

DOLLARIZATION OF LIABILITIES AND THE VALUE OF COLLATERAL

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I Introduction

It is widely agreed that one of the reasons that the East Asian financial crisis had such surprisingly severe real consequences is that East Asian firms contracted debt denominated in foreign currency. Since much of their revenues were denominated in domestic currency, this implied severe balance sheet mismatch which helped cause extremely widespread bankruptcy following devaluation. The costs of financial distress amplified the subsequent downturn. Furthermore, balance sheet mismatch increased pressure on policy makers to stop or reverse the depreciation of domestic currency. It is generally agreed that the resulting contractionary policies contributed to the downturn. Clearly concern about balance sheet mismatch was not the only factor in the policy debate, but it was a relevant factor.

There has been limited theoretical investigation of why firms might choose to contract dollar denominated debt. There has been some analysis of the effects of a credible permanently fixed exchange rate (Dooley 1997, Burnside Eichenbaum and Rebelo 1999). Clearly it is much easier to understand why firms issue dollar denominated debt if they are sure that there will not be a devaluation. This confidence would not be rational in the model presented below. It is also relatively easy to understand why public debt is indexed in foreign currency as domestic currency denominated public debt creates a time-inconsistency problem as debtor countries can choose to devalue to reduce the value of local currency denominated debt (Calvo and Guidotti 1990, Calvo

1996, Allen and Gale 2000). This paper addresses private sector debt issued by firms which do not have (direct) control over exchange rates and may suffer losses due to financial distress as the result of balance sheet mismatch.

An article quite similar to this one is Caballero and Krishnamurthy (2000) which addresses exactly the same issues. There are two main differences between Caballero and Krishnamurthy (2000) and this paper. The first is that Caballero and Krishnamurthy consider a real model in which real devaluation is the result of a real shock. In this paper, it is assumed that the devaluation is the result of a speculative attack. The assumption that this causes a real depreciation and reduces the dollar value of firms' revenues is based on an informal appeal to nominal rigidities. This difference is, perhaps, largely one of presentation as it is well understood how, in the presence of nominal rigidities, nominal shocks and real shocks can have similar effects. A much more important difference is that Caballero and Krishnamurthy assume that all debt is fully collateralized so all creditors are fully repaid. Thus the choices of creditors are easy to understand, and the only question is why domestic firms did not choose to insure against devaluation risk. In this paper it is not assumed that debt is fully collateralized so debt dollarization followed by devaluation leads to widespread bankruptcy. Indeed in the principal example, there is a positive probability that all firms in the economy go bankrupt as a result of debt-dollarization and devaluation.

The choice of dollar denominated debt is particularly surprising given the massive wave of bankruptcy that resulted, in part, from this practice. It is tempting to conclude that East Asian firms were irrationally optimistic about the stability of East Asian currencies. This paper will not address or criticize this sort of explanation. Instead rational expectations will be assumed throughout. Thus the paper might be seen as an effort to answer the question whether recent events in East Asia are inconsistent

with rationality. The answer (as usual) is no. Assumptions can be found which reconcile even this extreme behavior with rationality.

Certainly firms obtained a possible advantage from dollar denominated debt because creditors charged lower interest rates.

However, this behavior on the part of creditors is almost more difficult to understand than the choices of firms. It would be rational for creditors to charge lower interest on dollar denominated debt if, in this way, they did not have to bear costs in the case of a devaluation. In the event, creditors were not protected from such costs, since debtors went bankrupt. It appears that creditors were willing to reward debtors for making a promise which the debtors clearly could not keep. Again plain irrationality is a plausible explanation and again this possibility will not be addressed in this paper.

Instead the paper presents two arguments which rationalize the behavior of firms and their creditors respectively. First it is argued that bankruptcy was relatively less costly for firms exactly because so many other firms were bankrupt. Widespread bankruptcy can make seizing the assets of bankrupt firms less attractive to creditors because it is difficult to find a solvent firm to which the assets can be sold. This argument relies critically on barriers which make it difficult for foreign firms to buy and manage domestic productive capital. Often there are political barriers to such a practice, although lack of familiarity with domestic practices may have been more important in the case of East Asia. In contrast the argument is not based on bias or inefficiency of domestic bankruptcy courts, which appears to be an important factor, and clearly would support the analysis in the paper.

