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Banking and the Political Support for Dollarization

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Abstract

In this paper we study dollarization as a commitment device that the Central Bank could use to avoid getting involved in an undesirable banking-sector bailout. We show how a political process could induce an equilibrium outcome that differs from the one that a benevolent Central Bank would want to implement. Dollarization then could be used to restore the economy to the benevolent outcome. In so doing though, political support for dollarization becomes essential. For our benchmark case, dollarization does not have enough support to be actually implemented. But when we study the interaction among dollarization, the introduction of international banks, and the political process, we find that bank internationalization may help to attain the necessary political support that can make dollarization a viable policy. JEL Classification Numbers: E58, F30, G21

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1 Introduction

Dollarization, or the official adoption by a foreign country of the US dollar as the legal circulating liability, is the ultimate expression of a fixed exchange rate system. Fixed exchange rate regimes have been extensively studied in the literature. Much less effort has been devoted though to the study of the aspects that make dollarization different from less rigid fixed exchange rate regimes (see Berg and Borensztein (2000) for a general discussion). This paper focuses on an important distinction between a dollarized system and a currency board: dollarization can be used as a more credible commitment devise to thwart the use of inflationary tax to finance banking system bailouts.

It is not uncommon to find central banks that provide *de facto* full deposit insurance whenever the banking system experiences generalized financial distress. Gropp and Vesala (2000), for instance, provide suggestive empirical evidence to document this fact. Most of the time those rescues are financed with inflationary tax (see Kaminsky and Reinhart (1999)). In particular, the central bank prints money to reimburse depositors from banks experiencing difficulties. Either for political reasons or issues of economic feasibility, the inflationary tax is a timely available tax and hence becomes the central bank's preferred source of funding in these "emergency" situations. Adopting a system of dollarization allows the central bank to *ex ante* shut down such a source of "easy" funding. One may wonder though why a benevolent central bank would want to reduce the number of available instruments at hand to deal with an eventual aggregate crisis. A possible explanation can be traced to the political dynamics of the problem. Even in the case when a bailout is not the desired policy, the government may not be able to bear the political pressure impinged by interest groups that directly benefit from the bailout. In addition, the fact that the

central bank may give in to political pressures in the event of bank failures distorts the *ex ante* risk-taking behavior of individuals (see Bolton and Rosenthal (1999)). In those situations then it may well be the case that using dollarization as a commitment technology can allow the Central Bank to resist the aforementioned political demands.

But this raises a new question for the central bank, mainly how to respond to collective bank failures when the economy is dollarized. One possibility is to try to avoid financial-banking crisis altogether. For this, international banks may be worth considering. Regional banking crises usually are associated with negative developments in the real sectors of the economy. When the expectations of future prosperity fall, the price of real assets adjusts downward. However, the banking system debt balances are in nominal terms. In general this brings about an abrupt deterioration of the debt-collateral ratios and induces the banking system into a crisis. For an excellent description of one of these episodes see Beers, Sargent and Wallace (1983) (see also Chang and Velasco (1998) and Velasco (1987) for a Latin American perspective). In a way, these kind of financial crises are a matter of portfolio diversification. The shock to the real economy on a specific region induces the whole portfolio of the banks in that region to become insolvent. In the case of international banks, the part of the portfolios that is associated with assets in a particular country or region is in general relatively small. Hence, a regional shock can get pooled into a large set of other shocks and not become a problem for the financial health of the banks (see Calvo (2000), Section VI).[1]

The objective in this paper is to study the relationship between banking sector bailouts, political pressures, and the decision to dollarize the economy. We will also

[1] Calvo (2000) also discuss the recent process of liability dollarization that has been under way in some of the Emerging Market Economies. He provides an insightful review of how this phenomenon can alter some of the dynamics of the financial crises motivating the present paper.

study the economic and political complementarities that bank internationalization and dollarization have in this type of situation.

In the next section, we present a simple stylized economy where banks play a role and countries (regions) suffer sporadic aggregate shocks on the return to investment. In Section 3 we use the model to identify some of the factors that determine when the decision to bailout the banking system is an appropriate response for a benevolent monetary-banking authority. Section 4 shows how the political system may influence those *ex ante* decisions driving to unsatisfactory ex-post outcomes. Also in this section, we introduce our version of *the dollarization policy*. Basically, we argue that in our simple model dollarization can be thought of as equivalent to a policy by which the Central Bank ex-ante shuts down the fiscal (tax) sources of funds that would be used in a bailout of the banking system. In this manner, the monetary-banking authority manages to commit to no future (de-facto) deposit-insurance policies driven by political pressures. Section 5 studies how the economic and political decisions depend on the existence of international financial institutions. We show that even though the dollarization policy may not obtain sufficient support when introduced alone, when combined with a system of international banks it can become politically viable. And we also show that the internationalization of banks would need to be combined with (official) dollarization if investors in the economy are to choose the international banks over the domestic banks. Section 6 presents the conclusions.

2 A Simple Model

The model presented in this section is an adaptation of Ennis (2000), which draws on Holmstrom and Tirole (1997). Consider an economy (a country) populated by overlapping generations of agents. Each agent lives for two periods and consumes the

only good in the economy, the numeraire. They are all risk neutral and discount the future according to the discount factor $\beta \in (0,1)$. There are three groups of agents in each generation: investors, depositors and banks. There is also a monetary-banking authority that we will call the Central Bank (CB).

The size of each group of agents is exogenously given. It is no hard to endogenize the size of the groups but it would only complicate matters without adding to the point that is being made. Let $(1-\alpha)$ be the size of the group of investors, $\alpha - \theta$ the size of the group of depositors, and θ the size of the group of banks. The measure of all agents in a generation is thus equal to one.

