Why do countries borrow the way they borrow?*

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First Draft: July 2002. This Version: November 2002.

Abstract

This paper analyzes the interplay between individual borrowers' choices for liability denomination and the optimal monetary policy. If the monetary authority cares about preventing bankruptcy and most liabilities are denominated in dollars, it will stabilize the exchange rate at the expense of higher volatility in the interest rate and vice-versa if most liabilities are denominated in local currency. That can generate multiplicity of equilibria in the liability composition. If an individual borrower expects the others to borrow in dollars (pesos) he or she will expect the monetary policy to be tailored for that liability denomination and as a result would find it optimal to borrow in dollars (pesos) as well. If the monetary authority has a strong enough preference for exchange rate (interest rate) stability the equilibrium becomes unique with the liabilities denominated in dollars (pesos).

*The authors are grateful to Roberto Chang, Federico Sturzenegger and seminar participants at the Original Sin Pre-Conference and Lacea 2002 for helpful comments. Any errors are ours.

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1 Introduction

Why do companies and households in many emerging markets borrow in foreign currency? After all, the recent spate of crises in which liability "dollarization" has interacted with drastic real depreciations to create massive bankruptcies and economic havoc suggests that it is an important source of financial fragility. But what causes this phenomenon? Is it that they do not want to borrow in domestic currency because their choices are distorted by moral hazard, or is it that, for other reasons the domestic currency market does not exist, especially for international lending? A significant part of the literature has been focused on moral hazard interpretations. If companies expect to be bailed out by governments, they will not fully internalize the risks they bear (Dooley (2000), Burnside, Eichenbaum and Rebelo(2002), Schneider and Tornell (2000). But the telltale signs moral hazard in terms of the pattern of lending have not found much empirical support (Eichengreen and Hausmann (1999), Fernandez-Arias and Hausmann (2000). A more recent literature has proposed other models. Caballero and Krishnamurthy (2002) present a model where excessive dollar debt is the result of domestic financial constraints that lead firms to undervalue the social benefit of borrowing in local currency. Jeanne (2002) argues that liability dollarization can be a safe play when low monetary credibility keeps interest rates in domestic currency high. Chamon (2001) and Aghion, Bacchetta and Banerjee (2001) present a model where the correlation of devaluation risk and default risk makes domestic currency lending unattractive. In their setup, it is possible for a firm to expropriate the claim that domestic currency creditors have on the residual value of the bankrupt company by increasing their borrowing in foreign currency, given that in the context of a bankruptcy, the claims of domestic currency creditors will be automatically written down by the concomitant depreciation. In anticipation of this, investors refrain from lending in domestic currency. Tirole (2002) proposes a "dual-and-common agency" approach to the problem, where a foreign investor's return depends not only on the behavior of a private borrower but also on that of the borrower's government with whom he does not contract.

In this paper we explore the interplay between individual borrower's choices for liability denomination and the optimal monetary response of the Central Bank given those choices. We start from the assumption that the debt in domestic currency cannot be contracted at long maturities and at fixed rates. As a result, the terms in which it is rolled over or repriced will

depend on changes in the domestic interest rate. In the model presented, there is a shock to the expected future exchange rate. Since agent's are forward looking, that shock affects the present interest and exchange rates. The Central Bank uses monetary policy so as to determine how the absorption of that shock is divided between changes in the interest rate and in the exchange rate. If most liabilities are dollarized and the Central Bank cares about preventing bankruptcy, it will stabilize the exchange rate at the expense of larger movements in the interest rate. Alternatively, if most liabilities are denominated in pesos the Central Bank will stabilize the interest rate at the expense of larger movements in the exchange rate. This can generate multiplicity of equilibria in the liability composition, since if an atomistic agent expects all other agents to denominate their debt in dollars (pesos) he or she will expect the monetary policy to be tailored for that particular liability denomination and as a result may find it optimal to borrow in dollars (pesos) as well. It is worth noting that the policy maker in our model does not attempt to expropriate foreign investors to the benefit of domestic residents as in Tirole (2002). Instead, it is only trying to make dollar debt safer given that those contracts have already been written.

