Endogenous Financial Crises*

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Abstract

Holders of short-term debt receive signals about the macroeconomic fundamentals with a small amount of noise and act as speculators against the fixed exchange rate peg. The representative firm chooses the optimal amount of short-term borrowing, weighting the benefit of higher long-run returns against the cost of a higher risk of a liquidity crisis. The speculators attack the currency peg, with liquidity crises as a by-product. We find the unique equilibrium in the presence a liquidity crisis. The exposure of the economy to financial crises depends negatively on the size of the representative firm, positively on the level of govenment protection, and has a U-shaped form with respect to the quality of the domestic financial system. When the level of government protection is determined through lobbying, the model naturally suggests policy actions designed to limit financial crises.

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1 Introduction

Early crises models concentrated on the attacks on exchange rate pegs. The so-called first generation models (Krugman [1979], Flood and Garber [1984]) explained currency crises as due to continuous fiscal deficits financed by printing money. In such situations, maintaining the peg is impossible and crises become deterministic events. The cases when fiscal deficits are absent were the subject of second-generation models (Obstfeld [1986, 1994]). These models find that currency crises can be self-fulfilling, i.e. the cost of maintaining the peg becomes too high if speculators attack the currency. The second-generation models exhibit multiple equilibria, a problem resolved by Morris and Shin [1998]. They show that multiple equilibria outcomes are particular cases of a more general situation with a unique equilibrium, given that the speculators face private signals about the macroeconomic fundamentals of the economy.

Later (third-generation) models concentrated on the financial sector of the economy. A crisis in these models means a sudden reversal of capital inflows in a country, like the ones that happened in East Asia in 1997 and in Russia in 1998. Three major branches have appeared in this literature. The first explaines crises as by-products of bank runs (see, for example, Chang and Velasco [2001]). The refusal of foreign lenders to roll over the short-term debt of a bank makes it illiquid and creates two equilibria: a good one where domestic depositors do not run, and a bad one where all depositors run and the crisis occurs because of international illiquidity of the bank. The second branch (see, for example, Corsetti, Pesenti, Roubini [1999]) concentrates on the fact that in case of crisis, the government will stand ready to bail out the firms. Knowing this, firms overborrow and invest in unprofitable and excessively risky projects, borrowing against the future bailout revenues. The losses are covered by even more foreign borrowing. At some stage, the lenders refuse to finance the new losses and the financial system collapses. The third branch (with major contributions by Krugman [1999] and Caballero and Krishnamurthy [2001]) explains the crises as the consequence of shocks to the net worth of firms. In Caballero and Krishnamurthy [2001], for example, firms can borrow from abroad only against some of their assets which are accepted internationally as collateral (for example, the primary goods like copper or oil that the country is endowed with). A negative terms-of-trade shock decreases the value of this collateral and limits the capacity of external borrowing, which in turn leads to a sharp rise in interest rates and a fire sale of domestic assets.

These models, while identifying key sectors of the economy where crises are likely to originate and being extremely useful in understanding the mechanisms of crises, leave some question unanswered. Models like Chang and Velasco [2001] and Krugman [1999] exhibit multiple equilibria and do not explain **what causes the sudden shifts of lenders' expectations**. Moral-hazard driven models have, as Krugman [1999] points out, one negative feature: they imply that the availability of implicit guarantees crowds out all "legitimate" investment that bears the full burden of risk. In practice, however, this does not happen: often, in pre-crisis period "unprotected" investment does not show signs of decline.

Thus, **why do crises happen even in cases when investment is highly profitable?**

Our model attempts to resolve these issues. The modelling approach brings together the imperfect information about the fundamentals (like in Morris and Shin [1998]) with endogenous vulnerability of firms to liquidity crises. The first guarantees the uniqueness of equilibrium, while the second characterizes this equilibrium. Fundamentals determine the severity of the attack, but for given fundamentals, some countries can resist the attack while others can not, and we show that this depends on (a) the size of the representative firm, (b) the quality of the domestic financial system, (c) the government (bail-out) protection. We show also that insulating the government from the private-sector makes the country less vulnerable.

The noise in signals delivers the continuity in the share of speculators who attack. We assume that the emerging markets have no access to long-term borrowing, and a set of reasonable assumptions about the private sector delivers the parameter properties of the optimal vulnerability of the firm. We can describe the unique equilibrium as follows: if fundamentals are in the region where the share of speculators who attack is smaller than the share the firm can resist to, no crisis happens. If, on the contrary, the fundamentals are in the region where the attack is more severe than the firm can resist, a crisis will occur. The relative sizes of these regions optimally depend on parameters.