The potential rationalization of the behavior of foreign creditors is based on a distinction between interest charged on debt

contracted early in the process of debt dollarization and interest charged on debt contracted later. In particular, in the model, when the older (hence senior) debt is contracted, it is possible that debt dollarization will not proceed to the point that a devaluation causes bankruptcy. The subsequent choice to assume dangerous levels of dollar denominated debt is made independently by domestic firms, however they all make the same choice (which is not predictable in advance). Formally it is assumed that a payoff irrelevant variable (sunspot) is observed and firms condition their choice on the sunspot. Later the possible devaluation is caused by the action of investors who observe another sunspot. The two sunspot variables make it possible that the ex ante probability of massive bankruptcy was low and almost undetectable in interest rates charged even by rational creditors.

II A Model

The production process is risk free and linear in capital. All agents are risk neutral and have rational expectations. Initially only foreign (New York) banks have access to liquid funds which they may choose to loan to domestic (Indonesian) firms with debt contracts indexed in dollars or in rupiah. The firms are founded and managed by domestic entrepreneur/managers called managers below. For simplicity it is assumed that in period 1 one dollar costs one rupiah so the exchange rate E_1 is 1 rupiah per dollar. Firm i invests in K_i of capital. Firm i will receive revenue of $p K_i$ rupiah in periods 5 and 6 where p is a known constant. It is assumed that, if the rupiah does not depreciate, this is greater in present value than the K_i if discounted at the risk free international interest rate i . For reasons explained below it is assumed that the present value of revenues are not too high. For simplicity assumption A1 is that inequality 1 holds

$$1) \quad 2 > p(2+i)/(1+i)^5 > 1.$$

It is assumed that banks do not collude and that each firm borrows in dollars and rupiah from many different banks which do not coordinate action unless the firm is insolvent and asks to renegotiate debt repayment. Managers can not embezzle funds from active firms nor can they affect revenues other than by resigning or refusing to meet scheduled debt repayments and forcing creditors either to seize the firm and sell its assets to another firm or to attempt to manage the firm themselves (see key assumption A5 below). Thus the incentive compatibility constraint and the individual rationality constraint are identically that managers retain positive income after repaying loans. Formally where pay_t is total repayment made in period t in rupiah, the IR constraint inequality 2 must hold.

$$2) (p - pay_5)(1+i) + (p - pay_6) > 0.$$

Note that inequality 2 is a strict inequality. That is managers can credibly threaten to resign or equivalently to renege on debt repayments if existing contracts will require them to transfer all revenue to creditors.

The fraction of period 1 issued debt which is denominated in dollars is b . It assumed strictly for simplicity that both dollar denominated debt and rupiah denominated debt is to be repaid in equal installments in periods 5 and 6 (the periods in which firms earn operating profits). For more general debt contracts, b would be the fraction of period 6 scheduled payments to be made in dollars. Since a devaluation is possible, the scheduled dollar and rupiah interest rates are not equal. Since it is possible that firms go bankrupt, even the dollar interest rate is not equal to i , the risk free dollar interest rate.

Time is divided into six periods. In the first period domestic (Indonesian) firms borrow using dollar and rupiah denominated contracts and invest. In the second period f , a sunspot variable is

revealed to equal 1 with probability A or zero with probability $1-A$. In the third period firms decide whether to buy back outstanding rupiah denominated debt by issuing new dollar denominated debt. In the fourth period a second sunspot variable y is revealed to equal one with probability B or zero with probability $1-B$ and speculators chose whether to sell rupiah denominated assets for dollar denominated assets. I assume that if $y = 1$, there is a speculative attack and a devaluation of the rupiah, while if $y = 0$ there is no devaluation. Since models of speculative attack are familiar, I will not model the exchange market explicitly. For further simplicity I will simply assume that the devaluation is a 100% devaluation in which the rupiah price of a dollar (E) doubles from 1 to 2. In the fifth period firms receive revenue pK_i and may or may not make scheduled debt payments. If a firm does not pay, creditors either seize and resell its assets or renegotiate debt repayment with that firm. In the sixth and final period firm i receives revenue pK_i and contracts are fulfilled.

Three assumptions are made each of which makes it more difficult to find a dollarized debt equilibrium.

A2) It is assumed that creditors can costlessly and instantly seize the assets of bankrupt firms.