The interaction of liability denomination and monetary policy has received recent attention. Calvo and Reinhart (2000) and Hausmann, Panizza and Stein (2001) show that emerging markets that formally float their currency tend to limit the movement of the exchange rate vis a vis the interest rate and to accumulate significantly larger stocks of international reserves. Hausmann et al show that this behavior is strongly correlated with measures of the ability of a country to borrow internationally in its own currency. Hence, the title of their paper "Why do countries float the way they float?" receives implicitly the answer "because they borrow the way they borrow". There is also a recent literature relating the structure of liabilities to the choice of monetary policy. Aghion, Banerjee and Bacchetta (2001) show how balance sheet effects can make devaluations contractionary and optimal monetary policy apparently pro-cyclical. Cespedes, Chang and Velasco (2000) present a model where the effectiveness of monetary policy although still positive is significantly compromised in its ability to dampen cyclical fluctuations by the presence of liability dollarization. These works focus on how liability dollarization can affect the optimal monetary policy. There is also a literature that studies how monetary policy can affect the currency composition of corporate debt (for example, Jeanne 2000). In this paper, we emphasize how the choice of an individual entrepreneur's liability com-

position can be affected by the choice of the other entrepreneurs through the effect of their choice on the resulting monetary policy.

2 The basic environment

Consider a small open economy subject to shocks to its expected future exchange rate. These shocks are assumed to be out of the control of the economy's policy maker (for example terms of trade shocks) and are not modeled explicitly. We assume the resulting exchange rate expectations are distributed according to a random variable z_t.

The focus of the model is on a small segment of the nontradable sector which consists of atomistic entrepreneurs. Those entrepreneurs have access to a production function that requires an initial investment of one unit of the local currency (henceforth pesos) and whose output is worth A pesos. Two types of debt are considered. The first, which we refer to as dollar debt is denominated in the foreign currency. The second type which we refer to as peso contracts are denominated in the home local currency. We assume one cannot write peso contracts in terms of a fixed domestic interest rate. Instead, peso debt contracts must pay the ex post domestic interest rate for the period the loan was made. This assumption aims at capturing the fact that in practice the maturities of local currency contracts are much smaller than those of foreign currency ones in emerging markets, and that by borrowing through short-term local currency debt the borrowers are vulnerable to shocks to the interest rate at which that debt is rolled over.

The debt contracts must be written in the beginning of time t when the exchange rate is given by e_t^0. The expectation at time t for the exchange rate in period $t+1$ is given by the random variable z_t whose realization occurs at the beginning of period t, but only after the debt contracts have been written. The higher z_t, the larger the expected depreciation (which can be interpreted as the result of an adverse shock). Thus, the expected exchange rate in period $t+1$ at the beginning of period t is given by $E_t^0[e_{t+1}] = E[z_t]$, and is updated to $E_t[e_{t+1}] = z_t$ following the realization of that uncertainty.

The monetary authority decides how to accommodate the shock $z_t - E[z_t]$ between changes in the interest rate and in the exchange rate. We assume an uncovered interest parity condition must be satisfied:

$$1 + i_t = (1 + i^*)\frac{z_t}{e_t} \tag{1}$$

where i_t is the domestic risk-free rate, i^* the constant world interest rate and e_t is the value of the exchange rate following the realization of that shock. The value of e_t^0 is given by arbitrage between peso and dollar instruments at the beginning of time t :

$$E_t^0[1+i_t] = (1+i^*)\frac{E_t^0[e_t]}{e_t^0}$$

We assume that entrepreneurs are risk-neutral, but face a non-pecuniary cost associated with defaults. As a result, when deciding whether to borrow in pesos or dollars they seek to minimize the probability of a default occurring. An entrepreneur that has borrowed through peso debt, paying a risk premium r_{peso} defaults if:

$$A < (1+i_t)(1+r_{peso}) \tag{2}$$

while an entrepreneur that borrowed through dollar debt paying a risk premium $r_\$$ defaults if:

$$A < (1+i^*)(1+r_\$)e_t/e_t^0 \tag{3}$$

In principle an entrepreneur could mix the two denominations, but we show that this is not optimal in this model.

The timing of events is summarized below:

1. Debt contracts are written

2. The shock to the expectation of the next period exchange rate is realized.

3. Given that shock and the currency composition of the debt contracts, the monetary authority sets i_t and e_t.

The monetary authority (henceforth the Central Bank) takes that cost of default into account when choosing i_t and e_t. It also seeks to minimize the gap between the economy's output and an ideal target and to minimize the inflation rate. Output and inflation are a function of the interest rate and of the exchange rate, given by the equations below where a sans-serif font indicates a variable is expressed in log terms:

$$\begin{aligned} \mathsf{y_t} &= \overline{\mathsf{y}} + \alpha \mathsf{e_t} - \beta \mathsf{i_t} \\ \pi_\mathsf{t} &= \overline{\pi} + \gamma \mathsf{e_t} - \delta\ \mathsf{i_t} \end{aligned}$$

where $\mathsf{y_t}$ is the log of the output, π_t the inflation rate, $\overline{\mathsf{y}}$ and $\overline{\pi}$ are constants, and $\alpha, \beta,\ \gamma$ and λ are positive constants. Since the entrepreneurial sector

