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Gianluca Femminis and Luigi Ruggerone

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Gianluca Femminis, Università Cattolica del Sacro Cuore, Milano and CEPR
Luigi Ruggerone, Banca Commerciale Italiana

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Centre for Economic Policy Research
90–98 Goswell Rd, London EC1V 7RR, UK
Tel: (44 20) 7878 2900, Fax: (44 20) 7878 2999
Email: cepr@cepr.org, Website: www.cepr.org

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ABSTRACT

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We present a simple model where bank runs are possible and we analyse the role of subsidization of future investment in this setting. We find that such a policy exacerbates the short-run liquidity problem for banks. Moreover, we highlight that a 'shift in expectations' about the keeping of the subsidization promises induces a bank run. We analyse the effects of a (partial) forced conversion of non-liquidated deposits into banks equities, showing how a bank recapitalization of this type may help to solve the problem. In fact, the deposit/equity swap can make credible an *ex post* recovery of the banking system, thus preventing the shift in expectation from generating a self-fulfilling bank crisis. This commitment device may prove useful also in the case of 'political uncertainty'.

JEL Classification: E61, F34
Keywords: bail-out, bank run, financial crisis, international lending

Gianluca Femminis
Istituto di Teoria Economica
Università Cattolica del Sacro Cuore
Via Necchi 5
20123 Milan
ITALY
Tel: (39 02) 7234 2483
Fax: (39 02) 7234 2923
Email: femminis@mi.unicatt.it

Luigi Ruggerone
Banca Commerciale Italiana
Via Borgonuovo
20121 Milano
ITALY
Tel: (39 02) 88507177
Fax: (39 02) 88507195
Email: ruggerone@bci.it

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NON-TECHNICAL SUMMARY

In 1997 the global financial markets were shaken by a major crisis, which appears to present some peculiarities. These make it difficult to embed the Asian crisis into the standard models used to analyse such phenomena, and seem to call for a refinement of some of the tools used by the economists.

Our framework is very much in the spirit of the multiple equilibrium literature on bank runs started by Diamond and Dybvig (1983). Trying to embed Krugman's (1998) suggestion, however, we introduce a governmental subsidy on future investments and returns (an 'implicit bail-out').

In our model, this subsidy is motivated by the government's willingness to favour the interests of the 'business community', which is an 'elite' in whose hands non-labour incomes are concentrated. We model the implicit bail-out as a promise to cover a bank's future losses; the transfer is financed by a proportional tax on labour incomes. Also, our set-up is characterized by a heavy undercapitalization of banks and firms. Firms need to contract long-term loans from banks, while we assume that financial institutions obtain credit on a short-term basis. This stylizes the presence of demand deposits (of short-term loans); such maturity mismatch is at the root of the possibility of a bank run. We also assume that a relevant share of banks' funds is provided by foreign investors.

We assume that, if the government does not subsidize banks, they default, and a share of output of the following period is lost: if banks fail, firms lose their favourite credit channel and the 'maturation process' of capital is partly spoiled. As it is standard in the literature, we identify the conditions such that, when a bank run does not take place, the future output losses make the bail-out promise credible. Even under such conditions, however, if the run occurs, the 'rescue cost' is too large for the government.

We then analyse what happens in the model if, in the face of a run, the government requires the home depositors to buy newly issued shares; in other words, we assume that a (possibly partial) forced conversion of non-liquidated deposits into banks' equities is carried out. We show that such a deposit/equity swap is effective in making credible a future rescue of financial institutions; hence, it can fend off the panic attack and minimise the output loss.

Admittedly, this solution hinges on some specific characteristics of the environment we study. First, it is a market economy. Banks cannot default without being involved in a bankruptcy procedure that eventually eats up their resources. Hence, the fact that foreign creditors, after the deposit/equity swap, hold a higher share of 'senior' claims cannot induce debt repudiation from the banks. Second, the *liaison dangereuse* between the government and the

business community is exploited. The fact that the government evaluates the losses of its 'favourites' more than the tax bill imposed on the average taxpayer makes a bank rescue credible. In other words, we are proposing a way of tying the government's hands, by putting at stake (part of) the wealth of the people that the government is not willing to harm. This is done by the proposed deposit/equity swap.

The policy implications of our simple framework are far-reaching, in particular concerning the role of international institutions.

When no deposit/equity swap takes place, the provision of liquidity by an external source (e.g. the IMF) in the face of a financial crisis has very different effects depending on its size. If the bail-out is complete, the panic is stemmed, banks do not fail and there is no output loss. When the resources immediately available are not sufficient to allow for a complete repayment of the banks' debt, in our model, the injection of liquidity has no effect. In fact, everybody knows that the government, in the future, will still have no incentive to raise taxes since these will transfer resources from elite agents to an external institution.

Perhaps more surprisingly, we find that an IMF-type intervention may preclude the possibility of a successful deposit/equity swap. This result is obtained assuming that the injection of resources is used to liquidate a higher fraction of banks' liabilities when the bank run takes place, and that it must be repaid at the world rate in the future. In this case, our country, in the final period, must repay a higher amount of foreign capital, while the maximum bank capitalization is lower, since a larger share of home resources has been liquidated at the time of the run.

Our major point is that, on the basis of a multiple equilibria model, the IMF package, asking for bank recapitalization and restructuring, did not quite go in the right direction. In fact, under the pressure of the IMF, over 15 banks were closed in Indonesia, while all the others went through a deep consolidation process. Rather than a true recapitalization, the banking sector was forced to shrink its credit activity, thus making the recession even worse. As argued, for example, by Radelet and Sachs, there is no clear reason to believe that closing or restructuring banks should restore market confidence once a 'wave of panic' has arisen. This interpretation has led a number of authors to underscore the benefits of an international payments standstill, possibly coded in a 'super' Chapter 11. Our model highlights that, when the pocket of the international institutions is not deep enough to implement a full bail-out (or the involved moral hazard problems are judged too heavy a burden), an injection of fresh capital *from home agents* is an alternative (possibly complementary) way out of financial panic.

1. Introduction

In 1997 the global financial markets have been shaken by a major crisis that originated in July in Thailand and quickly spilled over to South Korea, Indonesia and Malaysia and, with somewhat less dramatic impact, to the Philippines and Taiwan. Both investors and economists have been surprised by the explosion and the evolution of the crisis,[1] which appears to present some peculiarities. These make it difficult to embed the Asian crisis into the standard models used to analyse such phenomena, and seem to call for a refinement of some of the tools used both by the practitioners and the economists. It does not come as a surprise that many different explanations and interpretations of the crisis have been put forward. Almost everyone agrees that neither "first-generation" models à la Krugman (1979) relying on money-financed fiscal imbalances, nor "second-generation" ones à la Obstfeld (1986,1994) where self fulfilling expectations are coupled with some sort of macroeconomic imbalance provide a convincing explanation of the crisis. As a matter of facts, the countries involved in the crisis did not show significant macroeconomic imbalances such as deep budget or current account deficits.[2] However, there is no agreement about what ultimately triggered the crisis and, as a consequence, about the possible policy actions to prevent similar events in the future. Broadly speaking, economic literature has recently been developing two main streams of research. On one side one can find the contribution of Krugman (1998) and Corsetti, Pesenti and Roubini (1999a), on the other side one can refer to the works of Radelet and Sachs (1998a,b), Chang and Velasco (1998a,b).