Agents are born with type dependent endowments: investors are endowed with an investment project, depositors are endowed with e units of wealth (in terms of the numeraire), and banks are endowed with a monitoring technology and e units of wealth.

Investment projects are indivisible and non-transferable. The owner of the project needs to invest I units of the numeraire to get a return R units (also in terms of the numeraire), with some probability, if the project succeeds (and 0 otherwise). The investor can exert effort to increase the probability of success of the project. If she performs effort the project succeed with probability p_H, assumed greater than the probability p_L obtained when no effort is exerted. However, effort is costly and non-observable by third parties. Let B be the cost, in utility terms, for an investor to perform effort and $\Delta p \equiv p_H - p_L$.

Assumption 1.

A1.a. $p_H R - \frac{1}{\beta} I - B > 0 > p_L R - \frac{1}{\beta} I$

A1.b. $R - \frac{1}{\beta} I < \frac{B}{\Delta p}$.

Assumption A1.a implies that only project undertaken with high effort have pos-

itive net present value when there is perfect information. Assumption A1.b implies that investors are subject to a moral hazard problem. How important these assumptions are will become apparent in the next section.

The returns of the projects within a country have a tight pattern of correlation. At any date t, if we observe that a project undertaken using effort has failed in that period, then we know that all the other projects undertaken with effort also failed (this happens $(1 - p_H)$ of the times). Similarly, projects carried out with no effort fail every time the effort-projects fail, and some other times (so that they fail $(1-p_L) > (1-p_H)$ of the times). In other words, the event of success of any particular project does not constitute an idiosyncratic shock to a particular project, but a shock to the entire country (or region) where the project is located.

The monitoring technology allows its owners to perfectly monitor the effort level of investors undertaking projects. The activity of monitoring is costly and non-observable. Let c denote the per-project cost of monitoring.

The CB can tax the young-generation members of the group of depositors (and only them) in order to finance a bailout of the banking sector.[2] Let τ denote the per-capita tax. However, when the CB raises an amount τ from taxation, only τ/ξ becomes available for the use of the CB. We consider the case of $\xi \geq 1$. This assumption is intended to capture an extra administrative (and possibly the dead-weight loss) cost of taxation. When the CB prints money to finance the banking-system bailout we will interpret τ as the proxy for the inflationary tax. Large values of ξ can be associated to situations where the excess of money creation prompts a currency crash that brings along a disruption in other sectors of the economy.[3]

[2] This is just a normalization. We could allow the government to tax all agents in the economy. What really matters is the net transfer that the agents get from the insurance scheme (the bailout). We choose this simplification because only young depositors get a negative transfer in every possible case (the tax).

[3] Note that there is no money in the economy. For this reason we may say that this paper presents

Assume that depositors as a group, after depositing a total per capita amount $\overline{D}$ in the banks during the first period of their lives, engage in overlapped (non-contingent) transactions and payment commitments among themselves for the amount $\gamma\overline{D}$, where γ is the gross interest rate.[4] Depositors will not be able to fulfill those commitments in the second period of their lives if they receive (in per capita terms) less than $\gamma\overline{D}$ from the banking sector. As a consequence, there is a disruption in economic activities and depositors experience a per capita utility loss ν. This assumption will motivate the existence of central bank bailouts in the model.[5]

Finally note that since risk neutrality implies linear utility functions, the level of deposits will be determined by the demand side of the market for funds. Define $Y \equiv \beta p_L \frac{c}{\Delta p}$ and $X \equiv \frac{\beta^2 \nu}{\xi - \beta}$.

Assumption 2.

A2.a. $I < \frac{\alpha-\theta}{1-\alpha}\left[e - \frac{\xi}{\beta}X\right]$.

A2.b. $e > \frac{(1-\alpha)}{\theta}Y$.

A2.c. $Y < I < Y + \frac{\alpha-\theta}{1-\alpha}X$.

Assumption A2.a implies that there are enough deposits in the economy to finance all projects. Assumption A2.b implies that bank-monitors have enough own funds to deal with their moral hazard problem. Finally, assumption A2.c limits the relative size of total deposits in the system. We will discuss the consequences of abandoning this last assumption at the end of next section.

The agents endowed with the monitoring technology will play the role of banks in

a *fiscal theory of dollarization*.

[4] Throughout the paper we adopt the following notation: for any variable x, we denote by $\overline{x}$ its aggregate per capita value.

[5] See Peck and Shell (1999) for a discussion on another way to model the payment services provided by demand deposits (theirs is an environment with indivisibilities in payments). It is important to notice though that in the set-up of the present paper the depositors' utility cost is directly associated to an *aggregate* failure of the financial sector. It is not a cost that could be individually avoided.

the model. Banks get paid an amount ϕ for the service of monitoring. Additionally the CB imposes a capital requirement on banks I_m. Entrepreneurs borrow I units of funds from the banks and pay back $\gamma I + \phi$ if the project succeeds (and zero otherwise). The bank in turn pays $\gamma(I - I_m)$ (per project) to depositors. It will be convenient to express $S \equiv \gamma I_m + \phi$ where γ is the equilibrium gross interest rate paid on entrepreneurs' borrowed funds and ϕ is the banks net fee from monitoring.

3 Benevolent Equilibrium

First we consider the case where the government-central bank is benevolent and cares equally about depositors and project owners (young and old). Bank-monitors always obtain zero net surplus in equilibrium so we can abstract from them in the welfare considerations.