that borrows from abroad is assumed to be small, the effect of its liability composition on these parameters is ignored. The Central Bank's inflation versus output trade-off is given by the loss function:

$$\ell = (\widetilde{\mathsf{y}} - \mathsf{y_t})^2 + \chi \pi_{\mathsf{t}}^2 \tag{4}$$

where $\widetilde{\mathsf{y}}$ is the log of the ideal output target and χ is a constant. In addition to that trade-off between output and inflation, the Central Bank's welfare function is also affected by the share of entrepreneurs that would default given its choice for i_t and e_t. The Central Bank's loss function taking this effect in consideration is given by:

$$\mathcal{L} = \ell + s(i_t, e_t)C \tag{5}$$

where $s(i_t, e_t)$ is the share of bankrupt entrepreneurs given the monetary policy and C is the cost of that default to the Central Bank's welfare. That cost differs from the private one incurred by the entrepreneurs depending on the extent to which the Central Bank internalizes their welfare and on the externalities that their bankruptcy can impose on the rest of the economy.

It is useful to initially consider the case where the Central Bank does not take into account those entrepreneurs when setting its monetary policy (i.e. $C = 0$). The Central Bank's loss function becomes $\mathcal{L} = \ell$. Minimizing (4) subject to (1) yields the following policy rules:

$$\mathsf{e_t} = \psi + \zeta \mathsf{z_t} \tag{6}$$

$$\mathsf{i_t} = \mathsf{i}^* - \psi + (1 - \zeta)\mathsf{z_t} \tag{7}$$

where:

$$\psi = \frac{(\alpha + \beta)(\widetilde{\mathsf{y}} - \overline{\mathsf{y}} - \beta \mathsf{i}^*) - \chi(\gamma + \delta)(\overline{\pi} - \delta \mathsf{i}^*)}{(\alpha + \beta)^2 + \chi(\gamma + \delta)^2} \tag{8}$$

$$\zeta = \frac{(\alpha + \beta)\beta + \chi(\gamma + \delta)\delta}{(\alpha + \beta)^2 + \chi(\gamma + \delta)^2} \tag{9}$$

and $0 < \zeta < 1$. Thus, the Central Bank accommodates the shock in a way that both the elasticities of i_t and e_t with respect to z_t are positive but smaller than one and together they add to unity.

Consider the case where parameters are such that $\zeta = 1/2$ (i.e. the Central Bank distributes the shock to z_t between i_t and e_t with the same

elasticity). We solve the recursive equilibrium and show that if everyone else borrows in dollars, an atomistic entrepreneur is better off borrowing in dollars as well since the monetary authority will stabilize the exchange rate at the expense of higher volatility in the interest rate. The opposite is true if everyone were to borrow in pesos.

Suppose that in the first stage of the game all entrepreneurs choose to borrow in dollars. The monetary authority knows that in order to prevent a default from occurring, it must set e_t below a critical level e_t^c given by:

$$e_t^c = \frac{Ae_t^0}{(1+i^*)(1+r_\$)}$$

There are three regions of interest for the problem solved by the monetary authority in stage 3:

Region 1: The condition $e_t \leq e_t^c$ is not binding:

In this region, the realization of z_t is such that the monetary authority does not need to worry about defaults occurring. As a result, it sets e_t and i_t according to (6) and (7):

$$\mathsf{e_t} = \psi + \frac{1}{2}\mathsf{z_t} \tag{10}$$

$$\mathsf{i_t} = \mathsf{i^*} - \psi + \frac{1}{2}\mathsf{z_t} \tag{11}$$

In this region both e_t and i_t increase on the square root of z_t.

Region 2: The realization of z_t is such that the Central Bank chooses to set $e_t = e_t^c$ in order to avoid defaults and accommodates the remaining part of the shock through i_t.

In this region the Central Bank sets:

$$\begin{aligned} \mathsf{e_t} &= \mathsf{e_t^c} \\ \mathsf{i_t} &= \mathsf{i^*} + \mathsf{z_t} - \mathsf{e_t^c} \end{aligned}$$

Note that instead of increasing on the square root of z_t, i_t is linear on z_t in this range.