According to Krugman's view, the roots of the crisis have to be found in what he calls "financial excess", namely poor banking regulation and excessive lending. In his model, the root of financial excess is the government willingness to guarantee the

[1] Market spreads failed to show crisis expectations and even the least enthusiastic observers, such as Krugman, expected only a sharp slowing down of Asian growth, but not a deep crisis.

[2] For a snapshot of precrisis macro data, the reader can refer to Corsetti, Pesenti and Roubini (1999b), or Radelet and Sachs (1998a).

normal rate of return to the financial intermediaries, even when the investment projects they fund are hit by a negative shock. Clearly, in this set-up, “moral hazard” leads to overinvestment in risky projects, while assets are overpriced. In such an environment, a fall in asset prices towards fundamental values might have been triggered by a real adverse shock and/or the reaching of the upward limit on the amount of money that governments were willing to spend for a bailout. This drop in asset prices burst the bubble and weakened significantly the solvency of banks and intermediaries. What was at work there, was an enormous moral hazard problem induced by the implicit or explicit bailout of banks that tended to overinvest. The major policy implication that can be drawn from this analysis is a closer control over banking activity and milder government intervention (if any). Furthermore, this kind of story tends to consider financial crises as salutary, since they foster a rapid convergence to an efficient market equilibrium. Therefore, any kind of international device (investment subsidies, guarantees on liabilities possibly related to IMF packages) that prevents asset prices from falling to their fundamental value is distortionary.

Prospective deficits (i.e. the cost of future bailouts) play a central role also in the currency crisis model by Burnside, Eichenbaum and Rebelo (1998). In their model, at the initial date, agents become conscious that future deficits will be so large that the government budget constraint implies an inevitable speculative attack. They then analyse the welfare effect of the abandonment of the fixed exchange rates under various alternative assumptions about the government behaviour.

The link between financial and currency crises is investigated also by Corsetti, Pesenti and Roubini (1999a), who use a “money in utility” model. They share Krugman’s view about the importance of “Panglossian values” in East Asian economies, and, in their framework, the bailout must become explicit once an exogenous level of implicit liabilities is reached. Since the labour income tax cannot be raised above a certain level, the Government is forced to print money to draw resources from households to bailout the corporate sector. The increase in money supply obviously alters the equilibrium exchange rate. Since expected jumps are not allowed in rational expectations equilibria, a speculative attack must take place, as in

"first generation" models, before the "trigger level" of liabilities is reached. According to Corsetti, Pesenti and Roubini, a crisis bears relevant distributive consequences, since the cost of the bailout is unevenly distributed, mainly resting on workers' shoulders, but it remains true that the crisis forces the economic system out of the inefficient equilibrium. [3]

Radelet and Sachs share a different view. Although they acknowledge that some macroeconomic imbalances and some examples of crony capitalism were present at the outset of the crisis, they do not see an asset price bubble. On the contrary, their emphasis is on the vulnerability of the system to financial panic. Their point is that sudden actions of investors withdrawing their funds can trigger major capital outflows and precipitate the crisis. A similar analysis can be found in Chang and Velasco (1998a,b). In their papers, they offer an explanation of the crisis based on the problem of *illiquidity*. By this, they mean a situation in which "the financial system's potential short term obligations exceed the liquidation value of its assets". [4] Their theoretical framework is an open economy version of the well-known Diamond and Dybvig (1983) model of bank runs. When investors perceive that a bank might become illiquid, they may react by trying, all at the same time, to withdraw their assets thus causing the collapse of the entire banking system.[5] The policy implications that follow these analyses point towards a limitation of short-term capital inflows, but, above all, to the injection of liquidity into banks in order to minimise a potentially very costly liquidation of assets. According to this view, the "IMF recipe", prescribing tight fiscal and monetary policies, but also bank closures or quick recapitalisation, may well have worsened the crisis. In fact, these measures are ineffective in preventing a panic run, while exacerbate the credit crunch following the financial crisis.

This stream of literature provides several "stylised facts" suggesting that a dramatic shift in expectations took place in mid 1997. In particular, the risk premia attached to loans to the East Asian economies (but for Thailand) were decreasing in

[3] Bai and Wang (1999), introduce the subsidisation of high-risk project in a portfolio model. They conclude that the induced results of high risk and high volatility stylise the observed behaviour of the East Asian economies.

[4] See Chang and Velasco (1998a) page 3.

[5] See also Marshall (1998).

early 1997 and capital inflows in those economies were strong in 1996 and, in most cases, also until mid 1997.

[Table 1 about here]

During the last twelve months before the crisis, the stock prices were falling in Thailand and South Korea, but not in Indonesia. In Malaysia, the equity market turned down only in March (see e.g. Radelet and Sachs, 1998a). However, as reported by Corsetti, Pesenti and Roubini (1998,1999b), some macroeconomic indicators, such as an increasing incremental capital/output ratio support the overinvestment view.[6] Corsetti, Pesenti and Roubini (1998) summarise the evidence suggesting a sustained lending boom in Malaysia, Thailand and the Philippines. Moreover, they elaborate the BIS data concerning the non-performing loans to GDP ratio in the area. These turn out to be as high as 14% in the Philippines, 13% in Thailand and Indonesia, 10% in Malaysia and 8% in South Korea.[7]

Irwin and Vines (1999) provide an attempt to merge the issue of multiple equilibria with the implicit bailout one. They assume that Governments are willing to guarantee to investors the "Panglossian value", and they introduce the possibility of default. In their set-up, as in many "second generation models", the Government bears a fixed cost when it decides not to honour the debt. Multiple equilibria immediately arise. If agents believe that the bailout will be maintained in all the states of the world, they do not ask for a risk premium, therefore making the cost of the ex-post subsidies always bearable. On the contrary, when they presume that the corporate sector will be rescued only if the productivity is high, they charge a risk premium that makes the subsidies sustainable only under favourable realisations of the shocks.

[6] However, Radelet and Sachs (1998b) note that the ICOR for the crisis countries, although increasing, was not higher than in other emerging market economies.