Definition 1 *We say that the economy is in a crisis when the investment projects done exerting effort fail. Let $s \in \{0, 1\}$ be an indicator of the state of the economy: $s = 1$ when economy is in a crisis, and $s = 0$ when it is not.*[6]

Let $T(D, \overline{D}, s) \geq 0$ be the CB policy of payment to depositors in their second period of life (contingent on the amount of the agent's deposits D and the aggregate per capita level of deposits $\overline{D}$). Since we only consider steady states we drop the time index to simplify notation. Depositors solve the following problem

$$\text{maximize } E[c_1 + \beta \overset{3}{} c_2 - \nu \mathbf{1}_{\overline{c}_2 < \gamma \overline{D}} \overset{\prime}{}]$$

[6] The definition of a crisis is specific to our environment. It is not of the "self-fulfilling" type. It is in fact closely associated to the performance of the *real sector* of the economy. For an excellent discussion on more general definitions of "crises" see Kaminsky and Reinhart (1999). Kaminsky and Reinhart also provide compelling evidence on the strong links between financial crises and the evolution of the real sector (they find that weak output indicators signal the advent of 89 percent of the banking crises they study).

subject to

$$c_1 = e - D - \tau(s),$$

$$c_2 = \begin{cases} \gamma D + T(D, \overline{D}, 0) & \text{if no crises,} \\ T(D, \overline{D}, 1) & \text{if crises,} \end{cases}$$

where $\mathbf{1}_{\overline{c}_2 < \gamma \overline{D}}$ is an indicator function that takes the value 1 when $\overline{c}_2 \leq \gamma \overline{D}$ and zero otherwise. Note that depositors have to choose how much to save before knowing the current realization of τ and that their utility cost ν is associated with an aggregate outcome that can not be avoided by changing the individual's decision.

The benevolent CB maximizes the following welfare function:

$$W(T(\mathbf{D})) = (\alpha - \theta)[e - D - p_H \tau(0) - (1 - p_H)\tau(1) +$$

$$\beta \left[p_H(\gamma D + T(D, \overline{D}, 0)) + (1 - p_H) T(D, \overline{D}, 1) - \nu \mathbf{1}_{\overline{c}_2 < \gamma \overline{D}} \right] +$$

$$(1 - \alpha)\beta \left(p_H(R - \gamma I - \phi) - B \right)$$

subject to

$$T(D, \overline{D}, s) = \tau(s)/\xi. \tag{1}$$

We will call a *Benevolent Equilibrium* an equilibrium where depositors, entrepreneurs and monitors maximize there life-time utility subject to their budget constraints, $\overline{D} = D$, the market for funds clears, and the government-CB chooses banking regulation policies and transfers to maximize the proposed welfare function $W(\bullet)$ subject to the balance-budget restriction (1).

Proposition 1 *Let* A1 *and* A2 *hold. Then there exists a Benevolent Equilibrium where (i) the interest rate is $\gamma^* = 1/\beta$, (ii) all project–owners get monitored by banks that get paid a fee $\phi^* = c/\Delta p - Y/\beta$ and, (iii) the CB imposes a capital requirement on banks $I_m^* = Y$ and a transfers schedule*

$$T^*(D, \overline{D}, s) = \begin{cases} \gamma D & \textit{if } s = 1 \textit{ and } \overline{D} \leq D_{MAX} \\ 0 & \textit{otherwise} \end{cases}$$

where $D_{MAX} = X$.

Proof. The proof follows 5 steps.

Step 1: *All project-owners getting the necessary credit to undertake the project should be monitored.*

First note that if the CB provides deposit insurance then it is in its best interest to have all projects being made with effort. To see this, suppose projects are carried out with no effort. Since depositors have deposit insurance we still have that $\gamma^* = 1/\beta$. Entrepreneurs obtain $p_L(R - \gamma^* I)$ from their projects. Also, by A1.a we have that

$$0 < p_H R - \frac{1}{\beta} I - B < R - \frac{1}{\beta} I,$$

which tells us that the entrepreneurs get a positive payoff from their projects. Furthermore, it follows from A1.b that this payoff is greater than the one obtained when exerting effort. However, the situation for the CB is different. The CB internalizes the fact that extra taxes are needed to finance the deposit insurance if the projects are carried out with no effort. The net payoff for the CB can be reduced to the following expression

$$(1 - \alpha)\beta[p_L(R - \gamma I)] - (\alpha - \theta)(1 - p_L)\tau,$$

where from (1) we have that $\tau = \xi\gamma\overline{D} = \xi\gamma(1 - \alpha)I/(\alpha - \theta)$.[7] It is not hard to show (after some algebra) that this expression is negative when $\gamma = 1/\beta$. Hence, the CB will want to implement a banking policy that induces agents to undertake their project with effort.

Now, recall that since the project owners have no wealth, they need a credit of I units to be able to carry out the project. By A1.b we have that

$$R - \gamma I - \phi \leq R - \gamma I < \frac{B}{\Delta p},$$

[7] Since the number of young depositors being taxed is the same as the number of old depositors benefiting from CB insurance, the balanced budget restriction reduces to the expression in the text.

and hence

$$p_L(R - \gamma I - \phi) > p_H(R - \gamma I - \phi) - B,$$

which means that the incentive compatibility constraint that would induce entrepreneurs to exert effort is not satisfied and that the only way to induce effort is through bank monitoring.

Step 2: *The CB imposes a capital requirement I_m^* on banks and banks get payed a fee ϕ^*.*

Assume that banks do not get deposit insurance on their deposit.[8] Two incentive conditions on the behavior of banks need to be considered. On one hand, the participation constraint is given by

$$\beta\left(p_H S - c\right) \geq I_m, \tag{2}$$

which says that (potential) monitors can choose between becoming a bank (in which case, they commit I_m units of funds per project monitored and get paid S with some probability in the future), or simply consuming their endowment during their first period of life. Note that since banks do not get deposit insurance and $\beta p_H \gamma I_m \leq I_m$ we can conclude that they will not make direct deposits in the system at the equilibrium interest rate γ. On the other hand, incentive compatibility requires that the following condition holds

$$p_H S - c \geq p_L S. \tag{3}$$

The CB sets a reserve requirement I_m that minimize the equilibrium bank fee ϕ^*. In fact, using constraints (2) and (3) we can see that if the CB sets $I_m = Y$, competition among banks will drive ϕ^* to its minimum feasible value (see Figure 1).