Region 3: The realization of z_t is so large that the Central Bank gives up accommodating the change in e_t and lets the entrepreneurs go bankrupt:

The Central Bank decides to "throw in the towel" if the interest rate hike necessary to keep the exchange rate at e_t^c is so high that the loss function

is actually larger than the one where it lets them go bankrupt and accommodates the shock between the two instruments. The Central Bank's loss function given a realization of z_t when ignoring bankruptcy issues can be defined as a function of $\mathsf{e_t}$. The difference between the value of that function obtained by setting $\mathsf{e_t} = \mathsf{e_t^c}$ as opposed to the level $\psi + \frac{1}{2}\mathsf{z_t}$ it would choose in the absence of bankruptcy considerations is obtained by taking a Taylor-series expansion[1]:

$$\begin{aligned}
\ell(\mathsf{e_t^c}) - \ell\left(\psi + \frac{1}{2}\mathsf{z_t}\right) &= \ell'\left(\psi + \frac{1}{2}\mathsf{z_t}\right)\left(\mathsf{e_t^c} - \left(\psi + \frac{1}{2}\mathsf{z_t}\right)\right) \\
&\quad + \frac{\ell''\left(\psi + \frac{1}{2}\mathsf{z_t}\right)}{2}\left(\mathsf{e_t^c} - \left(\psi + \frac{1}{2}\mathsf{z_t}\right)\right)^2 \qquad (12) \\
&= \frac{\ell''\left(\psi + \frac{1}{2}\mathsf{z_t}\right)}{2}\left(\mathsf{e_t^c} - \left(\psi + \frac{1}{2}\mathsf{z_t}\right)\right)^2 \qquad (13) \\
&> C \text{ for large enough } \mathsf{z_t} \qquad (14)
\end{aligned}$$

The above expression is increasing on the difference between $\mathsf{e_t^c}$ and $\left(\psi + \frac{1}{2}\mathsf{z_t}\right)$. Thus, for large enough $\mathsf{z_t}$ that loss will dominate the one associated with the cost C of letting the entrepreneurs go bankrupt. Once that level is reached, the Central Bank's response is given by (10) and (11). Note that there is a discontinuity around that critical value of z_t with a discrete increase in e_t and a discrete decline in i_t.

So far, we have shown that given dollarization of liabilities the Central Bank will "float with a life-jacket", letting the exchange rate float over some range but aggressively intervening if a certain threshold is reached. But for a high enough realization of z_t it will give up on that intervention and let it float again. It remains to show that given that the Central Bank will act this way, agents would indeed prefer to borrow in dollars.

Since the entrepreneurs are risk neutral, when choosing the composition of their liabilities they only care about which of them decreases the likelihood of a default.

Let $z_{\$}^c$ and z_{peso}^c denote the critical values of the realization of the z_t above for which an entrepreneur would default given dollar and peso liabilities respectively.

Since from arbitrage both types of liabilities must yield the same expected

[1] Note that since $\ell(\mathsf{e_t})$ is quadratic, $\ell^{(n)}(\mathsf{e_t}) = 0$ for $n > 2$.

return to the lenders, we have:

$$\int_{\underline{z}}^{z_{\$}^c}(1+i^*)(1+r_{\$})\frac{e_t}{e_t^0}\Pr(z)dz = \int_{\underline{z}}^{z_{peso}^c}(1+r_{peso})(1+i_t)\Pr(z)dz \qquad (15)$$

where both e_t and i_t are increasing functions of z, and the risk premiums $r_{\$}$ and r_{peso} are decreasing on $z_{\$}^c$ and z_{peso}^c. Arbitrage between risk-free short-term peso and dollar instruments implies:

$$\int_{\underline{z}}^{\overline{z}}(1+i^*)\frac{e_t}{e_t^0}\Pr(z)dz = \int_{\underline{z}}^{\overline{z}}(1+i_t)\Pr(z)dz \qquad (16)$$

The solution of the Central Bank's problem implies that there exists z_A and z_B such that $z_A > z_{\$}^c > z_B$ and:

$$\mathsf{e_t(z_A)} - \mathsf{e_t(z_B)} \leq \frac{1}{2}(\mathsf{z_A} - \mathsf{z_B}) \leq \mathsf{i_t(z_A)} - \mathsf{i_t(z_B)}, \text{ with strict inequalities for some } z_B \qquad (17)$$

Proposition 1 $z_{\$}^c > z_{peso}^c$

Proof. Suppose $z_{\$}^c \leq z_{peso}^c$.
Equation (16) can be rewritten as:

$$\frac{(1+i^*)}{e_t^0}\left(\int_{\underline{z}}^{z_{peso}^c} e_t\Pr(z)dz + \int_{z_{peso}^c}^{\overline{z}} e_t\Pr(z)dz\right) = \int_{\underline{z}}^{z_{peso}^c}(1+i_t)\Pr(z)dz + \int_{z_{peso}^c}^{\overline{z}}(1+i_t)\Pr(z)dz$$