[7] Burnside, Eichenbaum and Rebelo (1998) report higher estimates, especially for Korea, Malaysia and Thailand.

Although (self-fulfilling) multiple equilibria arise neatly, in their model the capital outflow follow the increase in interest rate, without causing any forced liquidation.

The model we present here is very much in the same spirit of Diamond and Dybvig (1983) and Chang and Velasco (1998a), but we introduce, trying to embed Krugman's (1998) suggestion, a governmental subsidy on future investments and returns.

The paper is organised as follows. In section 2 we set up and solve our model under the assumption that the promise of an implicit bailout of banks is believed by agents. We then check the ex-post consistency of the bailout policy. Section 4 focuses on the consequences of a "shift in expectations", stressing that a run on banks deposits can always occur. Section 5 provides an argument in support of bank recapitalisation in response to financial panic. Section 6 extends the model to a situation where political risk plays an important role. The last section summarises the main message and policy implications and discusses the open issues.

2. The model

A basic characteristic of our model is that all agents optimise in the belief that no bank run will take place. Debatable as it is, such assumption is shared with almost every self-fulfilling expectations - multiple equilibria models.

An important characteristic of our framework is that production takes time. More specifically, we assume that to yield some fruit at period t capital must be invested at time t-2. During period t-1 capital goods simply remain in the firms, carrying out their "maturation process"; in period t they are matched with the other factors to complete the production of goods.

[Figure 1 about here]

We restrict our attention to four periods (indexed from 0 to 3). The use of such a limited framework is unsatisfactory, but the adoption of an infinite-horizon model proved to be technically prohibitive[8].

Firms

The productive activity is performed by firms, which have access to a technology represented by the production function:

$$Y_t=AK_t^{\alpha}L_t^{\beta}T_t^{(1-\alpha-\beta)}$$

where Y_t denotes production at time t; K_t is capital and L_t labour. T_t denotes the other (non reproducible) productive factors such as land, estates or managerial skills. From now on, for the sake of exposition, we will refer to such factor as "land". With no loss of generality, we normalise T_t to unity. An alternative interpretation of our production function is that returns to scale are decreasing and hence that a fraction $(1-\alpha-\beta)$ of output is distributed as pure profit.

At time 0(1) firms aim at maximising profits at time 2(3) respectively; they borrow the capital they need from banks (at the lending rate r_{lt}). Since competition prevail in the labour and in the "land" markets, the optimal level of capital is

$$K_t^* = \left(\frac{\alpha A\, L_t^{\beta}}{r_{lt}}\right)^{1/(1-\alpha)}$$

Households

Agents are heterogeneous: they differ in the amount and in the sources of their income. While labour is evenly distributed (each agent is provided with one unit of labour), the property of "land" and capital is concentrated. We assume that the total mass of agents is 1; hence also L_t =1. Capital and land incomes entirely belong to a minority, labelled the "elite" as in Corsetti, Pesenti and Roubini (1999a). We denote by θ the ratio between the "elite" agents' claims on such types of income and the average. Hence, the elite is composed of $1/\theta$ agents. As for capital, we assume that the

[8] The main difficulty is due to the fact that, in a multiperiod framework, in the face of a bank run, the government could choose optimally the time profile for its actions.

economywide endowment is $2\bar{K}$. Bear in mind that this assumption implies that the capital inflow, in each period, is $K_t^* - \bar{K}$. Throughout the paper, we assume that: $K_t^* > \bar{K}$.

All the agents seek to maximise the same utility function:

$$U_i(C_{i2}, C_{i3}) = \frac{C_{i2}^{1-R}}{1-R} + \frac{C_{i3}^{1-R}}{1-R} \qquad (1)$$

where $i \in \{0, \theta\}$; for example, $C_{\theta 2}$ and $C_{\theta 3}$ are the consumption levels for the elite agents at time 2 and 3, respectively. $R \geq 0$ is the reciprocal of the elasticity of intertemporal substitution; hence, agents (imperfectly) substitute consumption between time 2 and time 3. Notice that the intertemporal subjective discount rate is naught. This assumption, again, is introduced for the sake of simplicity. Moreover, since we will normalise the world interest factor to one, the hypothesis of no intertemporal discount is consistent with the simple saving behaviour that we will describe in our model.

We shall discuss explicitly the simplest case $R=0$, and briefly comment on the more relevant situation with $R>0$. It will turn out that not only do our results hold, but also that they are strengthened.

Public policy

We now want to depict a situation where the government is willing to favour the interests of the "business community"[9].

Here we simply assume that the government aims at maximising the average utility of the elite "θ agents". Notice that we need to consider the elite agent average utility since, as it will be clearer in the sequel, in case of a bank run depositors will obtain different refunds and hence will enjoy different consumption levels. Our assumption is certainly crude, but it proves to be manageable. Alternatively, one may assume that banks belong to the elite agents and therefore maximise their welfare, taking account of the government's (ex-ante and ex-post) constraints. This is the road taken by Corsetti, Pesenti and Roubini (1999a); as shall be clear in the sequel, in our

[9] This stylises, for example, the liasons between the government and the chaebols in Korea or the role of the "minister nephews" in Indonesia.

settings this alternative assumption does not change our results, as long as the government aims at favouring the "elite".

We need to introduce several hypotheses concerning the tax policy. We assume that the government raises a proportional tax on labour incomes and that it uses the proceeds of the levy to subsidise the accumulation of capital. The tax rate cannot exceed an upper bound, δ. This may happen since the administration in charge does not wish to generate too much discontent in the working class to prevent riots or because a certain "degree of democracy" is in place (even if murky). For the same reason, a direct transfer from labour incomes to the elite is precluded.

We assume that the government cannot increase taxes or introduce a new fiscal instrument within each period. In fact, in our model, the need to increase the fiscal revenue is related to the need to rescue banks in the face of a run. Hence, our assumption accomplishes the fact that the bank run may happen in a situation where part of the income has already been distributed, taxed and consumed; moreover, a new (income) tax takes time to produce fiscal revenue. While Alesina, Prati and Tabellini in their 1990 seminal paper assume that the government can instantaneously raise taxes (at the price of an increasing distortion) some more recent literature such as Cole and Kehoe (1996) rule out this possibility.

In what follows we will concentrate on a situation where the government sets the labour income tax to its maximum level, δ. Notice that we are basically ruling out any possibility of a rescue based on a fiscal entrenchment, therefore considering a situation which is, loosely speaking, "potentially very prone" to financial panic.