Step 3: *If $T^*(D, \overline{D}, s) < \gamma \overline{D}$ then $T^*(D, \overline{D}, s) = 0$. And $T^*(D, \overline{D}, 0) = 0$.*

[8] This is mainly for convenience. The analysis can be carried out with deposit insurance over bank-deposits with only minor changes.

Recall that in equilibrium $\overline{D} = D$. Using the results from Step 2, we can rewrite $W(T(\mathsf{D}))$ as

$$\begin{aligned} W = (\alpha-\theta)[e-\overline{D}-p_H\tau(0)-(1-p_H)\tau(1)]+ \\ +\beta p_H\gamma(\alpha-\theta)\overline{D}+(\alpha-\theta)\beta\left[p_H\frac{\tau(0)}{\xi}+(1-p_H)\left[\frac{\tau(1)}{\xi}-\nu\mathbf{1}_{\overline{c}_2<\gamma\overline{D}}\right]\right]+ \\ +(1-\alpha)\beta\left[p_H(R-\frac{c}{\Delta p})-B\right]-\beta p_H\gamma(1-\alpha)(I-I_m). \end{aligned} \tag{4}$$

By A2.a the market clearing condition for funds is given by

$$(1-\alpha)(I-I_m) = (\alpha-\theta)\overline{D}.$$

By substituting this condition in W it is easy to see that the second and last term on the right hand side of equation (4) cancel out. Then, we obtain

$$\begin{aligned} W = (\alpha-\theta)\left[e-\overline{D}-\left[1-\frac{\beta}{\xi}\right][p_H\tau(0)+(1-p_H)\tau(1)]\right]- \\ -(\alpha-\theta)\beta(1-p_H)\nu\mathbf{1}_{\overline{c}_2<\gamma\overline{D}}+(1-\alpha)\beta\left[p_H(R-\frac{c}{\Delta p})-B\right]. \end{aligned}$$

Since β/ξ is less than one, it becomes apparent from this expression that the CB should set $\tau(0) = 0$ and $\tau(1) = 0$ whenever $\tau(1)$ is not sufficient to fully insure total deposits $\overline{D}$ plus interest payments. Hence, the claim in Step 3 follows.

Step 4: *The equilibrium interest rate under policy $T^*(D, \overline{D}, s)$ is $\gamma^* = 1/\beta$.*

By A2.c we have that $\overline{D} < D_{MAX}$. Entrepreneurs need funds. Hence $\overline{D}$ has to be positive in equilibrium. From the depositors' problem, this implies that $\gamma^* \geq 1/\beta$. By assumption A2.a we get that $\gamma^* \leq 1/\beta$ or otherwise there would be an excess supply of deposited funds.

Step 5: *The CB sets transfers to $T^*(D, \overline{D}, s)$.*

By Step 3 we only need to compare the value of W when the CB sets $\tau(1)$ equal to zero with the case when $\tau(1) = \xi\gamma\overline{D}$. Hence, the CB should set $\tau(1) = \xi\gamma\overline{D}$ only

when the following inequality holds

$$(\alpha-\theta)\left(e-\overline{D}-\left(1-\frac{\beta}{\xi}\right)(1-p_H)\xi\gamma\overline{D}\right)+(1-\alpha)\beta\left(p_H(R-\frac{c}{\Delta p})-B\right)>$$
$$(\alpha-\theta)[e-\overline{D}-\beta(1-p_H)\nu]+(1-\alpha)\beta\left(p_H(R-\frac{c}{\Delta p})-B\right),$$

which in turn reduces to the simpler expression

$$(\xi-\beta)\gamma\overline{D}<\beta\nu. \tag{5}$$

Hence, when the equilibrium interest rate $\gamma^*=1/\beta$ (as shown in Step 4), we have that the CB will implement full deposit insurance whenever $\overline{D}<D_{MAX}\equiv\beta^2\nu/(\xi-\beta)$. Finally, suppose that

$$(\xi-\beta)\gamma\overline{D}>\beta\nu,$$

when $\gamma=1/\beta$. If the CB sets $T(\overline{D})=0$ the equilibrium interest rate will be $\gamma'=1/p_H\beta$. From expressions (2) and (3) we know that I_m is independent of γ (and so is $\overline{D}$, see Figure 1). Therefore, the following inequality holds

$$(\xi-\beta)\frac{1}{p_H\beta}\overline{D}>(\xi-\beta)\frac{1}{\beta}\overline{D}>\beta\nu,$$

which verifies that $T(\overline{D})=0$ is in fact the policy that a benevolent CB would like to pursue. This, together with Step 3, proves the claim in Step 5. ■

Whether the CB wishes to implement a system of deposit insurance depends on several factors in the model (see expression (5)). It is useful to make a special mention to three of them here as they are always of major importance for the discussion of the general problem. First note that the higher the cost ν to depositors associated with the economic turmoil caused by the crisis, the more likely will be that the CB chooses to have a deposit insurance system. Second, the higher the administrative and distortionary costs of taxation (higher ξ), the less attractive will be the implementation

of a generalized deposit insurance. Finally, the size of the financial system (measure here by the size of $\overline{D}$) is important for the evaluation of the costs of implementing a deposit insurance system. This last fact appears in the model as a consequence of the pure transfer of resources among depositors (from young to old) that is involved in the financing of the deposit insurance scheme. More generally, the model suggests that it is important to determine the size of the reallocation of funds induced by the deposit insurance system when deciding about its implementation.