The model can be augmented to include lobbying by firms on the level of government bailout in case of a crisis. If government can be lobbied for the bailout, the firm optimally is more vulnerable (but opts for a higher return), since it has less to lose in crisis times. Thus, insulating (institutionally) the government from the firm decreases the vulnerability of the firm. The vulnerability decreases in the size of the firm throughout, and has a U-shaped form in quality of the domestic financial system.

Finally, we analyze the occurence of "twin" crises. Here, again, the crises regions are uniquely determined by the vulnerability of the firm and the resistance of the government to currency attacks. We also analyze a case of a causal link from financial to currency crises.

2 The Basic Model

2.1 A Firm

There are three periods, $t = 0, 1, 2$. At the beginning of period 0, a representative firm is endowed with assets worth s pesos and a type ϕ domestic financial system. During period 0, there is a peso-dollar parity peg. A higher ϕ indicates a better domestic financial system, i.e. the firm has access to more domestic credit in periods 1 and 2. In period 0, the firm can borrow from abroad, in pesos; the amount it chooses to borrow is F. The foreign lenders supply inelastically any amount, but only in short-term (one-period) form. In our model, this is the major difference between an emerging market and a mature one - due to the lack of reputation and unpredictability of long-term events in emerging economies, international lenders never extend long-term debt.

The firm invests into a long-run project, which is financed by the sum of s and F, bears no fruit in period 1, and (if completed), gives a positive net return in period 2, equal to $\Pi(F;\phi,s)$, with the following properties:

$$\Pi_s > 0 \quad \Pi_F > 0 \quad \Pi_\phi > 0 \quad \Pi_{sF} = 0 \quad \Pi_{ss} \geq 0 \quad \Pi_{FF} \geq 0 \tag{1}$$

The project exhibits non-decreasing returns. The return is increasing in the quality of the domestic financial system, since during the project there may happen situations where the firm needs to cover some (unforeseen) operational costs in liquid money. We can imagine that the firm has more operational flexibility, and therefore, its project gives a higher return, with a better domestic financial system.

The macroeconomic fundamentals of our economy, denoted by θ, are uniformly distributed on the unit interval $[0,1]$. At the beginning of period 1, the fundamentals are realized, and this realization determines much of the later events.

Since the borrowing is short-term, some or all of this debt may not be rolled over in period 1 (See the lenders' problem below). We assume that in such cases, the firm can meet up to some critical share of total debt obligations without jeopardizing the project, i.e. still guaranteeing the return Π in period 2. This critical share depends on the macro fundamentals of the economy, the quality of the domestic financial system, and the firm's choice of the amount of period-0 foreign borrowing, F. Denote this critical level as $\omega(\theta,\phi,F)$. ω has the following properties:

$$\omega(1,\phi,F) = 1 \qquad \omega(0,\phi,F) = 0 \qquad \omega_\theta > 0 \tag{2}$$

$$\omega_\phi > 0 \quad \omega_F < 0 \quad \omega_{\phi\phi} < 0 \quad \omega_{\phi F} = 0 \tag{3}$$

In the best state of fundamentals, the firm is fully internationally liquid. In the worst state of fundamentals, the firm is fully internationally illiquid. A better domestic financial system and a smaller total amout of debt obligations makes the firm more resistent. A higher ϕ and a lower F are perfect substitutes. The marginal benefit from a better financial system is decreasing.

If the share of short-term obligations that are not rolled over to period 2 is higher than ω, the project gets dismantled. The firm has to sell the productive inputs of the project and pay back the outstanding debt obligations. We assume that the unique buyer of the inputs is the government, which buys them at a discount rate $\alpha < 1$. The firm ends up with a (negative) net return $\pi(s,F,\phi,\alpha)$, which has the following properties:

$$\pi < 0 \quad \pi_s < 0 \quad \pi_F < 0 \quad \pi_\phi > 0 \quad \pi_\alpha > 0 \quad \pi_{sF} = 0 \quad \pi_{\alpha F} = 0 \tag{4}$$

We also assume that

$$\Pi_\phi \geq \pi_\phi \qquad \Pi_{\phi F} \geq \pi_{\phi F} \geq 0. \tag{5}$$

2.2 The Lenders

The lenders' problem is similar to that of the speculators in Morris and Shin [1998]. The "shadow" exchange rate, i.e. assuming no peg, is strictly increasing in the fundamentals, is denoted by $f(\theta)$, and has the property $f(\theta) \leq 1$, for all θ. In period 1, upon realization of θ, each holder of the firm's short-term debt decides whether to roll the debt over or to convert it into liquid pesos and attack the currency peg by exchanging the pesos into dollars. Converting one peso of debt into liquid money has a cost $t > 0$. If the peg is abandoned, the payoff from attacking (to a holder of one unit of debt) is $1 - f(\theta) - t$, while if the government manages to defend the peg, the payoff is $-t$. If the lender decides to roll the debt over, her payoff is just the interest on the debt, which for simplicity is normalized to zero.