The equation above and inequality (17) imply:

$$\frac{(1+i^*)}{e_t^0}\int_{\underline{z}}^{z_{peso}^c} e_t\Pr(z)dz < \int_{\underline{z}}^{z_{peso}^c}(1+i_t)\Pr(z)dz$$

which implies

$$\frac{(1+i^*)}{e_t^0}\int_{\underline{z}}^{z'}(1+r_{peso})e_t\Pr(z)dz = \int_{\underline{z}}^{z_{peso}^c}(1+r_{peso})(1+i_t)\Pr(z)dz$$

for some $z' > z^c_{peso}$. That implies $r_\$ < r_{peso}$, which in turn implies $z^c_\$ > z^c_{peso}$, a contradiction. ■

Thus if all other entrepreneurs borrow in dollars the resulting monetary policy is such that dollar debt is safer. Note that since e_t and i_t are perfectly correlated in the range where dollar debt holders would default, there are no benefits from mixing the two debt denominations (unless the borrowers could short the peso instrument which we do not allow in our analysis).

The problem presented is completely symmetric between e_t and i_t. As a result, if all liabilities were in short-term pesos the resulting monetary policy would be such that short-term peso instruments would be safer[2]. Therefore, if an atomistic agent expects all others to borrow through dollar (peso) debt, he or she will choose to borrow through dollar (peso) debt as well and multiplicity of equilibria in the debt composition occurs.

3 Preference towards exchange rate or interest rate adjustment

The previous section focused on the case where the elasticities of the exchange rate and the interest rate with respect to z_t were the same. But if parameters are such that the resulting optimal monetary policy exhibits a strong preference towards exchange rate or interest rate stability, the problem changes quite significantly. While for some range of parameters there is still multiplicity of equilibria, welfare is higher in the equilibrium where firms choose to borrow in the instrument whose return the central bank is trying to stabilize. Hence, if the Central Bank is more concerned with exchange rate stability, social welfare is higher if entrepreneurs borrow in dollars. Some ability to coordinate would allow them to choose the better equilibrium. This ability may be provided either by a few large borrowers or by the fiscal authority. If the government were to denominate its debt so at to minimize the risk of debt service to the fiscal accounts, it would choose dollar debts and firms would just follow suit. Moreover, once a large enough asymmetry is introduced, there is a unique equilibrium for the debt composition.

[2]In theory there could be a third equilibrium where half the liabilities are denominated in dollars and half in pesos. The Central Bank would not be able to help both groups of creditors, and would randomize which group to help. But that equilibrium is not robust to small perturbations since if one agent was to switch from peso to dollar debt, every agent would prefer to borrow only through dollars and vice-versa.

Recall equation (9) which defines the elasticity ζ of the exchange rate with respect to z_t according to the parameters that determine the effects of the exchange rate and of the interest rate in the output and inflation of that economy (in the region where the Central Bank ignores bankruptcy considerations). If ζ is small, most of the shock will tend to be accommodated through changes in the interest rates. That elasticity is small when the expansionary effect of exchange rates on output is low (α is small), the exchange rate pass-through to inflation is high (γ is large) and interest rates have little impact on aggregate demand and inflation (β and δ are small). These assumptions seem particularly relevant to emerging markets. Because of that we focus on the case where ζ is small. But just like in the previous section, the actual realizations of e_t and i_t are influenced by the composition of debt liabilities.

Figure 2 illustrates the case where ζ is small and liabilities are denominated in dollars. The range of z_t in which a default occurs is smaller than in the basic scenario of the previous section since the Central Bank is now more willing to stabilize e_t at the expense of i_t. But if liabilities are denominated in pesos, the Central Bank's greater willingness to stabilize the exchange rate will conflict with its willingness to prevent bankruptcy. That case is illustrated in Figure 3. For some range of z_t the Central Bank will refrain from raising i_t beyond a certain threshold in order not to bankrupt the entrepreneurs, accommodating the rest of the shock through the exchange rate. In that range i_t is held constant while e_t increases linearly in z_t. But just like in the analysis of the previous section, this deviation from the Central Bank's ideal rule for accommodating the shock becomes too costly for a large enough realization of z_t. Beyond that critical point, the Central Bank gives up trying to save the entrepreneurs and is again willing to stabilize the exchange rate at the expense of larger movements in the interest rate. Therefore the set of values of z_t for which a default under dollar debt occurs can be disjoint since e_t is not monotonic in z_t. For example, if an entrepreneur borrows in dollars she may be bankrupt for a given realization z_A if that realization lies in the region where the Central Bank lets the exchange rate depreciate more in order to keep interest rates low. But she may be solvent for realizations $z_B > z_A$ if z_B is in the range where the Central Bank would have given up trying to save the peso borrowers and $e(z_B) < e(z_A)$. Whether or not the resulting distributions of e_t and i_t can sustain an equilibrium where the debt is denominated in pesos depends on parameter values. If the costs of default are low (or if they are high but the Central Bank does not internalize them

much) or if the Central Bank is much more concerned about e_t than about i_t, then one would prefer to borrow in dollars even if everyone else were to borrow in pesos. As a result, there would only be a single equilibrium where all debt is denominated in dollars. But again, if parameters are such that multiplicity of equilibria still occur, welfare is higher in the equilibrium where the debt is denominated in the instrument whose movements the Central Bank would rather stabilize. It seems reasonable to assume that if large players are involved (such as the government), the economy will eventually manage to coordinate on the preferred of the two equilibrium.