Consider the following alternative assumption to A2.c:

$$(\text{A2.c})'.\ \ I > Y + \tfrac{\alpha-\theta}{1-\alpha}X$$

This is just saying that the equilibrium size of the banking system measured by total deposits is relatively large. We will call Assumption A2′ to the same set of inequalities as in assumption A2 but with inequality (A2.c)′ replacing inequality A2.c. Under this new assumption (i.e., when A2.c does not hold) the benevolent equilibrium has $\gamma^* = 1/p_H\beta$, $\tau(s) = 0$ for all s and no deposit insurance. It is not hard to show that even when the CB does not set a mandatory capital requirement, competition among banks and the necessity of entrepreneurs to attract external funding will drive the monitoring fee to its minimum level $\phi^* = c/p_H$. This system resembles a certification market for projects where the function of bank-monitors is only to certify that the investors are effectively exerting the required level of effort (see Holmstrom and Tirole (1997) for details).

4 Political Equilibrium

Instead of letting the benevolent central bank decide whether to run an (implicit) deposit insurance policy, we now consider a scenario in which this decision is the

outcome of a political process.[9] Assume that only depositors and entrepreneurs vote and that they vote according to their respective payoffs obtained under the different systems (bank-monitors are indifferent between systems as competition always drives their payoff down to the participation constraint). In other words, each agent decides her vote with the belief that she will be decisive. Agents that are indifferent between systems do not vote.[10] The timing of events is as follows: at the beginning of each period, agents vote for a system. Then, the system with more than 50% of the votes gets implemented and agents make the rest of their economic decisions. Finally uncertainty about the return of the projects in the region gets realized and agents obtain their period-payoffs. The choice of the timing is important here. We could alternatively have assumed that each period voting takes place after the uncertainty is resolved. One could argue that this addresses more directly the ex-ante/ex-post choice-of-policy conflict (time inconsistency) faced by voters. However, in our current simplified set up this alternative timing of events renders the voting decisions devoid of any interesting content. Moreover, we may say that such a timing is not necessarily the best way to represent real-world situations where the deepness of the crisis and the time when the bailouts are decided is not so clear-cut.

After the political process takes place, if a deposit insurance scheme is implemented we assume that the CB follows the optimal transfers and capital-requirement policies described in the previous section (see the proof of Proposition 1).[11] Essentially the voter needs to choose between being in an equilibrium with an optimal

[9] Political institutions are taken as given in this paper. Bolton and Rosenthal (1999) study an economy where the political arrangements that determine an ex-post bailout policy can be interpreted as arising endogenously to remedy contractual incompleteness. However, their setup is substantially different from ours in that they consider ex-post heterogeneous investors and voting decisions that take place after "types" get privately revealed.

[10] For an excellent discussion of politico-economic equilibrium see Krusell, Quadrini and Rios-Rull (1997).

[11] This rules out cases where the (implicit) bailout induces excessive risk-taking behavior by borrowers.

deposit insurance like the one in Proposition 1 or with no deposit insurance at all.

Let $h \in \{h_1, h_2\}$ be a state variable that indicates the result of the ballot. If the deposit insurance proposal gets the majority of the votes h takes the value h_1, otherwise $h = h_2$. Given the timing of events, it seems natural to consider that the interest rate γ for the current period will be contingent on the value of h in the following period. Finally, we will call $T^h(D, \overline{D})$ the transfers function under system h, i.e., $T^{h_1}(D, \overline{D}) = \gamma(h)D$ and $T^{h_2}(D, \overline{D}) = 0$. With the elements just described, we can define a *Political Equilibrium* in the obvious way. The following proposition shows that even when a *benevolent* central bank chooses not to set up a deposit insurance system, the political process may approve one.

Proposition 2 *Let* A1 *and* A2′ *hold. Then there exist a Political Equilibrium where (i) the interest rate is* $\gamma^* = 1/\beta$*, and (ii) the deposit insurance system is implemented.*

Proof. First note that $\gamma(h_1) = 1/\beta$ and $\gamma(h_2) = 1/p_H\beta$ as agents in the model have perfect foresight about the political outcomes. We have assumed that agents believe they are decisive when they decide their votes. If a depositor believes that the deposit-insurance proposal will not be accepted next period, then she will only agree to deposit her funds at an interest rate of at least $1/p_H\beta$. Also, by assumption A2.a the market clearing interest rate can not be greater than $1/p_H\beta$. It follows then that $\gamma(h_2) = 1/p_H\beta$. Similarly, conditional on h_1 the market clearing interest rate will be given by $1/\beta$, i. e., $\gamma(h_1) = 1/\beta$.

Consider now the voting decisions of the relevant agents:

(i) old depositors' expected payoff at the voting time is given by

$$p_H\gamma(h)D + (1 - p_H)[T^h(D, \overline{D}) - \nu \mathbf{1}_{T^h(\overline{D},\overline{D}) < \gamma\overline{D}}].$$

Now, if $h = h_1$ then their payoff is $\gamma(h_1)D$ and if $h = h_2$ then their payoff is

$p_H\gamma(h_2)D - (1-p_H)\nu$. Since

$$\gamma(h_1)D = \frac{1}{\beta}D > \frac{1}{\beta}D - (1-p_H)\nu = p_H\gamma(h_2)D - (1-p_H)\nu$$

we have that old depositors will vote in favor of the deposit insurance system;

(ii) young depositors' expected payoff is

$$p_H(e-D) + (1-p_H)[e-D-\tau(h)] + \beta[p_H\gamma' D + (1-p_H)\, T'(D,\overline{D}) - \nu \mathbf{1}_{T'(\overline{D},\overline{D})<\gamma'\overline{D}}]$$

where T' is taken as given by these agents (it will be decided next period) but equilibrium consistency requires that T' be the "winning" policy in *next period* ballot. Obviously without a deposit insurance system in place young depositors avoid taxation during the crisis and obtain higher expected payoffs. Hence young depositors will vote against deposit insurance;

(iii) young entrepreneurs' payoff does not depend on the voting decisions of the current period. As a result, they do not vote;

(iv) old entrepreneurs have an expected payoff given by

$$\beta\left[p_H\left[R - \gamma(h)(I-I_m) - \frac{c}{\Delta p}\right] - B\right].$$

Since $\gamma(h_1) < \gamma(h_2)$ and $I - I_m > 0$ we have that old entrepreneurs will vote for the deposit insurance.