The government associates a constant value v with defending the peg. The cost of defending the peg depends on the macro fundamentals and on the share of lenders who decide to attack the peg. Denote it by $c(\alpha, \theta)$. This cost is continuous in both arguments and has the following properties:

$$c_\alpha > 0 \quad c_\theta < 0 \quad c(0,0) > v \quad c(1,1) > v \tag{6}$$

Moreover, $1 - f(1) < t$. Then, denote by $\underline{\theta}$ the value of fundamentals such that $c(0, \theta) = v$, and by $\overline{\theta}$ the value such that $f(\theta) = 1 - t$. Then, if $a(\theta)$ denotes the share of lenders needed to force the government to abandon the peg, in the region $\theta \in [0, \underline{\theta}]$ this share is zero. Let's assume that in the region $\theta \in [\underline{\theta}, 1]$, $a(\theta)$ is smooth and increasing in fundamentals.

Morris and Shin have shown that if the true θ is unobservable, but each lender observes a signal x drawn uniformly from the interval $[\theta - \varepsilon, \theta + \varepsilon]$, with a small ε, then the share of lenders who attack the peg is unique and continuous in θ, and is given by:

$$q(\theta) = \begin{cases} 1 \text{ if } \theta < x^* - \varepsilon \\ \frac{1}{2} - \frac{1}{2\varepsilon}(\theta - x^*) \text{ if } x^* - \varepsilon \leq \theta < x^* + \varepsilon \\ 0 \text{ if } \theta \geq x^* + \varepsilon \end{cases} \tag{7}$$

where x^* is a unique value such that any lender observing a signal x below x^* attacks the peg and anyone else abstains from doing so.

2.3 Optimal Foreign Borrowing

Given the above assumptions and results, the equality $q(\theta) = \omega(\theta)$ has a unique solution. Let's denote it by $\hat{\theta}$. For any $\theta < \hat{\theta}$, $q(\theta) > \omega(\theta)$, and for any $\theta > \hat{\theta}$, $q(\theta) < \omega(\theta)$. Then, the probability of a financial crisis (which in our context means international liquidity crisis) is $\Pr(q > \omega) = \Pr(\theta < \hat{\theta}) = \hat{\theta}$, given our assumption on the distribution of θ. Since $q(\theta)$ is a piece-wise linear non-increasing transformation of θ, $\Pr(q > \omega) = 1 - \hat{\omega}$, where $\hat{\omega}$ is a value of ω at the point $q(\theta) = \omega(\theta)$. Then the probability of the event that the project is not jeopardized is simply $\hat{\omega}$. Note that $\hat{\omega} = \hat{\omega}(\phi, F)$ and carries through the properties (3).

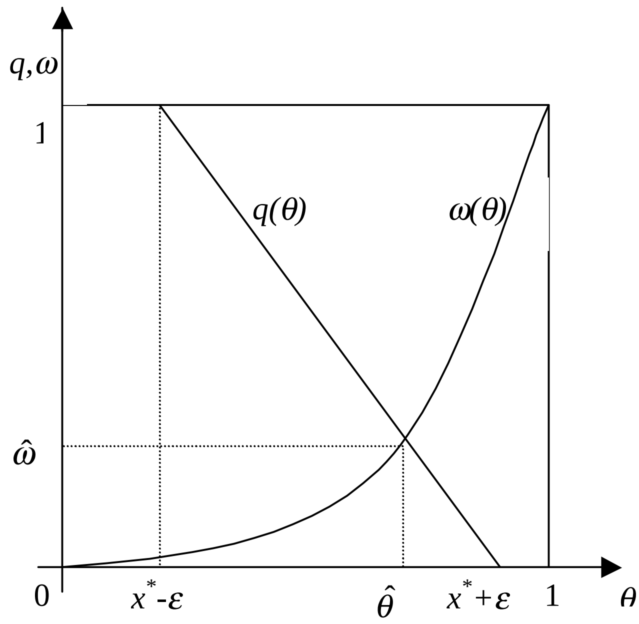

Figure 1: Liquidity crisis and survival regions

The firm maximizes the expected profit in period 2:

$$\max_F \Pi\hat{\omega} + \pi(1-\hat{\omega}) = \max_F \pi + \hat{\omega}(\Pi - \pi) \tag{8}$$

Let us assume that the maximand is strictly positive for any set of parameters, to make the foreign borrowing problem non-trivial.

Proposition 1 *Given the properties of the return and loss functions, the resistence level and the share of speculators (1)-(7), the optimal foreign borrowing has the following property:*

$$F^* = F^*(\underset{-}{s}, \underset{+}{\phi}, \underset{+}{\alpha}) \tag{9}$$

Proof. A theorem in monotone comparative statics (Milgrom and Shannon [1994]) states that if the return function R in a maximisation problem:

$$\max_x R(x; a) \tag{10}$$

where a is a parameter, has strictly increasing (strictly decreasing) differences[1] in (a, x), then the optimal x^* is strictly increasing (strictly decreasing) in a. For a proof, see Vives (2000), p.26, Theorem 2.3.