4 Discussion

The model presented in this paper argues that the interplay between individual borrower's choices for liability composition and the optimal monetary policy can lead to an outcome where liability dollarization is widespread. That result was obtained under a policy maker that is fairly benign towards foreign investors in the sense that it is not attempting to expropriate them to the benefit of domestic borrowers. Instead, all that policy maker is trying to do is to make dollar debt safer given that those contracts have already been written.

While the model presented only predicts corner solutions, a richer model with different types of shocks is likely to generate equilibria with internal solutions for the share of dollarized liabilities (with that share depending on how the monetary policy responds to different shocks). The preferences of the central bank towards exchange rate or interest rate adjustments can play a very significant role in terms of focusing the market on a type of borrowing and of monetary policy. In this sense, countries that exhibit original sin are countries where the central bank cares more about exchange rate movements than about interest rate movements. This is often the case in emerging markets, which can be explained by a number of reasons. In those countries, the exchange rate pass-through into prices tends to be higher than in developed ones, and the evidence for devaluations being expansionary is at best mixed. Moreover, a low level of financial development weakens the link between interest rates and aggregate demand, and as a result domestic interest rates have a lower impact on inflation and employment. All these elements will bias the choice towards more stable exchange rates at the expense of higher volatility in interest rates. Finally, emerging markets have more imperfect

and incomplete financial markets, so the costs of bankruptcy are likely to be larger. As a result, that bias towards exchange rate stability is amplified, with the monetary authority being more willing to use interest rates aggressively in order to stabilize the exchange rate in the presence of dollarized liabilities. In fact, the volatility of interest rates tends to be much higher in emerging markets than in developed economies.[3]

Why countries borrow the way they borrow? Why do countries differ in their borrowing behavior? The most likely candidates would be countries where the central bank has a preference for exchange rate stability and that suffer from high volatility and bankruptcy costs.

Finally, while the model has focused on the borrower's choice for liability denomination, some of the insights can shed light into the related problem of denomination of savings. If households are risk averse and their income is not correlated with the shock to the expected future exchange rate, then they would rather just save in whatever instrument makes the value of their savings more stable. For example, if the debt composition is such that the Central Bank stabilizes the exchange rate at the expense of the interest rate and the parameters are such that the resulting distribution of peso savings is riskier than that of dollar ones, the households would rather save in dollars. If however, the realization of the shock to the expected future exchange rate is correlated with household income (if for example it reflects productivity shocks that affect the marginal product of labor and as a result the household's labor income) then matters become more complicated. On the one hand households dislike uncertainty on the return to their savings. But on the other hand they want that return to covary negatively with their labor income. As a result, they will be willing to hold some peso denominated instruments, since those instruments do better than dollar denominated ones over some range of "bad" realizations of the shock[4]. The share of their savings held in peso instruments will depend on the distribution of returns and

[3]Hausmann (2002) estimates the volatility of changes in 12-month real interest rates in a sample of Latin American countries in the period 1994-1999. Using a sample that excludes observations when inflation exceeded 40% the average volatility was 10.5%, while the corresponding figure for the United States was only .9%

[4]The Central Bank will give up trying to stabilize the exchange rate for very bad realizations of the shock, and dollar savings would provide higher returns than peso ones in those states. But for intermediate levels of a bad shock, the exchange rate is stabilized at the expense of an interest rate hike and peso savings will have a larger return than dollar ones.

on how that shock to the expected future exchange rate covaries with their income.

Figure 1: Exchange rate and interest rate if $\zeta = 1/2$ and liabilities are denominated in dollars.