A3) It is assumed that seniority of debt is completely respected in that a firm may make payments on more recently acquired (junior) debt only after it has completely fulfilled older (senior) debt contracts, and that it can make new capital acquisitions only after it has met all scheduled debt payments. In the equilibrium of interest, managers implicitly conspire with new creditors to reduce the value of outstanding debt. This is clearly more difficult the more strictly seniority of debt is enforced.

A4) It is assumed (only for the purposes of evaluating the possible existence of a dollar denominated debt equilibrium) that domestic firms revenues are a fixed number of rupias i per unit of capital. Thus bankruptcy has no effects on production of the bankrupt firm or on demand by bankrupt firms for the products of

non-bankrupt firms. Further devaluation has no effect on rupiah profits (via increased competitiveness). This last assumption is an extreme version of the sort of assumption needed to create a problem of balance sheet mismatch between dollar debt and rupiah cash flows.

A key assumption is that

A5) foreign creditors are not able to manage the assets of domestic firms.

A second key assumption is that the ability of domestic firms to expand the productive capital under management are limited. In particular it is assumed that,

A6) in period 6, domestic firms can effectively manage only θ times as much capital as they have built in period 1 where θ is greater than one but strictly less than 1.5 .

Assumptions A5 and A6 are clearly crucial for the results of this analysis. In effect, this paper mainly attempts to evaluate their implications. Therefore it is very important to decide if they are reasonable. Essentially, the same reasons which might explain why it might be extremely difficult for foreigners to take over and manage bankrupt firms explain why it might be difficult for domestic firms to do so on a massive scale. One key difficulty, which appears to have, for the moment, blocked efforts to sell Daewoo motors to a foreign firm, is that balance sheets in South East Asian

countries are very difficult to evaluate¹. Thus extensive research is required in order to avoid paying too much for firms burdened e.g. by debts owed by subsidiaries. Clearly familiarity with local book-keeping practices and informal contacts with managers of

¹ Since, in this paper, debt is always renegotiated without formal bankruptcy proceedings the recent decision to declare Daewoo motors formally bankrupt does not correspond to the model (CNN November 8 2000)

such firms can be helpful, but rushed mergers and acquisitions in such countries may be extremely unwise. It is also possible that, especially for firms smaller than Daewoo (that is almost all firms) it is difficult to replace the system of implicit agreements between managers and workers, customers, suppliers and regulators (Shleifer and Vishny 1989). Another possible justification for the assumptions is political intervention in the market. Clearly politicians are often reluctant to allow foreigners to take over domestic firms and sometimes resist rapid expansion of domestic firms via mergers and acquisitions, in the name of competition policy with, perhaps, more interest in protecting incumbents. All these factors are also relevant in developed countries but are probably more important in emerging markets.

The exact composition of debt initially issued in period 1 is not crucial to the model. Thus it is assumed that

A7) firms issue enough debt in rupiah in period 1 that they can meet debt payments in the case of a devaluation so long as they do not pay off rupiah denominated debts by issuing new dollar denominated debt in period 3. That is inequality 3 holds

$$3) pK_i \geq E_6 b i_s + (1 - b) i_L$$

Where i_s indicates repayments scheduled in periods 5 and 6 on dollar denominated debt contracted in period 1 and i_L indicates repayments scheduled in periods 5 and 6 on rupiah denominated debt contracted in period 1.

Finally, It is assumed that,

A8) if senior creditors choose to renegotiate debt contracts, the Nash bargaining solution for bargaining between senior creditors and managers is reached instantaneously and without cost. Given assumption A3 above junior creditors can veto a renegotiated contract only if senior creditors receive at least full payment as due under the original contract. Consensus on bargaining among senior creditors is guaranteed by the assumption that all payments

to senior creditors must be proportional to the amount owed in the original debt contract.

Assumption A8 is strictly less favorable to debtors than the commonly made assumption that debt contracts can be renegotiated to any outcome Pareto superior to bankruptcy proceedings. This common assumption corresponds to a model in which debtors make one take it or leave it renegotiation offer to creditors, which seems highly implausible.