[1] R has strictly increasing (decreasing) differences in (a, x), if $R(x; a) - R(x; a')$ is strictly increasing (decreasing) in x for any $a > a'$.

Let us denote the expected return function in our maximisation problem (8) as $R(F; s, \phi, \alpha)$. Then, given assumptions (1)-(7),

$$R_{sF} < 0 \qquad R_{\phi F} > 0 \qquad R_{\alpha F} > 0 \tag{11}$$

Result (11) also implies that R has strictly decreasing differences in (s, F) and strictly increasing differences in (ϕ, F) and (α, F). However, from the theorem noted above, the optimal F^* is strictly decreasing in s and strictly increasing in ϕ and α. ■

Proposition 1 shows that the optimal foreign borrowing decreases in assets of the firm, and increases in the quality of the domestic financial system and the discount rate at which the government buys out the assets of an unfinished project.

The behavior of lenders is determined by the state of fundamentals and is given by the continuous non-increasing function $q(\theta)$, which measures the severity of the attack. The resistance schedule of the firm, $\omega(\theta)$, is continuous and strictly increasing in θ and passes through (0,0) and (1,1) points. Therefore, the support of the distribution of the fundamentals is split into two regions: the crisis region $[0, \hat{\theta}]$ and the survival region $[\hat{\theta}, 1]$. This is the unique equilibrium in our model. Since the fundamentals are a random variable, the optimal behavior of the firm determines the equilibrium behavior of the system. The following Corollary characterizes the equilibrium.

Corollary 2 *The equilibrium return from a completed project* Π^* *has the following properties : (1)* $\frac{d\Pi^*}{d\phi} > 0$, *(2)* $\frac{d\Pi^*}{d\alpha} > 0$, *(3) if* $F^*_{ss} > 0$, *then there exists a unique* $\widetilde{s} \geq 0$, *such that for all* $s < \widetilde{s}$, $\frac{d\Pi^*}{ds} > 0$, *and for all* $s > \widetilde{s}$, $\frac{d\Pi^*}{ds} < 0$. *The equilibrium resistance schedule* $\omega^*(\theta)$ *has the following properties: (4)* $\frac{d\omega^*}{ds} > 0$, *(5)* $\frac{d\omega^*}{d\alpha} < 0$, *(6) if* $F^*_{\phi\phi} \geq 0$, *then there exists a unique* $\widetilde{\phi} \geq 0$, *such that for all* $\phi < \widetilde{\phi}$, $\frac{d\omega^*}{d\phi} > 0$, *and for all* $\phi > \widetilde{\phi}$, $\frac{d\omega^*}{d\phi} < 0$.

Proof. Since $\Pi = \Pi(\overset{+}{s}, \overset{+}{F}, \overset{-}{\theta})$ and $\omega = \omega(\overset{-}{F}, \overset{-}{\phi})$ by assumption, and $F^* = F^*(\overset{-}{s}, \overset{+}{\phi}, \overset{+}{\alpha})$ from Proposition 1, properties 1, 2, 4, and 5 follow immediately. To prove the property 3, let's compute the derivative $\frac{d^2\Pi^*}{ds^2}$:

$$\frac{d^2\Pi^*}{ds^2} = \Pi_{ss} + \Pi_{Fs}F^*_s + \Pi_F F^*_{ss} = \Pi_{ss} + \Pi_F F^*_{ss}$$

Given that $\Pi_F < 0$ and $F^*_{ss} > 0$, the second term is strictly decreasing in s, while the first term is non-decreasing in s. Therefore, this second derivative is strictly increasing in s. There are two cases: (1) $\frac{d^2\Pi^*}{ds^2} \geq 0$ around zero; if so, $\frac{d\Pi^*}{ds} > 0$ for all $s > 0$; (2) $\frac{d^2\Pi^*}{ds^2} < 0$ around zero; then there exists a unique $\widetilde{s} > 0$ at which $\frac{d^2\Pi^*}{ds^2} = 0$ and beyond which the second derivative turns positive. Putting these two cases together gives us the property 3. The property 6 is proven analogously. ■

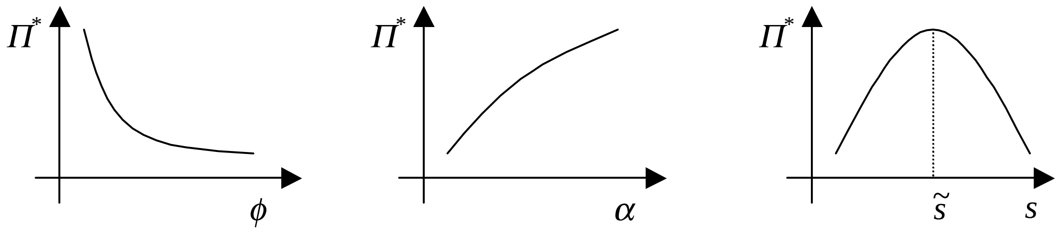

Figure 2: Properties of the equilibrium return from a successfully completed project.