Finally, we assume that the Government's budget is balanced.[10]

Financial institutions

Banks play a relatively passive but central role in our model. They are heavily undercapitalised so that their internal resources are actually negligible; hence they need to raise deposits on the market. We assume that financial institutions obtain

[10] After all, in Asian countries macroeconomic imbalances were not dramatic. Moreover, in our two-period model, it is equivalent to finance a subsidy to banks by future or by current taxation. However, our assumption disregards the issue of the possibility of government default.

credit on a short-term basis. This stylises the presence of demand deposits and of short-term loans. In terms of our model, such assumption requires that the debt contract signed at time 0(1) must be rolled over at time 1(2) to allow for the completion of the physical capital maturation process. We assume that our country is integrated in the international financial market, so that capital is borrowed at the constant world rate *r*.

At time 0 and 1, banks lend to firms to finance the capital stocks becoming productive in periods 2 and 3, respectively. Such long-term loans generate a maturity mismatch in its severest form. Banks control the lending rates at time 2 and 3 to maximise $C_{\theta 2}$ and $C_{\theta 3}$ respectively. This happens because they are public and hence they maximise the government's objective function.

Notice that, if the lending rate is lower than banks' borrowing rate, banks will need to be subsidised by the government. This is the root of the "implicit bail-out" policy characterising the model. Banks take account of the tax burden in their maximisation process.

Hence, they maximise: $U_{\theta}(C_{\theta 2}, C_{\theta 3})$ with respect to r_{l2}, r_{l3} under the constraints: $K_t^* = \left(\frac{\alpha A}{r_{lt}}\right)^{1/(1-\alpha)}$ and $(r-r_{lt})K_t^* = \tau_t \beta A K_t^{*\alpha}$, t=2, 3.

Our problem consist of the sum of two static optimisations, each of which is solved by:

$$r_{lt} = \max\left\{\frac{r}{1+(\theta-1)(1-\alpha-\beta)}; \frac{\alpha r}{\alpha+\beta\delta}\right\},\ t=2, 3.$$

Notice that the lending rate will be lower than the world risk-free rate if $\theta>1$. In fact, if the government aims at maximising the welfare of agents whose endowments of resources are higher than the average, it favours the accumulation of capital, therefore inflating the incomes accruing to "land". Hence, r_{lt} is reduced, and labour incomes are penalised, since the implied rate of the proportional tax is:

$$\tau_t = \min\left\{\frac{\alpha}{\beta}\frac{r-r_{lt}}{r_{lt}}; \delta\right\},\ t=2,3.$$

The two last equations imply that τ_t is equal to δ when $\theta \geq 1+ \frac{\beta\delta}{\alpha(1- \alpha - \beta)}$. [11, 12]

3. Ex-post consistency

In the face of the behaviour of banks, it becomes necessary to check whether the government is actually willing to perform the bailouts at periods 2 and 3. We assume that, if the government does not subsidise banks, they default, and a share γ of output of the following period is lost. Such hypothesis seems natural: if banks fail, firms lose their favourite credit channel and the "maturation process" of capital is partly spoiled. This may happen because of the need to finance some working capital, to obtain credit to back export and so on. The presence of γ accounts for this sort of effects, that would otherwise be left out of the model. Our simple assumption involves one major problem: in period 3 there are no incentives to maintain the (implicit) bail-out promise. Here, we take a shortcut: we assume that the government must maintain his promises, unless banks default has already taken place in period two. In other words, government repudiation is ruled out in period three. While this hypothesis may seem awkward to accept, it is clearly motivated by the fact that, in real life, the incentive to keep the bail-out promise, related to future output losses, is always present.

Hence, we focus on the ex-post consistency of bailout promises in period 2. These guarantees will be kept when such course of action grants to "agents θ" a welfare level higher than the one achievable in case of default.

When capital levels, taxes and lending interest factors are equal in both periods 2 and 3, using the utility function (1), the elite agents' welfare when the government pays the subsidies is:

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[11] If we set β=0.6, α=0.3 (the "standard" values roughly compatible with the income and capital shares) and we set δ to 0.15, we obtain that θ must be larger than 4, a sensible restriction. Notice that these values imply the subsidies to banks to be in the order of the 9% of GDP.

[12] Since taxes and interest rates are constant, the consumption levels, under the assumption of no bank run are equal:

$C_{\theta 2} = C_{\theta 3} = [\beta(1-\tau)+\theta(1-\alpha-\beta)]AK^{*\alpha} + r\theta\bar{K}$

where $\tau=\tau_2=\tau_3$ and $K^* = K_2^* = K_3^*$.

$$2\frac{\{[\beta(1-\tau)+\theta(1-\alpha-\beta)]AK^{*\alpha} + r\theta\bar{K}\}^{1-R}}{1-R} \qquad (2)$$

In case of default in the second period, "agent θ" welfare is deeply affected by the repayment procedure adopted by (or imposed to) banks. Here we assume that all depositors (home and foreign) are alike: none of them enjoys a privileged right to repayment. Hence, in case of a run, they are refunded on a "first come first serve" basis. When banks run out of funds, a forced rescheduling of debt takes place; all the agents whose claims have not been satisfied during the second period obtain an identical share of their deposits in period three. The probability of being repaid in period two, ψ, depends on the amounts of resources available to banks in case of default, $r_l K^*$, and on the total claims, $2rK^*$, hence $\psi = r_l/2r$. The period three rate of return is obtained dividing the resources paid by firms to banks, $(1-\gamma)r_l K^*$, by the amount of capital which still needs repayment $2(1-\psi)rK^*$.

Hence, the expected welfare level for a type θ agent is:

$$\psi\, U_\theta^{R2}(.) + (1-\psi)\, U_\theta^{R3}(.) \qquad (3)$$

where $U_\theta^{R2}(.)$ and $U_\theta^{R3}(.)$ are obtained maximising the utility function (1) under the resource constraints for an agents enjoying repayment during the second and the third period, respectively.

When (2)≥(3) the implicit bail-out promises are credible.

For the case R=0, i.e. when agents perfectly substitute consumption between the second and the third period, the above inequality can be easily transformed into:

$$\theta q \geq 1-\gamma\frac{\alpha+\beta+\theta(1-\alpha-\beta)}{2\beta\delta+\gamma\alpha}$$

where $q \equiv \bar{K}/K^*$ and r=1. We assume that such inequality is satisfied.

4. Bank runs

We continue to focus on period two, and we now consider a "shift" in expectations. More precisely, we assume that agents who are lending to home banks now believe that the bailout will not be performed; hence, they refuse to roll over their loans. As in Diamond and Dybvig [1983], this happens because of the "sequential service constraint": agents who find themselves in a "good position" in the queue in

front of banks' tills have an incentive to withdraw their deposits (to refuse to roll over their short-run loan contracts). If the bank run induces the government not to pay subsidies, a self-fulfilling bad equilibrium emerges.