The principal assertion of this paper is that there is a sunspot equilibrium in which in period 3, if $f=1$, all domestic firms chose to convert rupiah to dollar debt so that they all go bankrupt in period 5 if there is a devaluation ($y=1$). The motivation is that bankruptcy is not costly to the bankrupt firm if all other domestic firms are bankrupt so productive capital has value zero to foreign creditors who thus choose to renegotiate debt contracts. The key condition for such a period 3 equilibrium to exist is that no domestic firm profits by deviating by maintaining rupiah not dollar denominated debt in order to be able to buy capital at very low prices from creditors of bankrupt firms. Assumption (6) which restricts the scale of this highly profitable activity is key to the result.

The model is solved by backward induction starting in period 6. The one key feature is that in the candidate equilibrium, if $f=1$, all firms convert rupiah debt to dollar debt. This means that, if $f=1$ and $y=1$ all firms are unable to meet debt repayments. In any case, since there is no sunspot realized between periods 5 and 6 there is no uncertainty and all debt contracts signed in period 5 (after renegotiation) are fulfilled.

In period 5, if there has not been a depreciation ($y=1$) it is clear that all firms will be able to meet debt payments and banks can

instantly and costlessly seize all the money they are still owed. Formally, if the creditor refuses to renegotiate the contract it will receive full payment while the manager of the domestic firm will receive positive residual income in period 6 and therefore all bargaining models imply that the creditor receives full payment. In contrast if there has been a devaluation, in the absence of renegotiation all revenues would be transferred to the creditors (given assumption A1). Thus managers credibly threaten to resign.

The key feature of the candidate equilibrium is that if $f=1$ and $y=1$, all firms are insolvent and thus, given assumption A3, no firm can purchase capital seized by creditors. This means that in the absence of renegotiation firm i 's senior creditors receive only income earned by period 5 pK_i rupiah = $pK_i/2$ dollars. Creditors can seize the firm, but, since they can not manage it or find a solvent buyer for its assets, they only effectively seize cash on hand. This is their threat point for Nash bargaining over the renegotiated debt contract. Clearly in the absence of renegotiation junior creditors and managers receive zero. In the absence of renegotiation, potential revenues from operation in period 6 are lost, thus it is in the joint interest of managers and senior creditors to renegotiate debt repayment. Clearly, in this case as well, assumption A3 implies that junior creditors receive zero as senior creditors are not fully repaid and that junior creditors can not veto a renegotiated contract negotiated by senior creditors and managers. If $f=1$ and $y=1$, senior creditors and managers bargain over cash on hand of pK_i and future revenues of pK_i in period 6 which have present value $pK_i/(1+i)$ in period 5. The threat points are 0 for the manager and pK_i for the senior creditor so the remaining pK_i in period 6 is split evenly.

In the proposed equilibrium, if $f=1$ the firm buys back all its rupiah denominated debt on the secondary market by issuing new

dollar denominated debt. In principle, creditors holding senior rupiah denominated debt could choose not to sell the debt back to the firm. To deal with this possibility it is necessary to consider how cash on hand is divided among creditors if they seize the firm and to decide how renegotiated payments are divided. Clearly the standard practice is that such partial repayments are divided proportional to the amount theoretically owed as is assumed above. The assumption that banks do not collude implies that no single rupiah creditor can block rescheduling by refusing to resell debt on the secondary market. Instead each rupiah creditor may keep rupiah denominated debt but (like senior dollar creditors) must realize that its value is reduced by refinancing and the consequent risk of bankruptcy. This guarantees that, in equilibrium, expected payments on junior dollar denominated debt are exactly the same as expected payments on rupiah denominated debt. It might seem that this is taking the assumption that banks do not collude rather far, however, the point is that firms can change their exposure to devaluation risk by buying and selling assets with equal expected returns. Alternatively it could have been assumed that, in period 1, firms borrow only in dollars and hedge devaluation risk on the foreign exchange futures market and that in period 3 they all decide whether to reduce their hedge position to the point that a devaluation causes them all to go bankrupt.

The result of the assumptions made above is that it is not at all undesirable for managers to all become insolvent. This puts each of them in a position of bilateral monopoly with their senior creditor, which enables them to threaten to close down their firm by resigning or forcing their creditors to invoke the bankruptcy court. This can be quite profitable since they collectively possess the valuable ability to manage domestic firms and that they have effectively managed to commit to not compete with each other in the market for managerial services via laws designed to protect creditors (assumption A3 in the model). Given the assumptions

above the situation of collective insolvency implies that manager i receives income $\frac{p}{2} K_i$ in period 6.