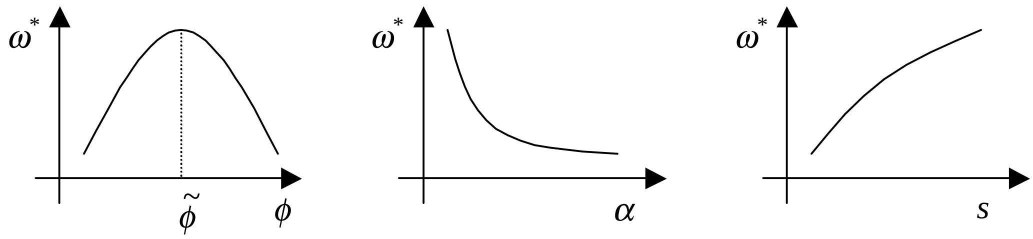

Figure 3: Properties of the equilibrium vulnerability of the firm.

Corollary 2 tells us several important results. In equilibrium, the net return to the firm (in the absense of crisis) is increasing in the quality of the domestic financial system and in the rate of government protection. This return has a hump-shaped form with respect to the quantity of assets that the firm owns: the return is surely decreasing beyond some size of the firm. The vulnerability of the firm to liquidity crises is decreasing in its size, increasing in the rate of government protection, and has a U-shaped form with respect to the quality of the domestic financial system. Beyond some level of quality, the vulnerability increases in this argument.

3 Policy

Our model allows for the analysis of several policy measures of the government. We concentrate on three: (1) financial liberalization; (2) restrictions on debt-currency convertibility; (3) government bailout guarantees.

3.1 Financial Liberalization

Numerous commentators (starting from Diaz-Alejandro [1985]) have noted that financial liberalization may lead to crises. In our model the effect of this measure

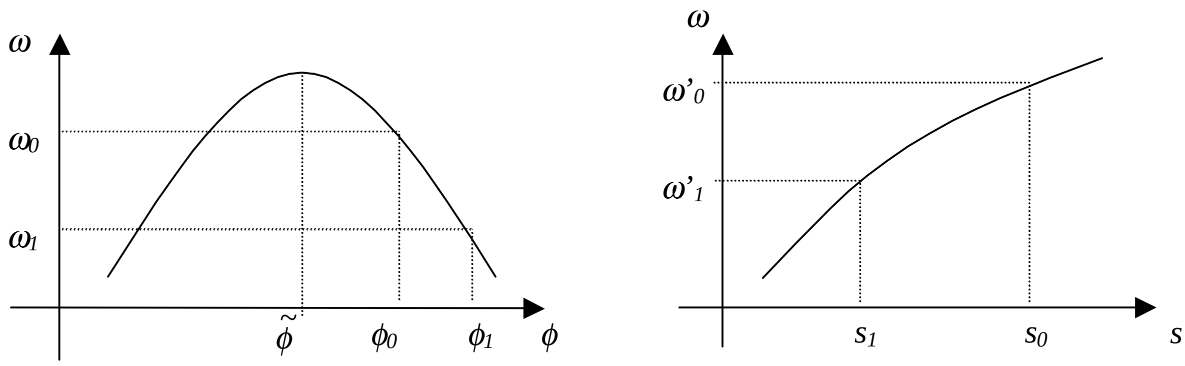

Figure 4: Consequences of a financial liberalization.

depends on the pre-liberalization quality of the domestic financial system. Financial liberalization usually leads to a fall in the size of firms in the sector and to an increase in the quality of the financial system. The properties 4 and 6 in Corollary 2 state that the vulnerability of a firm to liquidity crises is decreasing in its size and has a U-shaped form with respect to the quality of the domestic financial system. Thus, we have two cases: (a) the pre-liberalization quality of the domestic financial system is relatively high (i.e., beyond the $\widetilde{\phi}$ level); (b) the quality of the financial system before liberalization is relatively low (below $\widetilde{\phi}$). In case (a), both the further increase in the quality of the financial system and the fall in size of the firms imply an increase in the vulnerability to crises. In case (b), two effects run against each other, and the total effect is ambiguous. However, our model still proves useful by decomposing the impact of financial liberalization into two effects: the size effect and the quality effect.