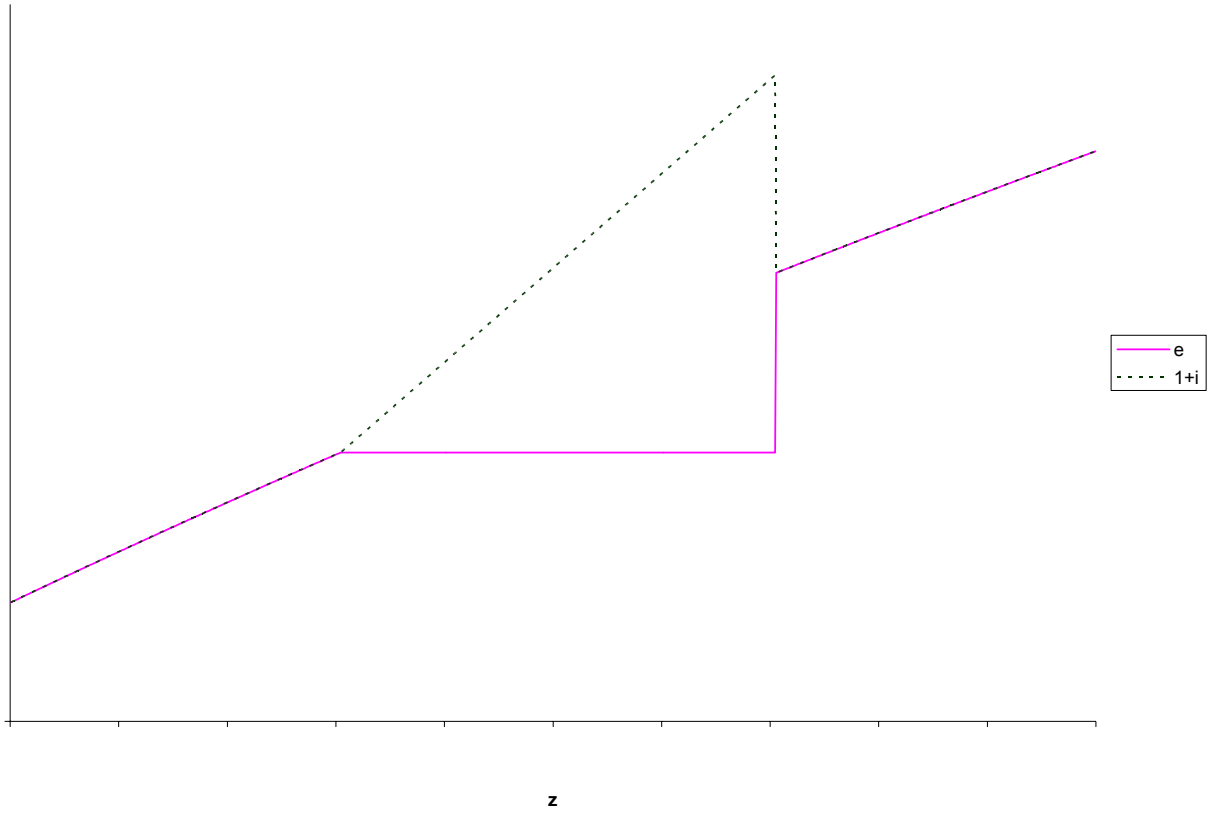


Figure 2: Exchange rate and interest rate if ζ is small and liabilities are denominated in dollars.