Before concluding that a run is always possible, we need to check when the government, the run notwithstanding, is willing to "rescue" banks. (In this case, the run is not self-fulfilling and hence must be ruled out.) A rescue takes place when the government pays the subsidies at time 2 and raises period 3 overall fiscal pressure up to the point that banks can pay the world rate of interest to their depositors. Since labour taxes cannot be raised, we assume that a proportional tax on "land" income (τ_L) is introduced[13].

When R=0, the agent θ average welfare (W_θ) is:

$$W_\theta = \psi\, U_\theta(.) + (1-\psi)\, U_\theta(.) =$$

$$[\beta+\theta(1-\alpha-\beta)](2-\gamma)AK^{*\alpha}$$

$$- \tau_2\beta AK^{*\alpha} - \tau_3\beta(1-\gamma)AK^{*\alpha} - \tau_L\theta(1-\alpha-\beta)(1-\gamma)AK^{*\alpha}$$

$$+ 2r\psi\theta\bar{K} + \frac{\theta\bar{K}}{r}\left[(1-\gamma)r_l + \tau_3\frac{\beta}{\alpha}(1-\gamma)r_l + \tau_L\frac{(1-\alpha-\beta)}{\alpha}(1-\gamma)r_l\right]$$

where $\psi = \dfrac{r_l + \tau_2\beta\, AK^{*(\alpha-1)}}{2r}$

When r is normalised to unity, simple calculations show that

$$\frac{\partial W_\theta}{\partial \tau_2}, \frac{\partial W_\theta}{\partial \tau_3} \geq 0$$

if $\theta q \geq 1$. When this condition is satisfied, both the period 2 and 3 tax rates are fixed at their highest admissible lever, δ. Moreover, it is easy to see that:

$$\frac{\partial W_\theta}{\partial \tau_L} \geq 0$$

when $q \geq 1$, which is never fulfilled.

[13] One may wonder why a capital income tax is not considered. The reason is twofold. On one hand, it is reasonable to assume that the government does not wish to impose such a tax on foreign investors. On the other, were this tax introduced only for domestic agents, the latters would find easier to circumvent it rather than a tax on land income.

This shows that, in case of a "liquidity crisis", an "ex post" bailout of banks is never optimal. This happens because the "period three" tax on land (τ_L) hurts the elite agents by the amount $\tau_L\theta(1-\alpha-\beta)(1-\gamma)AK^{*\alpha}$ which is partly transferred to foreigners (when $\bar{K}\leq K^*$).

When R is positive, the marginal utility of an agent that fully recovers his money during period two is lower than the marginal utility of a depositor that is liquidated during the third period. This introduces a powerful incentive to impose a period three land tax, since it helps achieving a better (from the government perspective) income distribution. In absence of a resource transfer abroad, the optimum would actually be to let every θ agent to consume the same amount, hence rescuing banks. Nevertheless, the transfer to foreigners induces the government to optimally set the tax to a level lower that the one needed for an ex-post banks rescue. Hence, when $R>0$, the result expounded in this section still holds.

5. Banks capitalisation as a reaction to financial panic

Suppose now that a crisis materialises in period two. To fix the ideas, imagine that the roll over decision is taken "just before" production is obtained (see Figure 2). A "queue" in front of banks' tills is formed and a share ψ of (home and foreign) agents is entitled for an immediate repayment. The other depositors know that they will be partly refunded during period three.

[Figure 2 about here]

At time 2^-, the government requires the home depositors to buy newly issued shares; in other worlds we assume that a (possibly partial) forced conversion of non liquidated deposits into banks equities is performed. Denote by ε the share of non-liquidated deposits, which is transformed into banks' corporate capital. Two possibilities now arise. When the amount of resources available to banks at the end of period three is sufficient to repay the deposits at the world rate $r=1$, also the residual claimants are (partly) remunerated. In this case, bank are "rescued" and the run proves to be based on irrational fears. Hence, foreign investors' confidence should quickly be

established again and the financial turmoil ended, thereby avoiding the output loss in period three. On the contrary, when the fiscal transfer is low and/or deposits are large, they cannot be fully repaid and hence the share capital cannot be refunded.

The first situation takes place when:

$$(1-\gamma)r_l K^* + \beta\tau_3(1-\gamma)AK^{*\alpha} + \tau_L(1-\alpha-\beta)(1-\gamma)AK^{*\alpha} > 2r(1-\psi)(K^*-\varepsilon\bar{K}) \qquad (4)$$

The left hand side of the equation above represents the overall resources available to financial institutions and is the sum of the payments from firms (the first addendum) and of the subsidies from the public sector (the second and the third addenda). The right hand side of eq. (4) is obtained by deducing from the total amount of capital the share liquidated during period two ($2\psi K^*$) and the deposits converted into equities, $2\varepsilon(1-\psi)\bar{K}$. Of course, when the sign of eq. (4) is reversed, banks are in default.

We now determine the level of ε guaranteeing banks' rescue.

When $R=0$, agent θ average welfare becomes:

$$W_\theta(\varepsilon)^S =$$

$$[\beta+\theta(1-\alpha-\beta)](2-\gamma)AK^{*\alpha} - \tau_2\beta AK^{*\alpha} - \tau_3\beta(1-\gamma)AK^{*\alpha} - \tau_L\,\theta(1-\alpha-\beta)(1-\gamma)AK^{*\alpha} +$$

$$+ 2r\psi\theta\bar{K} + 2r\theta(1-\varepsilon)(1-\psi)\bar{K} +$$

$$+ \theta[(1-\gamma)r_l K^* + \beta\tau_3(1-\gamma)AK^{*\alpha} + \tau_L(1-\alpha-\beta)(1-\gamma)AK^{*\alpha} - 2(1-\psi)(K^*-\varepsilon\bar{K})]$$

when condition (4) is satisfied or

$$W_\theta(\varepsilon)^{NS} =$$

$$[\beta+\theta(1-\alpha-\beta)](2-\gamma)AK^{*\alpha} - \tau_2\beta AK^{*\alpha} - \tau_3\beta(1-\gamma)AK^{*\alpha} - \tau_L\theta(1-\alpha-\beta)(1-\gamma)AK^{*\alpha} +$$

$$+ 2r\psi\theta\bar{K} + \theta(1-\varepsilon)\bar{K}\left[\frac{(1-\gamma)r_l K^* + \beta\tau_3(1-\gamma)AK^{*\alpha} + \tau_L(1-\alpha-\beta)(1-\gamma)AK^{*\alpha}}{K^* - \varepsilon\bar{K}}\right]$$

when it is not.

Simple calculations show that:

$$\frac{\partial W_\theta(\varepsilon)^S}{\partial \tau_2}; \frac{\partial W_\theta(\varepsilon)^{NS}}{\partial \tau_2} \geq 0$$

when $\theta q \geq 1$. This happens because, from the vantage point of an institution aiming at maximising the welfare of elite agents, it is always optimal to impose taxes at time 2, since they burden on labour incomes, while providing resources to increase the share of liquidated deposits. Hence, τ_2 is equal to its maximum value, δ, and ψ=0.5, for any ε.

Notice that some calculations yield:

ndition (4) is fulfilled, any additional resource is used to increase the remuneration of the residual claimants. Hence, a government committed to favour the "business community" is willing to raise these resources and sets τ_3 to δ.

Finally, notice that:

$$Sign\left(\frac{\partial W_\theta(\varepsilon)^{NS}}{\partial \tau_L}\right) = Sign(-K+\bar{K})$$

which is always negative. This simply shows that, when the additional resources are used to repay the depositors, it is never optimal to tax the land incomes: agent θ^* will pay $\tau_L\theta(1-\alpha-\beta)(1-\gamma)AK^{*\alpha}$ while his income increases only in proportion to the ratio between her $(2(1-\psi)(1-\varepsilon)\theta\bar{K})$ and aggregate $(2(1-\psi)(K^*-\varepsilon\bar{K}))$ deposits.

On the contrary, when condition (4) is satisfied,

$$\frac{\partial W_\theta(\varepsilon)^S}{\partial \tau_L} = 0$$

When taxes, at the margin, are used to refund the banks' equity capital, each "agent θ" receives the same amount she pays as land income taxes. Hence, the government is ex-post indifferent between levying and not levying land income taxes. We assume that it will not. This assumption implies that we do not consider credible the announcement of an action that is not going to increase the elite welfare. Moreover, had we considered the presence of some (however small) administrative cost to set up the tax and to gather its proceedings, the introduction of the tax on land income would have reduced the elite agents' welfare. The same would be true if the tax had been assumed to be distortionary. Hence, we set τ_L=0, always.

Since $\partial W_\theta(\varepsilon)^{NS}/\partial\tau_3$ may be negative, we need to take a closer look at the condition allowing for an increase in the average welfare of "θ agents" due to the levy of the labour income tax. We must distinguish three cases.

(i) Condition (4) is satisfied even when $\tau_3=0$. We clearly find ourselves in the most favourable circumstances, since $\partial W_\theta(\varepsilon)^{S}/\partial\tau_3>0$, always. Hence, when $\varepsilon > [1-(1-\gamma)r_l]/q$, the depositors will always be refunded and hence the financial crisis is not self-fulfilling. The tax on labour will be imposed ex-post for distributive reasons, i.e. to increase the yield obtained by the equity holders. Since $\varepsilon \in [0,1]$, the lowest possible value for the ratio between home and foreign capital compatible with this situation is $q=[1-(1-\gamma)r_l]$. This individuates point A, while the inequality above allows us to draw the bold line in Figure 3.

[Figure 3 about here]

(ii) When $q > 1/[\varepsilon+\theta(1-\varepsilon)]$, i.e. when $\partial W_\theta(\varepsilon)^{NS}/\partial\tau_3 > 0$, again, it will always be optimal to raise the labour tax. To have a "banks rescue", ε must be high enough to grant the fulfilment of condition (4) when τ_3 reaches its maximum, otherwise the depositors cannot be remunerated at the world rate. Hence $\varepsilon > \gamma/q$. These two inequalities individuate the portion ECD of the (q, ε) plane in Figure 3. Here, the share of deposits converted into banks' equities is low enough to make credible an ex post tax on labour; at the same time, ε is sufficiently high to grant repayment to depositors. Notice that the lowest possible value for the ratio between home and foreign resources, q, is $[\gamma(\theta-1)+1]/\theta$, a condition that is very likely to be satisfied in practice when θ is "reasonably high".

(iii) Finally, even when $\partial W_\theta(\varepsilon)^{NS}/\partial\tau_3 < 0$, it may still be credible to levy a third period labour tax. This happens when $W_\theta(\varepsilon)^{S}\Big|_{\tau_3=\delta} > W_\theta(\varepsilon)^{NS}\Big|_{\tau_3=0}$. Such condition reduces to:

$$\theta(q-\gamma) - (1-r_l)(1-\gamma) > \theta(1-\varepsilon)q\left[\frac{(1-\gamma)r_l}{1-\varepsilon q}\right] \qquad (7)$$

When ε=1, condition (7) reduces to $q>[(1-r_l)(1-\gamma)+\gamma\theta]/\theta$. This allows us to position point B to the left of point A, since θ>1. Notice that the lowest admissible value for ε is γ/q (condition (4) must be satisfied when $\tau_3=\delta$). When we substitute $\varepsilon=\gamma/q$ into (7), we obtain:

$\theta(q-\gamma) - (1-r_l)(1-\gamma) > \theta(q-\gamma)r_l$

which reduces to $q > [\gamma(\theta-1)+1]/\theta$. Hence, the boldly dotted line passes through point C. Finally, notice that the right hand side of the above inequality is decreasing in ε. This simply means that an increase in the share of deposits converted into equities at the end of period two reduces the welfare of the agents who have not obtained refund. Hence, when inequality (7) is (weakly) satisfied for a value on the boldly dotted line in Figure 3, it will be fulfilled for any higher ε. This completes the characterisation of the area in the (ε,*q*) space compatible with the bank rescue.

In sum, for any given *q*, when ε is chosen in the area BCDE, the ex-post bank rescue is credible ex-ante.

Notice that the fact that welfare is always non-increasing in ε is not relevant. In our model, as confidence is restored via the deposit/equity swap, the loss of output caused by the crisis becomes negligible. Hence, it is in the elite's interest to support the swap.

As before, when *R* is positive the "distributive incentive" to bailout banks exerts its influence; accordingly, the area of ex-post banks rescue in the (ε,*q*) space is larger.

6. "Political uncertainty"

So far, we have examined how a self-fulfilling bank run can be fended off by a "deposit to equity" swap. Now we turn to examine a situation in which the bank run is generated by a shift in expectation regarding the likelihood of a government change.[14] When a relevant shift in the political guidelines of the government in charge is expected, or feared, our commitment device could become inappropriate.

We now assume that the investors attribute an exogenous probability *p* to the event that, at the end of period two, a "populist" party (i.e. a party maximising the

[14] Radelet and Sachs (1998a) and Corsetti, Pesenti and Roubini (1999b) suggest that the crisis countries were characterised by extensive political uncertainty.

welfare of agents without non-labour incomes) takes charge. More specifically, we assume that the roll-over decision is taken at time $t=2^{---}$; that the decision on bank recapitalisation is taken at time $t=2^{--}$, that the government in charge may change at time $t=2^{-}$ and that it may decide upon default at the end of period two. Notice that, from the point of view of the investors this is the worst possible scenario.

In fact, it is immediate to verify that such a government, maximising the welfare of $\theta=0$ agents will opt for default when $\delta \geq \gamma$[15]. If an investor believed that only the populist government would default, she would ask for an interest rate taking account of the political risk, $\tilde{r}$. It is easy to check that even the "pro-business" government would be induced to default by the rise in interest rates. In fact, the government cannot augment labour taxes to offset the required increase in subsidies. A land income tax is never optimally set to a level high enough to guarantee the bailout, as it happened in the situation described in Section 3.

Notice that an external observer ignoring the "change of sentiment" about the political equilibrium, would be tempted to label a default as the effect of the "bad realisation" of a sunspot process within a multiple equilibria framework.

We now briefly assess what happens in our model when the probability of a change in government is taken into account. In particular, some tedious calculations allow to compute the deposit/equity swap as a share of home capital, for a given exogenous probability of government change. The bold curve in Figure 4 is drawn for $p=0.5$ and provides a quantitative assessment of the minimum share of deposit/equity swap necessary to guarantee the ex post bailout. The parameters take our baseline values ($\theta=10$, $\alpha=0.3$, $\beta=0.6$, $\gamma=\delta=0.15$).

[Figure 4 about here]

It is important to remark that the deposit/equity swap may not be in the elite's own interest. In this case, in fact, even when γ is reduced to 0 as confidence is

[15] Since the populist government can bail out banks by means of a "land" income tax levied in period 3, it decides for default when the period 2 fiscal saving for the labour force is not lesser than the future reduction in the wage bill due to the default itself.

restored, the domestic real interest rate must be higher than the world one, due to the political risk. Even if the current government stays in power, it will not be able to raise enough resources to let the banking system pay $\tilde{r}$ to every investor (future labour taxes can not be raised). Hence, the owners of banks, being the residual claimants, will be damaged. Moreover, if the "populist" government takes charge, the banks are not bailed out at the end of the third period and this enlarges the expected losses of the "elite" in case of a forced deposit/equity swap. These cost may be large enough to overtake the gains due to the confidence reestablishment. This explains the boldly dotted line in Figure 4: the deposit/equity swap is in the elite's own interest only if q is larger than the critical value q^* ($\cong 0.71$ in our example).

In sum, it seems that our proposed policy can be of some help also in the "political uncertainty" case. Moreover, bear in mind, that this set-up considers a case "very prone" to financial crises. For example, if we add a period to our model, a recently elected "populist government" might be willing to bail out banks to avoid suffering from the prolongation of the output loss in the final period.

7. Final remarks and open issues

Clearly, our solution hinges on some specific characteristics of the environment we study.

First, it is a market economy. Banks cannot default without being involved in a bankruptcy procedure. Hence, the fact that foreign creditors, after the deposit/equity swap, hold a higher share of "senior" claims can not induce debt repudiation from the banks. Clearly, this is a major difference between our model and the ones dealing with sovereign debt.

Second, the *liason dangereuse* between the government and the business community is exploited. The fact that the government evaluates the losses of its "favourites" more than the tax bill imposed to the average taxpayer, makes a bank rescue credible.[16] In other worlds, we are proposing a way of tying the government's hands, by putting at stake (part of) the wealth of the people that the government is not willing to harm. This is done by the proposed deposit/equity swap.

[16] Notice from equation (6) that, were not $\theta>1$, an ex-post labour tax would never be optimal.

The policy implications of our simple framework are far-reaching, in particular concerning the role of international institutions.

When no equity/deposit swap takes place, the provision of liquidity by an external source (e.g. the IMF) in the face of a financial crisis has very different effects depending on its size. If the bailout is complete, the panic is stemmed, banks do not fail and there is no output loss. When the resources immediately available are not sufficient to allow for a complete repayment of the banks' debt, in our model, the injection of liquidity has no effect. In fact, everybody knows that the government, in period three, will still have no incentive to raise "land" taxes since these will transfer resources from elite agents to an external institution.

Perhaps more surprisingly, we find that an IMF-type intervention may preclude the possibility of a successful deposit/equity swap. This result is obtained assuming that the injection of resources is used to liquidate a higher fraction of banks' liabilities in period two, and that it must be repaid at the world rate r=1 in period three. In this case, our country, in the final period, must repay a higher amount of foreign capital, while the maximum bank capitalisation is lower, since a larger share of home resources has been liquidated at the end of the second period.

Our major point is that, on the basis of a multiple equilibria model, the IMF package, asking for bank recapitalisation and restructuring, did not quite go in the right direction. In fact, under the pressure of the IMF, over fifteen banks were closed in Indonesia, while all the others went through a deep consolidation process. Rather than a true recapitalisation, the banking sector was forced to shrink its credit activity, thus making recession even worse. As argued, for example, by Radelet and Sachs (1998b), there is no clear reason to believe that closing or restructuring banks should restore market confidence once a "wave of panic" has arisen. This interpretation has led a number of authors (e.g. Radelet and Sachs (1998b), Bhattacharya and Miller (1999) and Stiglitz and Miller (1999)) to underscore the benefits of an international payments standstill, possibly coded in a "super" Chapter 11. Our model highlights that, when the pocket of the international institutions is not deep enough to implement a full bail-out (or the involved moral hazard problems are judged a too heavy burden),

an injection of fresh capital *from home agents* is an alternative (possibly complementary) way out of financial panic.

Clearly, our model can be criticised from several point of views.

First, it does not consider liquidity shocks to preferences. However, the fact that some agents need a large fraction of incomes in period two, should not prevent the Government from forcing a deposit/equity swap when the alternative is bank default (and hence a partial reimbursement in period three).

A more worrying feature of our model is that it is unable to explain why the banks capitalisation policy has not been introduced, since it is welfare improving. Here, the hypothesis of a complete re-establishment of confidence plays an important role. In practice, in the face of a confidence crisis some output losses are a likely outcome. These may make the deposit/equity swap not in the interest of the elite. However, the provision of international liquidity conditioned on a bank recapitalisation may reduce its costs by helping to avoid the damages to the productive activities that arise because of the bank liquidity shortages.

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	Flows to Asia/Pacific (USD bln.)			
	1996	**1997**	**1998**	**1999 (*)**
Equity investment, net	62.7	57.8	60.3	72.8
Direct equity, net	45.4	51.9	55.2	54
Portfolio equity, net	17.2	5.9	5.1	18.8
Commercial Banks,net	80.1	-14.5	-59.6	-31.8
Nonbanks, net	33.6	23.5	3.5	-0.8
International Institutions	0.3	24.7	22.7	-3.6
Bilateral Creditors	6.1	17.2	5.7	6.2

Source: Institute of International Finance, Washington D.C
(*) estimate

Table 1

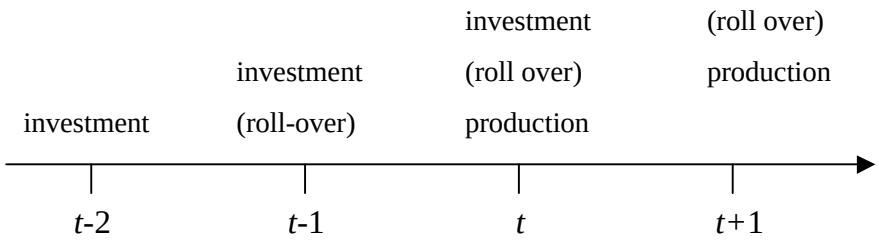

Figure 1: the timing of the model

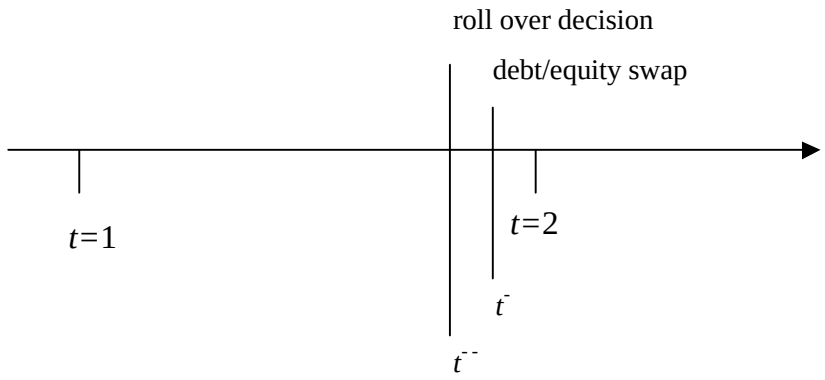

Figure 2: the modified timing of the model

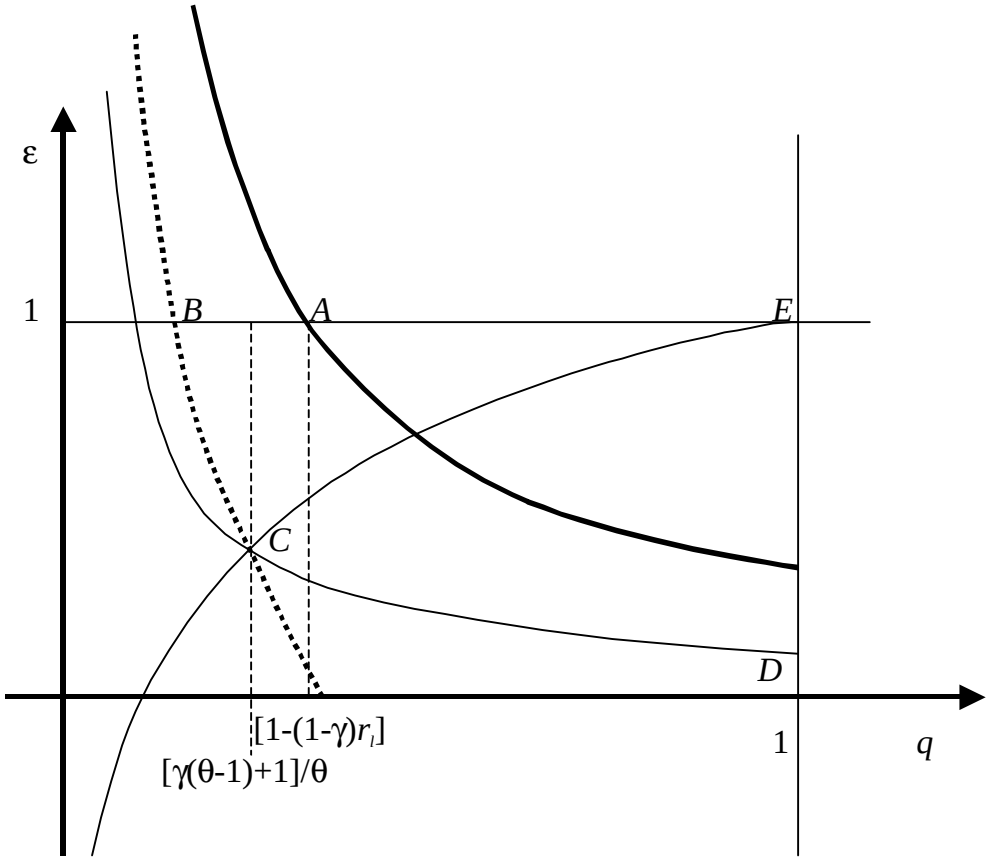

Figure 3: banks are rescued in the region *BCDE*

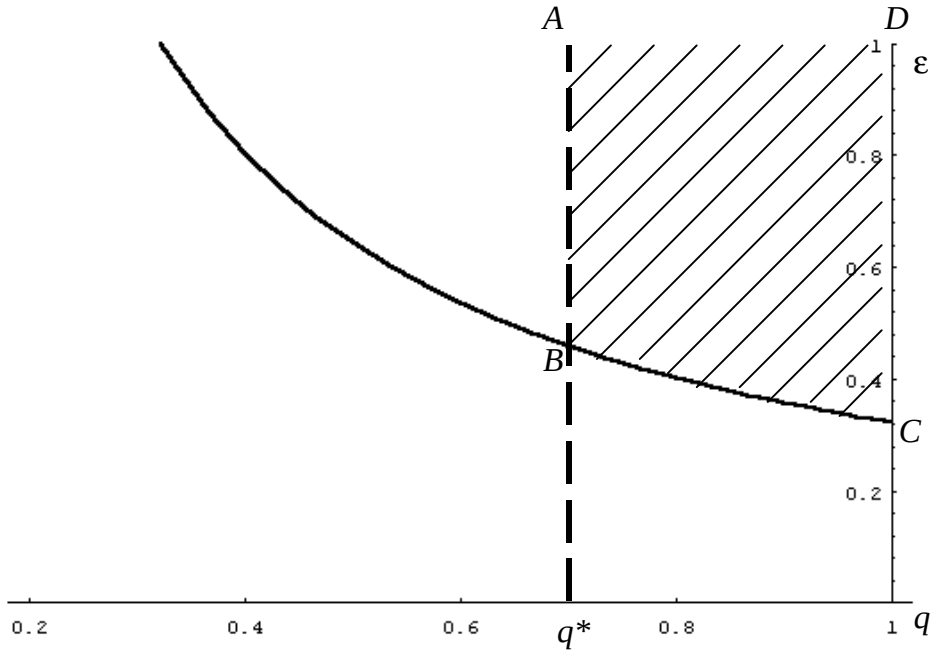

Figure 4: banks are rescued in the region *ABCD*