3.2 Convertability restrictions

What if the government increases the cost associated with the conversion of the short-term debt into liquidity? Let's assume away the complications related to the possible creation of the black exchange market. Morris and Shin [1998] have shown that an increase in t implies, *ceteris paribus*, a decrease in the severity of the attack on the peg. Graphically, this means a leftward shift in the $q(\theta)$ line. Since such a measure keeps the firm characteristics unaltered, an increase in the cost of conversion implies a decrease in the susceptability of the economy to financial crises.

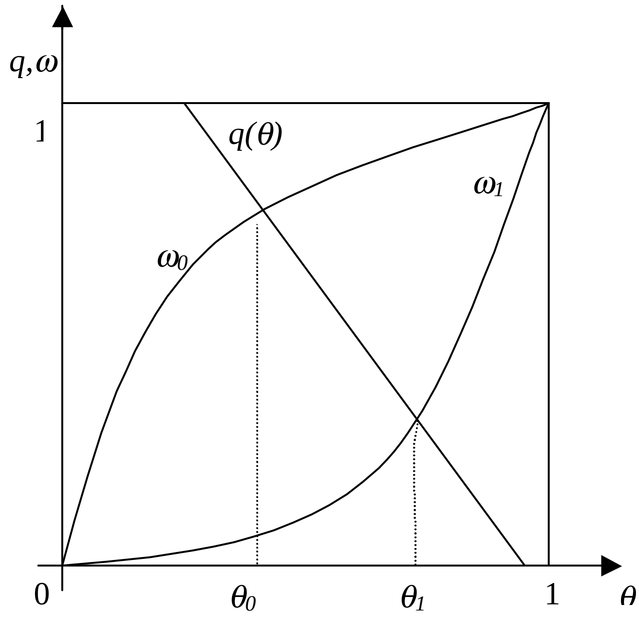

Figure 5: Crisis regions before and after liberalization.

3.3 Government bailout guarantees

Assume now that the government decides on the rate of protection α, which can be lobbied via contributions from the firm. Certainly, the preferred policy for the firm is $\alpha = 1$, i.e. that it loses nothing even in the case when the project is dismantled. The government's problem then can be formulated as:

$$\max_{\alpha} \lambda[b(\Pi) + e(\omega)] + (1 - \lambda)C(\alpha), \tag{12}$$

where $b(\Pi)$ denotes the social benefit from the successfully completed project, $e(\omega)$ is the social benefit associated with the resistance of the economy to liquidity crises, and $C(\alpha)$ is the firm's lobbying contributions schedule. There is a binding agreement on the part of the firm, to provide lobbying contributions, conditional on the policy chosen. Finally, $\lambda \in [0, 1]$ is a measure of the government's independence from the lobbies (which we assume to be institutionally determined). These functions have the following properties:

$$b_{\Pi} > 0 \;\; e_{\omega} > 0 \;\; C_{\alpha} > 0. \tag{13}$$

Since the preferred policy of the firm is $\alpha = 1$, the firm is ready to pay higher contributions for higher protection. We also assume that the society gets less than full benefit from the completed projects (for example, the firm exercises

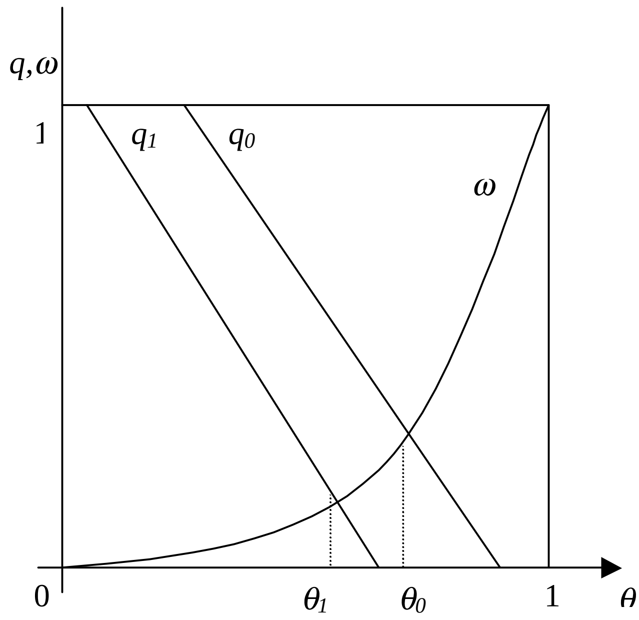

Figure 6: Crisis regions with and without convertibility restrictions.

some market power), i.e. b_Π is small. In particular, for the next result, we assume that

$$0 < b_\Pi < \frac{C_\alpha - e_\omega \omega_\alpha}{\Pi_\alpha}. \tag{14}$$

Given (12)-(14), we can prove that the equilibrium rate of protection α^* is decreasing in λ. Denote the maximand in the problem (12) as $G(\alpha, \lambda)$. Given the properties (13)-(14), $G_{\alpha\lambda} < 0$. Therefore, G has strictly decreasing differences in (α, λ). Using the basic theorem of the monotone comparative statics (see the proof of Proposition 1), this implies that $\frac{\partial \alpha^*}{\partial \lambda} < 0$.