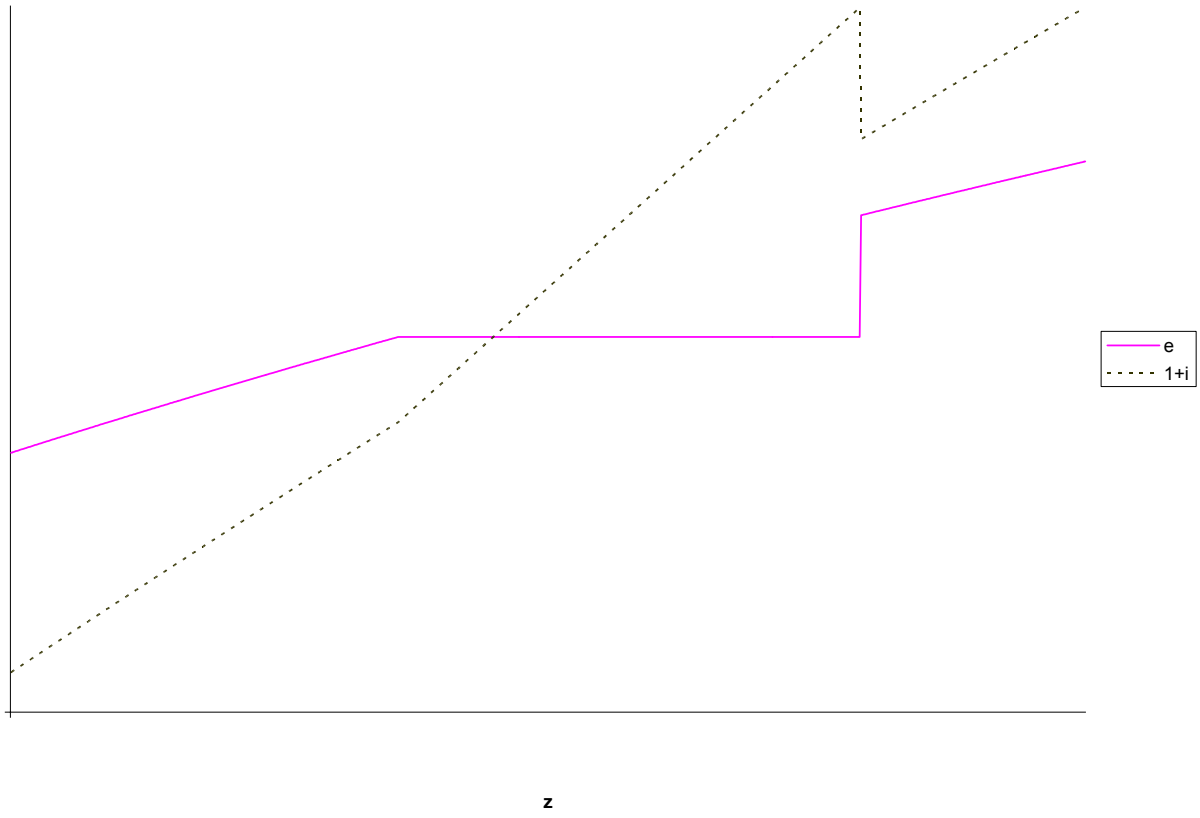
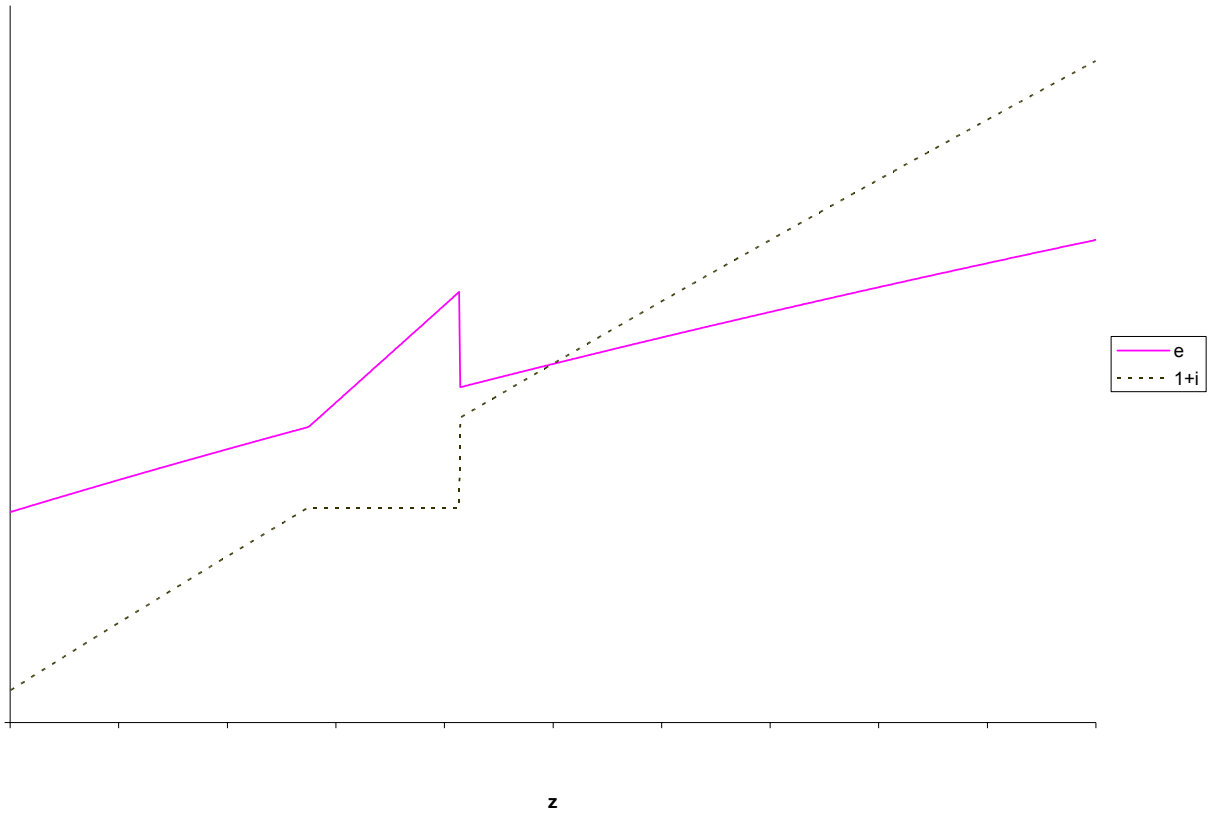


Figure 3: Exchange rate and interest rate if ζ is small and liabilities are denominated in pesos.



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