In summary, the old generation votes for the deposit insurance system but only the depositors of the young generation vote against. Hence the deposit insurance proposal will win in a political contest that repeats itself every period. The interest rate in the political equilibrium is then $\gamma^* = \gamma(h_1) = 1/\beta$. ■

At the end of the previous section we showed that when Assumptions A1 and A2′ hold the Benevolent Equilibrium will have no deposit insurance in place. However, Proposition 2 shows that if the government is subject to political pressure and its

decisions are determined primarily by this pressure, then it may be that in equilibrium (Political Equilibrium) the deposit insurance system actually makes its way into the monetary-banking arrangements of the economy. In this case, the government may benefit from a policy that shuts down ex-ante the sources of funds that are used to finance the insurance system. This brings us to our formal definition of *dollarization* in this environment.

Definition 2 *A Period-t^d* Dollarization *is the CB policy that sets $\tau(s,h,t) \equiv 0$ for all $t \geq t^d$.*

This is why we call our study a *fiscal theory of dollarization*.[12] There is no money in our model. As we argue in the introduction, the inflationary tax is generally use in bailouts of the banking sector. It plays the role of an "emergency" tax. Dollarization is then a way to block this source of funds. We consider that our specification captures well this essential feature of the problem. Note that the previous definition describes dollarization as an irreversible policy. Schmitt-Grohé and Uribe (2000) cast some doubts on the appropriateness of this strict definition. They provide examples of regional economies that have been able to (re-) introduce a local currency into the system during periods of financial distress. Velde and Veracierto (2000) also discuss this point and they provide some specific arrangements that a government could use in order to adopt a credibly irreversible dollarization policy.

Let us call *Benevolent Outcome* the outcome of a Benevolent Equilibrium as describe in Proposition 1. Then the following proposition directly follows.

Proposition 3 *Let* A1 *and* A2 *′ hold. The CB can implement the Benevolent Outcome by establishing a Dollarization at the beginning of time, i.e., with $t^d = 1$.*

[12] For a similar perspective on the fiscal disciplining role of dollarization see Burnside, Eichenbaum and Rebelo (2000).

We can then say that in this environment the dollarization policy allows the CB to commit to a policy of no de-facto deposit insurance. In a sense, by adopting dollarization the government-CB is able to resists the political pressures to bailout the banking system undergoing a period of crisis. However, this solution leaves us with the next natural question: how does the government-CB finds political support for the dollarization? The next proposition shows that dollarization will not find the support of a majority of voters at any given period t.

Proposition 4 *Let* A1 *and* A2 $'$ *hold. Then, a Period-t Dollarization is not a Political Equilibrium of the economy for any* $t \geq 1$.

Proof. The proof follows the same logic as that of Proposition 2. Nevertheless, the voting decisions are now changed due to the *permanent* nature (irreversibility) of dollarization. Let us use the variable $d \in \{d_1, d_2\}$ to indicate whether the system is dollarized (d_1) or not dollarized (d_2). From Proposition 2 we know that

$$\gamma^*(d_2) = \gamma(h_1, d_2) = \frac{1}{\beta},$$

and that $T^*(D, \overline{D}; d_2) = T^h(D, \overline{D})$. It is also straightforward to see that

$$\gamma^*(d_1) = \gamma(h, d_1) = \frac{1}{p_H \beta}.$$

Consider now the voting decisions for the different agents in the economy:

(i) old depositors' payoff is given by

$$p_H \gamma^*(d) D + (1 - p_H) \left[T^*(D, \overline{D}; d) - \nu \mathbf{1}_{T^*(\overline{D}, \overline{D}; d) < \gamma \overline{D}} \right].$$

If $d = d_1$ then their payoff is given by $(1/\beta)D - (1 - p_H)\nu$, and if $d = d_2$ it is given by $(1/\beta)D$. Hence, old depositors vote against the dollarization proposal.

(ii) young depositors' payoff is given by

$$e - D - (1 - p_H)\tau^* + \beta \left[p_H \gamma^*(d) D + (1 - p_H)(T^*(D, \overline{D}; d) - \nu \mathbf{1}_{T^*(\overline{D}, \overline{D}; d) < \gamma \overline{D}}) \right],$$

where $\tau^* = \xi T^*(D, \overline{D}; d)$. Note that when voting on dollarization the young agents may actually be able to influence their old-age payoff. This is not true with the voting of deposit insurance every period as in Proposition 2. Now, if $d = d_1$ their payoff is $e - D + \beta[(1/\beta)D - (1 - p_H)\nu]$ and if $d = d_2$ their payoff is $e - D - (1 - p_H)(\xi/\beta)D + \beta(1/\beta)D$. Hence, young depositors will vote in favor of dollarization whenever the following inequality holds

$$\beta\nu < \frac{\xi}{\beta}D. \tag{6}$$

But by Assumption (A2.c)$'$ we know that $D = \overline{D} > D^{MAX}$ in equilibrium which implies that inequality (6) always holds. That is, young depositors will favor dollarization in equilibrium;

(iii) Both young and old entrepreneurs can now decide by voting (or at least they believe so) which interest rate on loans they wish to face. Since $\gamma^*(d_1) > \gamma^*(d_2)$, they vote against dollarization.[13]

As a result, the dollarization proposal does not get sufficient support and it is not a Political Equilibrium of the model. ■

One may think that Proposition 4 is an artificial consequence of the generational structure of our model. However, an interesting general insight comes out from this specific result. The proposition suggests that even when dollarization is considered the "best" policy for society overall, the CB may have to wait for an appropriate time to launch the proposal. When political considerations become important, it seems essential for the success of the dollarization plan to find a time-period in which there is a relatively small group of depositors getting positive net transfers from a

[13] Entrepreneurs payoff is still given by

$$\beta \left[p_H \left[R - \gamma(d)(I - I_m) - \frac{c}{\Delta p} \right] - B \right],$$

and I_m is independent of d (see Figure 1).

contingent bailout of the banking sector (old depositors in the model are the net-transfers recipients).