Let's concentrate now on two options: (a) the government is fully independent from the lobbies' influence ($\lambda = 1$); (b) the government is imperfectly benevolent ($0 < \lambda < 1$). In the second case, the equilibrium policy α^* is higher and, as a consequence, the economy is more vulnerable to financial crises.

4 Twin Crises

The basic model of Section 2 can be easily extended to analyze the phenomenon of the so-called "twin" crises, i.e. liquidity and currency crises happening together. The previous theoretical research suggests causality directions in both ways. Stoker [1994] shows how a currency crisis can lead to a credit crunch and therefore cause a liquidity crisis. Mishkin [1996] analyzes the case when the

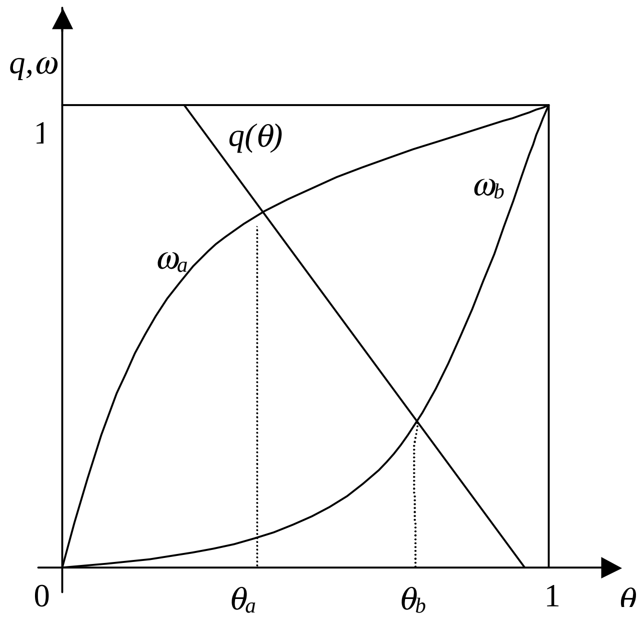

Figure 7: Crisis regions with and without lobbying

devaluation worsens the balance sheets of the firms if a part of their debt obligations is denominated in foreign currency. Both ideas have important real-world counterparts. However, because our model is strongly simplified, the setup that we have assumed excludes the possibility of these two channels.

Denote as θ_A the level of fundamentals at which $q(\theta) = a(\theta)$. If $\theta < \theta_A$, the attack on the peg succeedes. Denote as θ_B the level of fundamentals at which $q(\theta) = \omega(\theta)$. If $\theta < \theta_B$, the firm is suffers the financial crisis. The relative vulnerability of the firm and the fragility of the currency peg (the scarcity of government's foreign reserves) determine the relative position of θ_A and θ_B. There are two possible cases (we are not concentrating on the highly improbable case when θ_A and θ_B coincide):

- $\theta_B < \theta_A$. In this case, the fundamentals can be divided into three regions: (1) if $\theta \in [0, \theta_B]$, currency and financial crises happen together; (2) if $\theta \in [\theta_B, \theta_A]$, currency collapses but the financial system survives; (3) if $\theta \in [\theta_A, 1]$, neither financial nor currency crisis takes place. As we noted above, in this model the currency crisis does not cause the financial crisis.

- $\theta_A < \theta_B$. The three regions are: (1) if $\theta \in [0, \theta_A]$, both the currency and the financial crises take place; (2) if $\theta \in [\theta_A, \theta_B]$, the financial system collapses but the currency peg is not abandoned; (3) if $\theta \in [\theta_B, 1]$, nei-