Effectively, in this case, bankruptcy reduces the amount paid in period 6 to senior creditors from scheduled payments (after refinancing) of $2b_i K_i$ rupiah to $\frac{p}{2} K_i$ rupiah and reduces the amount paid in period 6 to junior creditors to zero.

In period 4 all action occurs on the market for foreign exchange which is not the focus of this paper. The reader is referred to the extensive literature on speculative attacks and balance of payments crises to support the assumption that a sunspot can affect the exchange rate if the foreign exchange authority has insufficient foreign currency (dollar) reserves to repurchase the domestic currency (Rupiah) assets held by speculators (Krugman 1979, Flood and Garber 1984, Obstfeld 1986, Agenor, Bhandari and Flood 1992, Spadofora 1998). Assumption A4 implies that there is not a unique equilibrium exchange rate and that the foreign exchange market is in effect purely speculative, so that any exchange rate is the market clearing exchange rate if it is expected to last. This does not seem to be an extreme assumption given the events.

As noted above, the choice in period 3 of all firms to refinance with all dollar denominated new debt if $f=1$ and of no firms to refinance with all dollar denominated new debt if $f=0$ is the critical point of the proposed sunspot equilibrium. From the analysis of periods 5 and 6 above it is clear that manager i receives residual income of $\frac{p}{2} K_i$ in this equilibrium if $f=1$ and $y=1$ and she converts all debt to dollar denominated debt. Total repayments to creditors are $\frac{p}{2} K_i$. In contrast if she does not refinance, she will repay all debt and repayments to senior creditors will be $(2b_i + (1-b_i)i_L) K_i$ rupiah. In exchange for such larger

repayments the firm will have the opportunity to buy capital of other firms which has been seized by creditors for a very modest price. In the case in which one firm deviates from the refinance with dollar denominated debt equilibrium, this firm will have a monopoly on financially unburdened management skills and can buy capital for creditors' reservation price $p/2$ per unit of capital.

This means that by deviating and not converting all debt to dollar denominated debt, firm i obtains profits $p/2$ per unit of new capital. However, since firm i can expand K_i only by a factor of a this is less profitable than renegotiating repayment of debt to half of profits on firm i 's original investment if a is small enough.

The gains described above are in addition to the conventional gains or losses from insuring against devaluation by issuing debt in rupiah. However, since banks and firms are risk neutral and have rational expectations, the expected value of conventional gains and losses is zero, so, if a is small, expected end of period 6 wealth of firm i is greater if it converts all debt to dollar denominated debt if $f=1$. In other words, the argument in the preceding paragraph considers repayments on senior dollar denominated debt and profits from purchase of capital of distressed firms. It does not consider repayments of junior denominated debt if the firm refinances or repayment of rupiah denominated debt if the firm does not refinance. These payments are not considered since they must be equal in expected value given the assumption that all agents are rational and risk neutral.

In contrast, the effect of refinancing on expected payments on senior dollar denominated debt (or on any senior rupiah denominated debt held by creditors who do not accept refinancing) need not be zero, since such senior creditors do not have to (or do not) agree to refinancing.

To formalize this argument, consider the market for new, junior dollar denominated debt issued in period 3. This debt will pay $1+i_j$

where i_j is the payment made on junior dollar denominated debt in period 6 if there is no devaluation. If there is a devaluation no payment is made on junior debt so

$$4) (1+i_j)(1-B)=1+i$$

As noted above the expected return on senior rupiah debt must be the same as on junior dollar debt.

To determine whether it is optimal for firms to refinance, consider expected repayments income of firms after debt repayments with and without refinancing.

