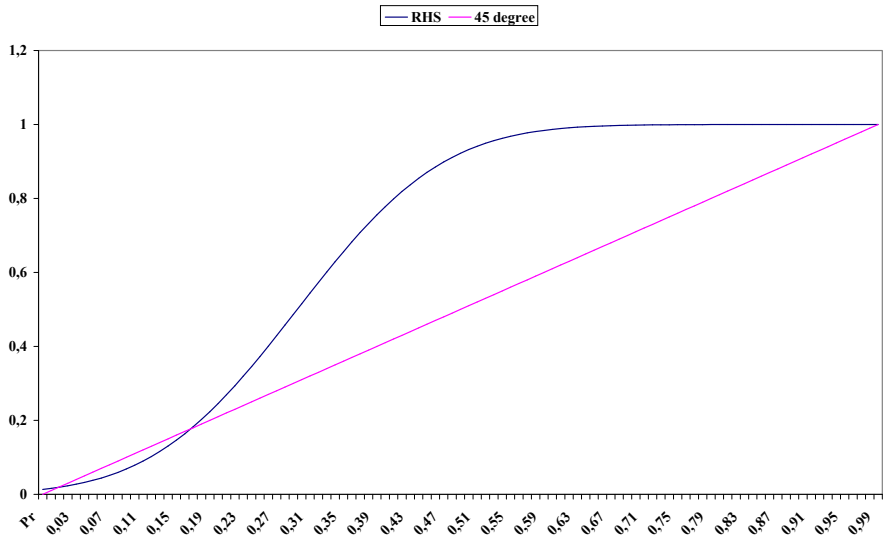

Figure 3: Turkey 1997

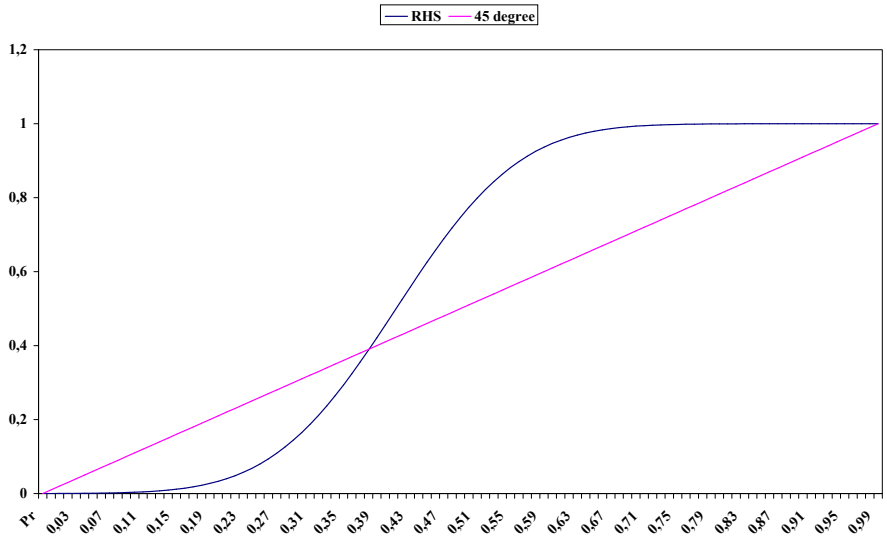

Figure 4: Turkey 1999

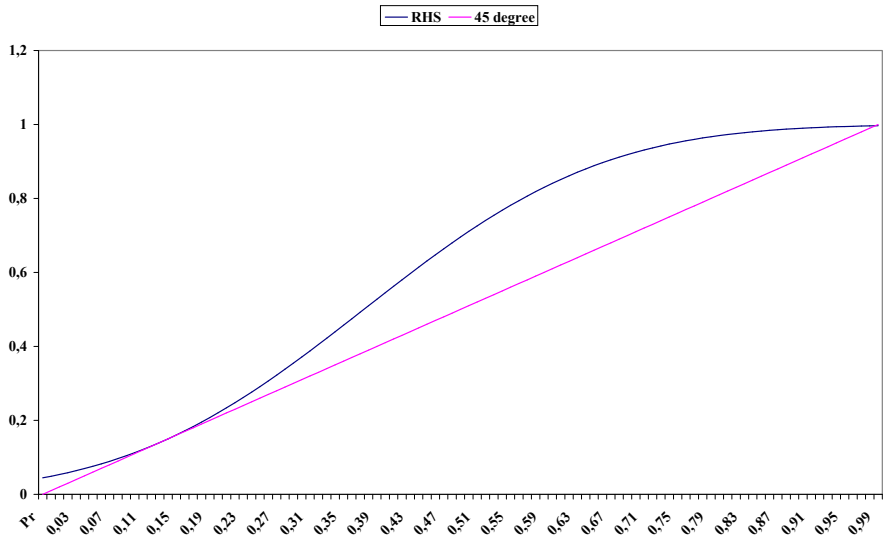

Figure 5: Brazil 1997

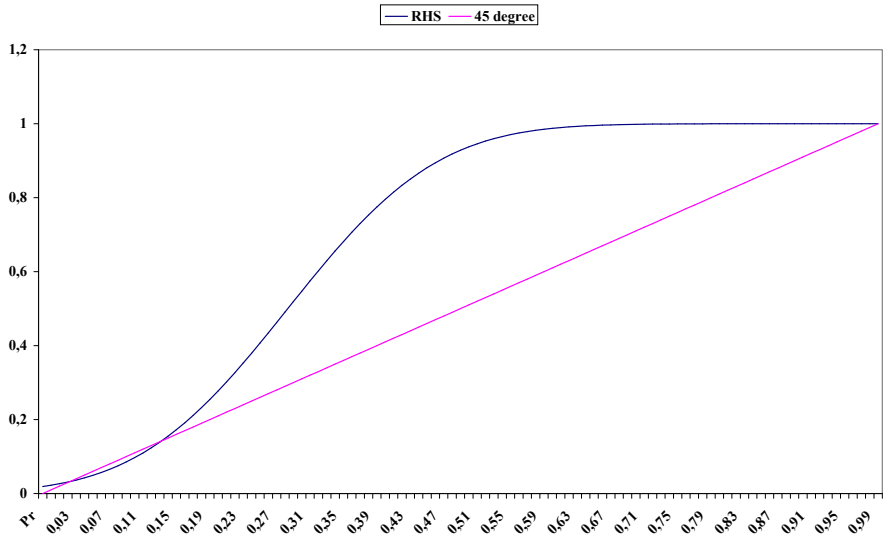

Figure 6: Brazil 1999