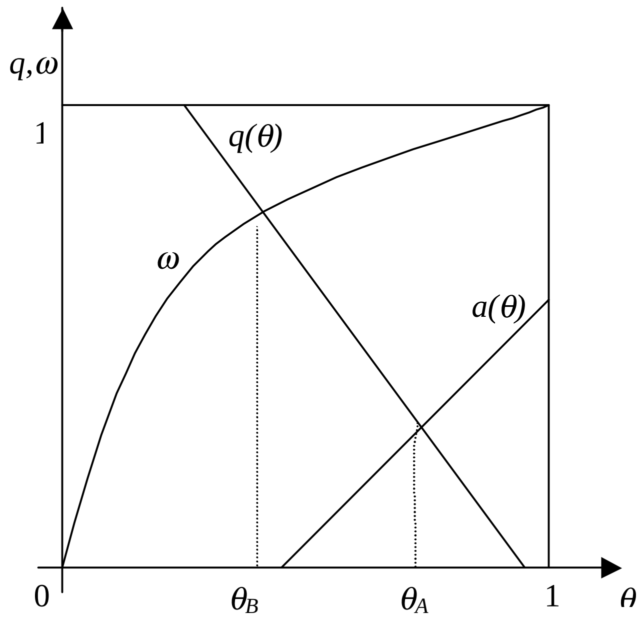

Figure 8: Weak government, strong firms

ther financial nor currency crisis takes place. If fundamentals fall into the intermediate region, the financial crisis can cause the currency collapse. This depends on how the government finances the budget deficit resulting from the bailout. One can model this explicitly; however, for exposition and simplicity purposes, let's concentrate on two extreme cases: (a) the government finances the budget deficit simply by printing money. This means that the peg is unsustainable regardless of the realization of fundamentals and we are in the case of the first-generation currency crises models. In period 2, $q(\theta)$ becomes a horizontal line $q = 1$ for all θ, and all lenders attack the peg which gets abandoned. Here, the financial crisis causes the currency crisis. For a more detailed analysis, see Velasco [1987]. (b) the deficit is financed without any effect on the foreign reserves and the information set of the lenders is unaltered. Then, neither $q(\theta)$ nor $a(\theta)$ schedules changes and the currency peg survives. In this case, the financial crisis does not cause the currency crisis.

5 Conclusions

This paper has presented a simple model with a unique equilibrium in presence of a financial crisis. While it is not the first model of financial crises to exhibit unique equilibrium, the characteristic of the equilibrium in this model manage

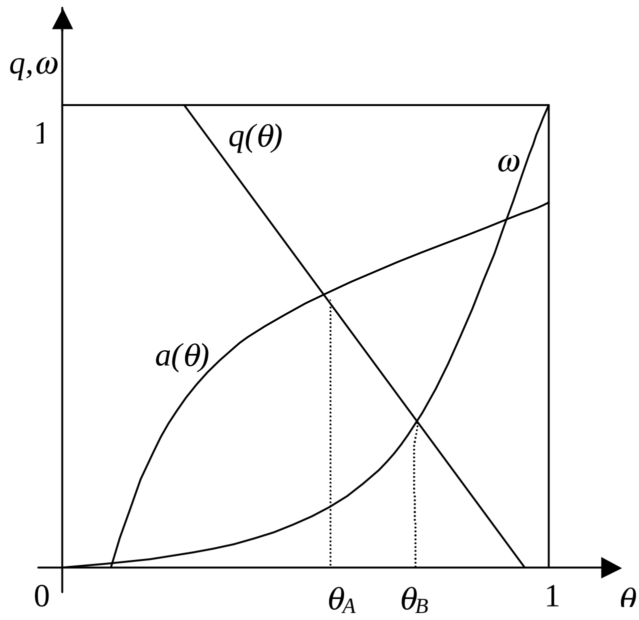

Figure 9: Strong government, weak firms

to resolve two shortcomings of the previous models. First, we have shown the conditions under which the crisis occurs even without a low realization of fundamentals. Second, our analysis includes the case when the crisis happens when the investment is profitable.

The novelty of the model is that the vulnerability of firms to liquidity crises is endogenous. The vulnerability increases with the amount borrowed from abroad, which is choosen by the firm. The firm chooses the optimal amount of short-term borrowing, weighting the benefit of higher long-run returns against the cost of a higher risk of a liquidity crisis.

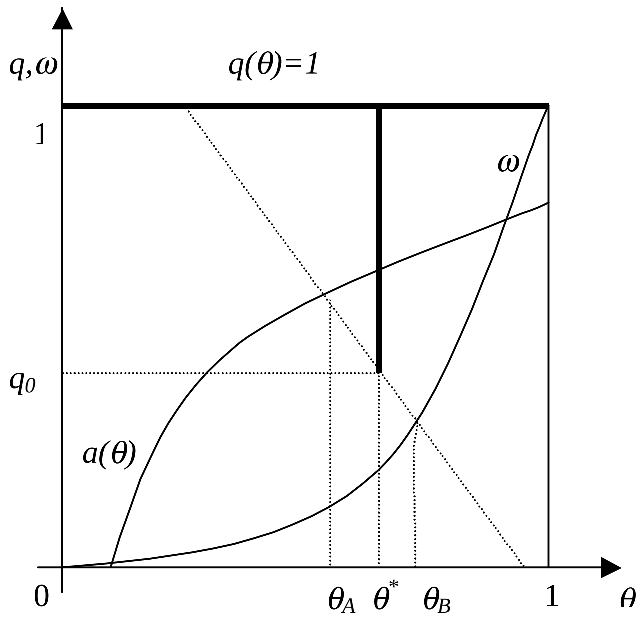

Figure 10: The effect of monetary deficit financing

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