Without refinancing the firm, if there is a devaluation, the can expand and obtain income $a p K_i$. It pays $(a-1) p K_i/2$ for the new capital and fully repays $(2 b i_s + (1-b) i_L)$. If the firm does not refinance and there is not a devaluation it obtains residual income $(p - b i_s - (1-b) i_L) K_i$

So expected residual income Π in period 6 conditional on $f=1$ is given by equation 5

$$5) \Pi = (1-B)(p - b i_s - (1-b) i_L) K_i + B[a p K_i - (a-1) p K_i/2 - (2 b i_s + (1-b) i_L) K_i]$$

If the firm does refinance and there is not a devaluation it receives $p K_i$ and pays $(b i_s + (1-b) i_j) K_i$. If the firm refinances and there is a devaluation it receives $p K_i$ and pays only $p K_i/2$ so

$$6) \Pi = (1-B)(p K_i - b i_s - (1-b) i_j) K_i + B p K_i/2.$$

Refinancing is optimal if inequality 7 holds

$$7) (1-B)(p K_i - b i_s - (1-b) i_j) K_i + B p K_i/2 - (1-B)(p - b i_s + (1-b) i_L) K_i -$$

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$$B[\mathbf{a}pK_i - (\mathbf{a}-1)pK_i/2 - (2b i_s + (1-b)i_L)K_i] > 0$$

Inequality 7 simplifies to inequality 8 because expected repayments on junior dollar denominated debt must be equal to expected repayments on Rupiah debt with bankruptcy risk and because all scheduled repayments are made in the absence of a devaluation

$$8) BpK_i/2 - B[\mathbf{a}pK_i - (\mathbf{a}-1)pK_i/2 - (2b i_s + (1-b)i_L)K_i] > 0$$

If inequality 3 holds with equality, this simplifies further to inequality 9

$$9) (1-(\mathbf{a}-1))BpK_i/2 > 0$$

Which states that it is better to refinance if $f=1$ and $\mathbf{a}<2$.

If all other firms have sufficient exposure to devaluation risk that devaluation causes insolvency, it is optimal to refinance if inequality 3 holds with equality and firms can manage no more than double the capital managed the previous period. If inequality 3 holds with inequality, refinancing is less attractive for given \mathbf{a} , but there is an ϵ small enough to make it optimal.

In contrast if $f=0$, no other firm converts all debt to dollar denominated debt so, in the case of a devaluation, creditors seize firm i 's capital if it converts debt to dollars. This means it is not profitable to deviate from the equilibrium of not converting debt to dollar denominated debt in period 3 if $f=0$.

In period 2 only the sunspot moves.

In period 1, banks anticipate the possibility that firms might will

convert rupiah denominated debt to dollar denominated debt in period 3. Thus the interest rates they charge on rupiah and dollar denominated debt acquired in period 1 reflect this risk. Since banks and firms are both risk neutral and have the same rational expectations about the distributions of f and y in periods 2 and 4, each is indifferent between rupiah and dollar denominated debt in period 1.

Formally, since banks are risk neutral, the expected return on dollar denominated debt (in dollars) must be equal to the dollar risk free rate

$$10) 1 = i_{\$}/(1+i)^5 + 1 - ABi_{\$}/(1+i)^6 + AbPK_i/(4(1+i)^6)$$

so

$$11) i_{\$} = [(1+i)^6 - AbPK_i/4]/(1+i+(1-AB))$$

Since holders of rupiah denominated debt do not have to resell it even if $f = 1$ the expected return on rupiah denominated debt differs from the expected return on dollar denominated debt only because rupiah lose value with devaluation. The expected return (in dollars) of rupiah denominated debt must be equal to the dollar risk free rate

$$12) 1 = i_L/(1+i)^5 + 1 - ABi_L/(1+i)^6 + AbPK_i/(8(1+i)^6)$$

So

$$13) i_L = [(1+i)^6 - AbPK_i/8]/(1+i+(1-AB))$$

Since expected unconditional returns of both types of debt are equal assumption A7 is consistent with rationality.

To recap, firms initially contract debt both in foreign and domestic currency with little enough foreign currency denominated debt that there is no chance of bankruptcy unless they acquire more foreign currency denominated debt. The risk premium charged by rational creditors may be very low. The subsequent choice to assume dangerous levels of dollar denominated debt is made independently

by domestic firms, however they all make the same choice (which is not predictable in advance). Formally it is assumed that a payoff irrelevant variable (sunspot) is observed and firms condition their choice on the sunspot. In particular each firm rationally chooses to refinance domestic currency denominated debt with new foreign currency denominated debt if and only if other firms do. Each manager realizes that in the case of devaluation her firm will be bankrupt, but that, if all other firms are bankrupt as well, her creditors will have to renegotiate debt repayments with her. Later possible devaluation can be caused by the action of investors who observe another sunspot. If and only if the first sunspot implies that firms refinance and the second that there is a speculative attack all firms in the economy are unable to meet scheduled debt repayments.