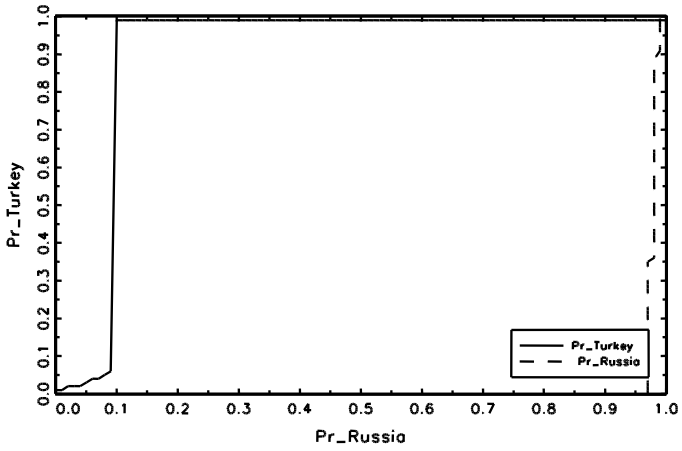

Figure 7: Russia - Turkey 1997

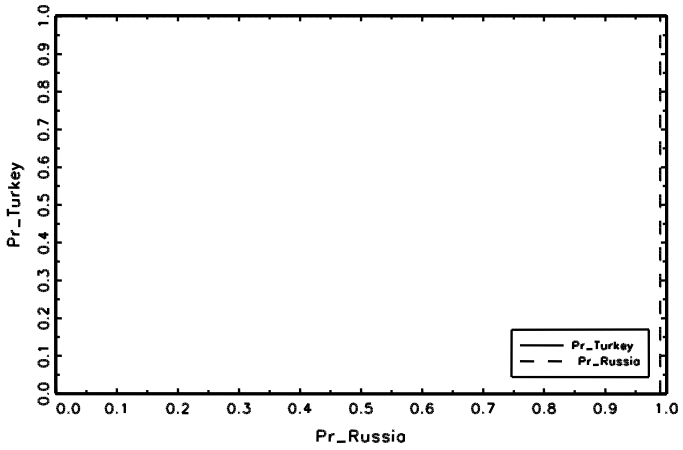

Figure 8: Russia - Turkey 1999

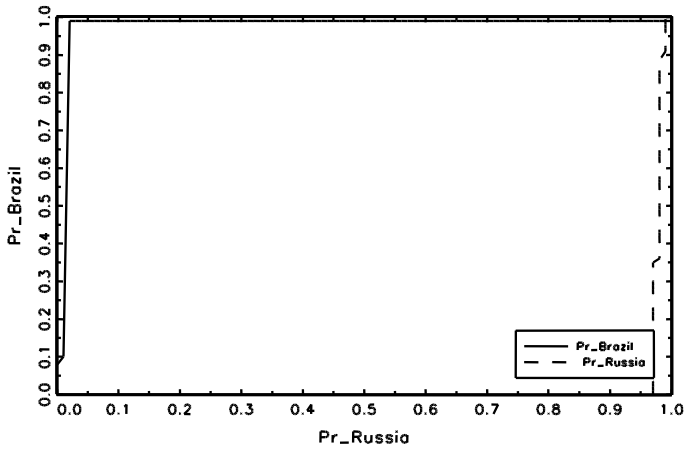

Figure 9: Brazil - Russia 1997

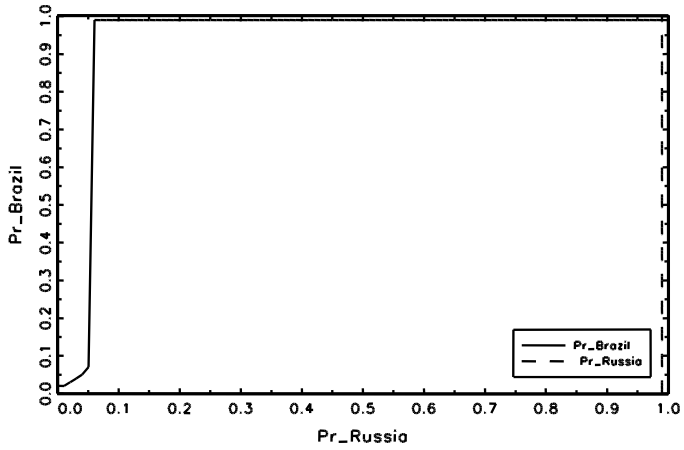

Figure 10: Brazil - Russia 1999