5 The Banking System

As we saw in the previous section, dollarization may be a useful policy for the CB to be able to commit itself and not get involved in banking-sector bailouts that are detrimental for society overall. However, we also showed that in these situations it is sometimes difficult to obtain the political support necessary to implement the dollarization policy. But even if the CB can gain the voters advocacy for the proposal, another important open question still arise: what should the CB do when a crisis come? One possibility could be to try to avoid these banking crises altogether (even at the cost of mayor economic restructuring). For this, international banks ought to be seriously considered (see Calvo (2000)).

Suppose that the domestic economy considered in the previous two sections is in fact part of a large group of independent economies (countries) that form the world. Also assume that the event of project-success in each of the different countries is uncorrelated. Hence, an international bank could fully diversify its portfolio of projects and always get a proportion p_H of success per period (see Ennis, 2000). In that case, the agency problem at the monitor's level disappears and no capital requirements are necessary for international banks. Assume however that there exists an extra operational cost of having a fully diversified widespread institution. Let that cost be proportional to the size of the bank and denote by δ the per-depositor cost. For most of the results in the section we will set $\delta = 0$.

Let us call P^i the amount paid to the international bank by a successful en-

trepreneur with a credit of I units. It is not hard to see that

$$P^i = \frac{\gamma}{p_H} I + \phi^i.$$

Note that the interest rate over the loan is higher than the interest rate over deposits. This spread is due to the fact that this system removes the subsidy over loans implicit in the deposit insurance scheme.

Since anyone owning a monitoring technology can set up an international bank, the following zero-profit condition will hold in equilibrium,

$$p_H P^i = \gamma I + c + \delta,$$

This implies that international banks charge a fee ϕ^i given by

$$\phi^i = \frac{c + \delta}{p_H}.$$

Let P^* be the amount paid to banks by entrepreneurs with a loan of I units under the de-facto deposit-insurance system. From the previous section we have that

$$P^* = \gamma^* I + \phi^*,$$

where $\gamma^* = 1/\beta$ and $\phi^* = (1 - p_L)c/\Delta p$. When $\delta = 0$ we have that $\phi^* > \phi^i$. However it may still well be that $P^i > P^*$ since the interest rate on loans is higher under the international-banks system. This is important because when $P^i > P^*$ the international banks will not be used by the entrepreneurs of an economy with (implicit) deposit insurance. We can now compare the value of the benevolent-CB objective function under the alternative systems: the deposit insurance system ($W(\gamma\overline{D})$) and, the international-banks system (W^i). Simple algebra give us the following expression,

$$W(\gamma\overline{D}) - W^i = (1 - \alpha)\beta p_H (P^i - P^*) - (\alpha - \theta)(1 - p_H)\tau(1),$$

which clearly shows that even when international banks are not used in equilibrium (i.e., $P^i > P^*$) it could be the case that it would be best for the economy overall to have them functioning (i.e. $W(\gamma\overline{D}) - W < 0$).

So far we have considered the de-facto deposit-insurance system to be the default system. This makes sense since we have proved in the previous sections that it is the system that the Political Equilibrium will select. But for reasons that will become clear below, it is also interesting to consider the effects of international banking under a dollarization policy. As before, let us call P^d the sum that entrepreneurs with I units of credit pay to banks. From the previous section we know that

$$P^d = \gamma^d I + \phi^d = \frac{1}{p_H \beta} I + \frac{c}{p_H},$$

where we have defined $\gamma^d \equiv \gamma^*(d_1)$ to simply the notation of Section 4. Note that $P^d = P^i$. Hence, entrepreneurs will be indifferent between taking a credit from a local bank or an international bank. However, since local banks fail with probability $(1-p_H)$ and depositors suffer a loss ν when this happens, in equilibrium international banks will capture deposits and they can prevail over local banks.[14] This result is important. Consider the situation where the CB prefers the international-banks system over the deposit-insurance system, that is when $W(\gamma\overline{D}) < W^i$. If the CB can implement a dollarization - plus - international-banks system then it will be able to obtain the desire W^i.

In summary, we have seen that when a (perhaps implicit) deposit insurance is into place, international banks will not be used even when they are beneficial for the society as a whole. However, when the economy is dollarized, international banks will

[14]There is a coordination issue here that we chose to put aside. When all but one depositor do business with local banks, the one individual remaining will be indifferent between depositing in the international banks or in the domestic banks. This is because either way, under the crisis situation, she will experience the utility cost ν due to transactions-payments disruption. Note that we are assuming here that all depositors choose the international bank even in this situation.

be extensively used in equilibrium. *Dollarization and international banking are in a sense good complements.*

An important question still remains: would the international banking plus dollarization policy obtain sufficient political support to be implementable? The following proposition suggest a possible answer.