II Discussion

Clearly the equilibrium described above does not correspond to south East Asian reality, since, even in Indonesian, not all firms went bankrupt. It is important to decide whether the basic conclusions strictly require the extreme event of universal bankruptcy. They do not. So long as solvent firms are few enough and have a low enough that they can't able to take over and manage all capital of bankrupt firms, they are in a strong position when bargaining over the price of seized assets. To semi-formalize, assume that at the beginning of period 5 banks have one chance to arrange a deal to sell assets of their insolvent debtors to solvent firms. The banks reservation price is cash on hand plus one half of period 6 profits (what they get from bargaining with incumbent managers). If the few solvent firms can not buy and manage all the capital of insolvent firms, the analysis above of the case of a single solvent firm remains valid, that is, they can buy the assets for banks' reservation prices. Payoffs differ from the case above only because managers who refinance face a positive risk of seizure of their firms if they convert rupiah debt to dollar

debt. Clearly, if the fraction of solvent firms is low enough, this need not make refinancing irrational.

It remains to be explained why some firms might have chosen not to refinance and thus to remain solvent in the case of devaluation. This could be explained within the type of analysis presented above, if they have unusually high β .

The other unrealistic assumptions were chosen to make it harder to find a refinancing equilibrium.

Assumptions A2, A3, A4, and A7 range from slightly to highly implausible. A7 states that firms could have repaid debts if there had been no devaluation. It basically must be true if banks rationally chose to lend at interest rates similar to medium quality corporate bond rates. While it is not clear that banks were rational, this is a standard assumption. Clearly if banks were naive, the potential to profit from their mistakes is higher and it is easier to find a rationale for domestic firms' choice of dollar denominated debt.

Assumption A2, that creditors can costlessly and instantly seize assets and that seniority is strictly respected is highly unrealistic. Clearly it makes it much more difficult to find an equilibrium in which firms choose dollar denominated debt. Indeed it is possible that dollar debt was chosen because borrowers knew that the bankruptcy process in South East Asian countries was slow and unfavorable to creditors and that banks naively imagined otherwise.

Assumption A3, that seniority is strictly respected, was used in the analysis. However, it was introduced since the equilibrium is based on refinancing which is jointly profitable to debtors and junior creditors because it reduces the value of senior debt. Strict enforcement of seniority makes it much more difficult to achieve this.

Finally assumption A4 is exceedingly unrealistic. It implies that the financial crisis had no effect on production. Obviously interest in the issue is largely motivated by the huge recessions which followed devaluation. Further large costs of conflict resolution and financial distress are easy to understand and well documented even in the absence of macroeconomic disruption (Cutler and Summers 1988). The assumption was made partly to focus on corporate finance, but largely to make it more difficult to find a refinancing equilibrium. The key question is must it be highly profitable to be one of the few solvent firms in the economy. Assumption A6 is sufficient to make the answer no. However another reason why it was, in fact, not highly profitable to solvent firms in affected countries is that operating profits are low if there is a severe recession caused by mass bankruptcy (or caused by macro-economic policy errors). Thus the opportunity to buy capital for a low price is not immensely valuable if that capital is not generating positive operating profits and might not begin to do so for a long time. Thus, like assumptions 2 and 3, assumption 4 was made largely to make it difficult to find a fully dollarized debt equilibrium.

IV Conclusions

This paper has presented a model in which widespread bankruptcy following a devaluation follows from rational choice on the part of the bankrupt firms and their creditors. In the model severe mismatch between dollar denominated debt and domestic currency revenues of firms may occur. The explanation is based on the possibility that it is relatively less costly to enter bankruptcy if many other firms in the same country are bankrupt. This possibility depends on two key assumptions, that national characteristics make it very difficult for foreigners to manage firms in the country and that the capacity even of domestic firms to effectively expand via mergers and acquisitions is limited. In the

model creditors are fully rational. To reconcile the large observed losses of creditors with rationality, it is assumed that debtors actions depend on a sunspot. Thus widespread balance sheet miss-match might or might not develop. Much simpler models can explain the observed experience of firms in East Asian countries and their creditors if creditors are irrational.

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