Proposition 5 *Let* A1 *and* A2 $'$ *hold. If* $2(1-\alpha) < (\alpha - \theta)$ *then the dollarization - plus - international-banks policy constitutes a Political Equilibrium.*

Proof. When voting, agents will compare their payoff in the (implicit) deposit insurance system with their payoff in a dollarization - plus - international-banks system. This is because the political equilibrium without dollarization have a deposit insurance policy as the outcome. Consider first the voting decision of depositors. Old depositors get $(1/\beta)D$ in either system and hence they do not vote. Young depositors get

$$e - D - (1 - p_H)\tau + \beta\gamma^* D^*$$

in the deposit-insurance system and $e - D - \beta\gamma^i D^i$ in the dollarization - plus - international-banks system. Since $\gamma^i = \gamma^* = 1/\beta$ young depositors will vote in favor of dollarization. Finally, the payoff for both young and old entrepreneurs is given by

$$\beta\left[p_H(R-P) - B\right].$$

Two possible cases need to be consider here. First, when $P^i < P^*$ it is clear that entrepreneurs will vote for dollarization. Then, dollarization wins the ballot by unanimity. Second, when $P^i > P^*$ entrepreneurs vote for the status quo, that is, the implicit deposit-insurance system. However, since $2(1-\alpha) < (\alpha - \theta)$ holds, dollarization still dominates the votes and hence it will get implemented. ■

Note that once international banks are introduced, whether the economy is dollarized or not does not influence the equilibrium outcome. However, dollarization is important to ensure that investors and depositors operate with the international banks in equilibrium. In the dollarized economy the domestic banking system provides no deposit insurance and hence international banks can prevail.

The assumption that $2(1-\alpha) < (\alpha - \theta)$ is a statement about the relative size-distribution of net debtors and creditors in the voting population. It says that the number of net creditors per generation is at least twice the number of net debtors. We are inclined to believe that this is a realistic assumption, but our analysis can certainly be done without such a restriction. Dollarization - plus - international-banks will not always be a political equilibrium in that case though.

6 Conclusions

There is at least two possible ways to think about the role of dollarization during a financial crisis. On the one hand, one could think that dollarization tends to reduce the chances of an expectations-driven currency collapse (see Velde and Veracierto (2000) and Burnside, Eichenbaum and Rebelo, 2000). On the other hand, it could be that dollarization is a suitable mechanism to avoid the amplification of a domestic banking crisis into a more general overall country default. The views expressed in the present paper are closer in spirit to this second line of interpretation (see Chang and Velasco (1998) and Kaminsky and Reinhart (1999) for a detailed discussion on the nature of financial crises under this view).

Our set-up is highly stylized. We do not intend to be descriptive in any way. Instead, the objective of the paper is to illustrate the interaction between the relative performance of the banking sector and those government policies oriented to cope

with its sporadic major breakdowns. We stress the role that the political process may play in the determination of specific policies, and in particular in the decision of whether or not to dollarize the economy. We show that it may be optimal for society as a whole to adopt a dollarization system to hinder the political pressures that favor a banking sector bailout during a crisis. But, we also show that when introduced alone dollarization faces substantial political opposition, reducing its chances of actual implementation. The reasons for this result are somewhat distinct. Our model presents a partial theory of dollarization that stresses its role as a "crisis policy". We view dollarization as an instrument that the Central Bank can use to *commit* not to get involved in pernicious transfer schemes during periods of financial distress. There is no annual seignorage loss associated with dollarization in our model (see Berg and Borensztein (2000) and also Cooley and Quadrini (1999) and Schmitt-Grohé and Uribe (2000) for some quantitative assessments of the possible losses associated with dollarization). However, under a non-dollarized system there is always a latent mass-transfer of resources via bailouts ready to be triggered by the surge of major banking-sector turmoil. When the transfer goes from a small group (less politically powerful) to a large group (more politically powerful), it can undermine the political support for dollarization, even in cases where dollarization is an otherwise socially beneficial policy. The account may seem pessimistic up to that point. But we also show that there exists an alternative policy that can achieve the desired no-bailouts outcome: the introduction-promotion of international banks. This indeed can sufficiently increase the political support for dollarization. And simultaneously, dollarization is an essential component to the promotion of international banks as it curtails the implicit subsidy attached to the use of domestic financial institutions. Hence, the combination of dollarization and bank internationalization can solve the problem of having in place transfers schemes (implicit banking bailout) that are detrimental for

society as a whole.

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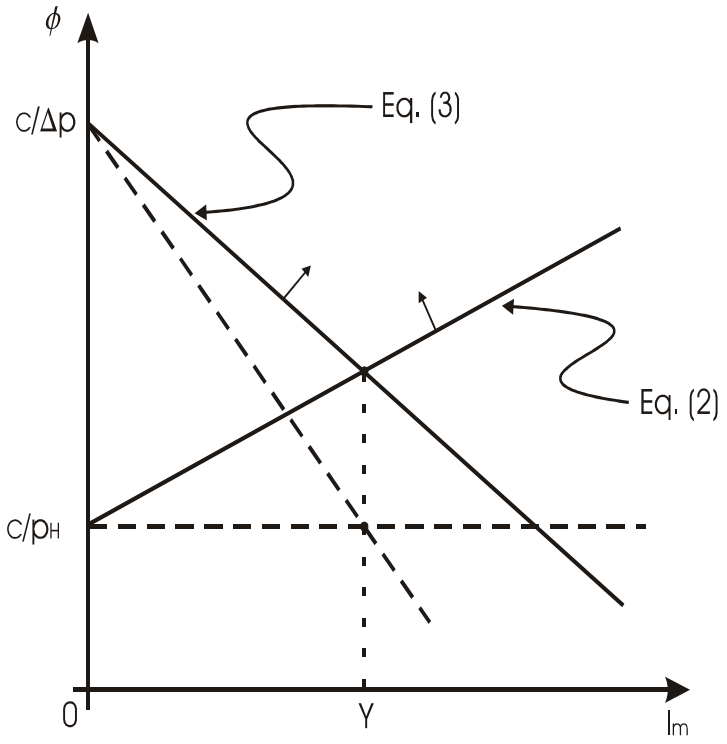

Figure 1: