Currency and Financial Crises:
Dividing the (Negative) Spoil

(submitted as a D.Phil Thesis)

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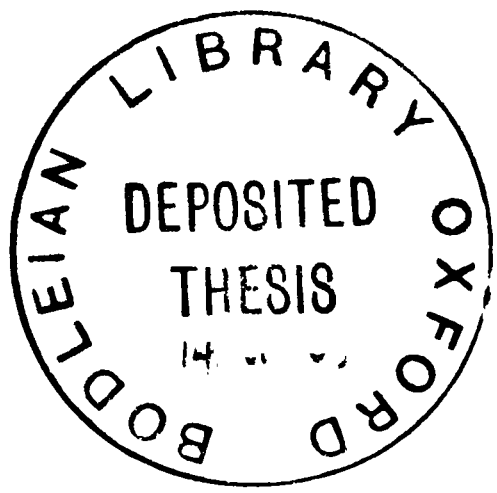

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Abstract

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Following the 1997 Asian Crisis, a number of economies have been burdened with so-called Twin Crises, facing both vulnerable exchange rates and a distressed financial sector. The three papers in this thesis examine the resolution of a twin crisis in one such country - Indonesia. In *debt overhang and exchange rate collapse*, I adopt the simplest representation of the economy and the Asian crisis. The model is a modified Hecksher-Ohlin framework with labour as the sole domestic factor. The crisis is triggered by a terms of trade shock. The analysis implies that workers have already suffered a wealth loss in the form of a wage cut. If they are inclined to pay all the overhang, they will take another cut - a large one - due to the so-called overhang multiplier. In *Indonesian cronies' tardy crisis resolution skills,* both the underlying model and the description of the crisis are made more realistic. The model has another domestic factor added to allow for the existence of domestic capitalists. The crisis is triggered by two additional factors; a loss of confidence by foreign investors and an end to a domestic subsidy on foreign capital. Until agreement is reached on the overhang, the economy suffers so-called corporate decay. I introduce the cronies, and show that it may be optimal for them to stall agreement, even if there is perfect information. Contrary to conventional wisdom, bankruptcy reforms do not necessarily hasten agreement, though they do improve the payoffs to the international creditors. In *debt forgiveness*, I examine the pessimistic scenario that Indonesia becomes like a Highly Indebted Poor Country (HIPC), so that all the issues related to debt forgiveness become relevant. I improve a contract arising from a workhorse model of debt forgiveness, showing a better way to provide reform incentives for countries heavily in debt.

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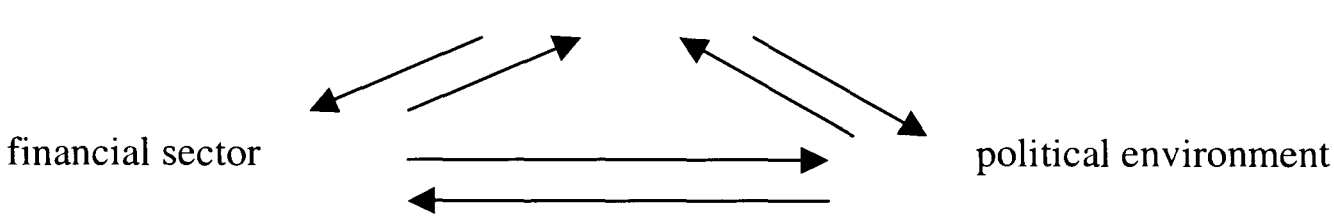
Chapter 1: Background to the Papers

1 Introduction

Following the 1997 Asian Economic Crisis, a number of economies have been burdened with so-called Twin Crises, facing both vulnerable exchange rates and a distressed financial sector. One connection between the two is the stock of unhedged foreign debt, blunting (or completely reversing) the normal stabilizing properties of a floating exchange rate. Policy makers in these economies must operate in an environment reminiscent of the proverbial chicken and the egg, with another egg thrown in.



Which comes first? Given unhedged liabilities, financial sector reform and corporate debt restructuring are always overshadowed by developments in the foreign exchange market. Progress on the financial sector front, in turn, feeds back into further exchange rate fluctuations. The additional factor is the political environment that influences, and is influenced by, both the exchange rate and the financial sector.

The purpose of this thesis is to explore the resolution of a twin crisis in such a complex environment. The focus is on how to divide the debt overhang - the 'negative spoil' - between the domestic capitalists, domestic workers and foreign creditors.

It is difficult to proceed with such an analysis at a high level of generality, since the foreign debt literature is burdened by some unresolved issues. In particular, there is the fundamental question of why debtors pay off liabilities in the international arena.[1]

If it is the fear of financial autarky that encourages payment, then one wonders how that fear can be maintained in the face of creditor lenience. For example, sovereign defaulters from the 1930s were able to borrow again by the 1960s (Lindert and Morton 1989).[2] Furthermore, dictators have discovered that the existence of discrete financial havens makes it possible to secure a stream of benefits from a loan, even if it is in default to its original creditor (Hanlon 1998).

Considerations such as these have led some writers to emphasize disruption to trade as a possible sanction (Bulow and Rogoff 1989), while others have emphasized the effects of reputation across multiple relationships (Cole and Kehoe 1998). Finally, there is the possibility that some parties feel an obligation to pay their debts. Weak though this latter motivation may be, it is not to be dismissed out of hand.[3]

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[1] It is standard to distinguish between sovereign debt, for which it is difficult to penalize problem debtors, and private debt. However, for countries with weak legal systems, the enforcement of private debt contracts is problematic, and the distinction could be blurred (Eaton 1993).

[2] Lindert and Morton argue that defaults lead to a subsequent restriction in lending, but that all developing countries tend to suffer, and, that the defaulters are not penalized when lending resumes.

[3] I asked various Indonesian officials about the importance of debtor moral obligations. A former central bank governor said that he thought exporters sometimes wanted to pay. An IMF representative noted that the Indonesian Bank Restructuring Agency presses for personal guarantees from debtors. Any outstanding guarantees are perceived, in Asian culture, to be transferable to one's children upon death, thereby bringing dishonor. The debt negotiators I talked to expressed the view that some participants, particularly small debtors, do want to pay. However, 'they are influenced by the chance of getting away with not paying'.

In what follows, I examine how the negative spoil might be divided in the case of Indonesia. This allows me to impose a *volitional structure* (i.e. who wants to pay what to whom) on agents in the debtor nation, based on their observed actions to date. The advantage of doing this is that the motives of the parties do not have to be proven theoretically. The disadvantage is that any results may not be transferable to other debtor nations.

It is important to state at the outset the linkages between the positive and normative aspects of the analysis. Primarily, I will focus on how the debt *will* be divided, rather than how it *ought* to be divided. However, in all the models where there is resolution, the relationship between debtor and creditor is maintained.

If this is indeed the outcome, growth theory suggests some commonsense ways in which an orderly resolution may be advantageous from the point of view of the debtor. If debtor/creditor relationships are preserved, there may be new lending. In an open economy, this can lead to rapid capital formation, with possible knowledge spillovers from foreign direct investment.[4] This, in turn, may help avoid social disintegration, and its adverse effects on growth (Rodrik 1999). Thus, from the debtor's point of view, how the debt *is* divided may be close to how it *ought* to be divided.

The remaining material in this first chapter is organized as follows. Section 2 examines Indonesia prior to the crisis. Sections 3 and 4 cover the basic facts of the crisis, and some

[4] There is no need to assume that capital formation must come through domestic savings, especially for an emerging economy.

related theoretical issues. Section 5 introduces the three basic models used in thesis and Section 6 summarizes their conclusions.

2 Indonesia Prior to the Crisis: the Rise of the Cronies

Paradoxically, the Indonesian economy exhibits both underdevelopment and long-standing internationalization. By the latter I mean that the production of spices (and later oil) has supported a vigorous trading relationship with the rest of the world. Indonesia's membership of OPEC is common knowledge, but its two century captivity to the Dutch East India Company (Vereenigde Oost-Inddische Compagnie;VOC) is less often remembered.[5]

The VOC existed between 1602 and 1799. Its quasi military status allowed it to enforce a monopsony in the Indies, while dominating European markets for spices. It ruthlessly uprooted existing plants, concentrating production in its own plantations. Some indication of its enormous profitability is given by its return on investment. By 1670 it was the richest corporation in the world, offering a 40 per cent dividend to its shareholders. It boasted 50,000 employees, 30,000 fighting men and 200 ships (Economist 1998). The height of exploitation occurred in the 18th Century, where spices were transferred to the company in the form of either so-called forced deliveries or contingencies. The former was 'tribute disguised as trade' while the latter was 'tribute undisguised'. The whole system of trade was designed to extract produce from the Indies for disposal on a European market without stimulating any fundamental technological

change in the area's economy. The surplus belonged entirely to the company or its 'perkeniers'[6] (Britannica 1997).

Several longstanding sociopolitical conflicts exist in Indonesian society, some of which have relevance for the economy. First, there is the political and economic dominance of Java. Second, there is the conflict between Muslim and non-Muslim peoples. Third, there is the conflict between the different Muslim factions (particularly on Java). Finally, there is the conflict between rich and poor. The latter conflict largely subsumes racial conflict, because many of the rich are non-indigenous. By far the most economically important people-group among the rich are the Chinese. Accounting for 2 per cent of the population, they nonetheless control around three-quarters of the nation's wealth and own much of the small-scale industry. Furthermore, this racial/distributional conflict is reinforced by religious ones - the Chinese being Christians, Buddhists and atheists. Recent violence directed against the Chinese has clearly been detrimental to the economy (Radalet 1999).

Any assessment of Indonesia's development would be incomplete without a discussion of the policies of the Suharto regime. The embodiment of 'guided democracy' (a phrase coined by his predecessor Sukarno to describe authoritarian leadership glossed over by some democratic institutions) he nonetheless pursued policies that were responsible for bringing millions of Indonesians out of poverty.

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[5] Indonesia has only existed as a sovereign nation since 1949; the following comments refer to the geographical area destined to become Indonesia.

Suharto was declared president in 1968 following a coup and the slaughter of hundreds of thousands of communists. He immediately indicated his pragmatic style, by diffusing a conflict with Malaysia that had led to Indonesia's withdrawal from the UN in 1965. His 'New Order' sought to reverse many of the anti-Western policies of Sukarno.

He rescheduled Indonesia's foreign debts (probably aided by his anti-Communist reputation) and attracted aid through an intergovernmental group of donor countries. The complex regulations governing economic activity were simplified. In 1967 a new foreign investment law provided a framework for new private capital investment. Oil production increased, as the administration coordinated successful exploration with the aid of foreign oil companies.

With respect to these foreign capital inflows, later modeling will acknowledge this use of foreign capital in the production of exportables. I will adopt the simplifying assumption that *all* capital in the exportables sector is borrowed from foreigners.

In the mid-1980s there was a large decline in the oil price, requiring some very skillful policy management. The regime rose to the challenge, managing to combine adjustment, growth and human development (Stewart 1995). Successful economic reforms achieved the required external adjustment by emphasizing switching, as well as disabsorption. That is, trade liberalization allowed a wide range of firms to compete in the production of labour-intensive manufactured products on world markets. Firms producing textiles, garments, footwear, toys, furniture, and later electronics, expanded rapidly, creating

[6] A small European plantation owner controlled entirely by the VOC.

millions of jobs in the late 1980s and early 1990s that lifted many Indonesians out of poverty (Radalet 1999).

Suharto had to withstand significant criticism during the early stages of his reforms. Many felt that Indonesia was excessively reliant on overseas capital, and that the exploitation of the VOC had returned in another guise. They complained, with some prescience, that Suharto had created a 'crony' class that had lined their pockets with the help of foreign companies.

Nevertheless, by the 1980s the criticisms had abated, as the spectacular successes of the New Order came to be seen. Of particular interest was the way in which Suharto attempted to redress regional grievances. Although three quarters of new investment (excluding oil) between the late 1960s and 1980s occurred in Java, in per capita terms the outlying regions fared well (Britannica 1997).

Radalet's assessment of the Suharto regime is more mixed from the mid-1980s onwards. The two developments that would ultimately prove Indonesia's undoing were the emergence of a weak financial sector, and the increasing power of the inner circle of 'cronies'.

Banking reforms saw the number of private banks rise from 108 in 1988 to 232 in 1993. This was accompanied by the usual advantages of such reforms. Intermediation costs fell, and many Indonesians could access the financial system for the first time. However,

financial system regulation and supervision was not effective. The central bank would not, or could not, enforce prudential standards - especially for banks with links to the cronies. By the early 1990s bad loans were on the rise, some banks were undercapitalized, and many banks were in violation of normal standards such as the share of loans outstanding to affiliated companies. However, the decay of the financial system was evident only to those with knowledge of the quality of the loans rather than their quantity. At the onset of the crisis, credit growth was modest compared to other countries in the region (Radelet and Sachs 1998).

As President Suharto's children came of age, the family circle came to extend its influence into many new areas. Initially its commercial interests had mainly been in military-controlled natural resources. At this later time, it reached into non-military resource opportunities, then into domestic manufacturing, and finally into finance. The picture was clouded by the success of many export businesses that had no connections with the family circle. International creditors continued to lend, based on solid growth and, possibly, the perceptions of implicit backings for the business interests of the president's family (Dooley 1999). Another political snare for Indonesia was the lack of a clear successor for the President. This was one factor that differentiated Indonesia from other Asian economies embroiled in the later crisis (MacLeod 1998).

Meet the Cronies

The inner circle of Suharto - the cronies - turn out to be very important players in the later modeling. It is therefore worth pondering their characteristics in some detail. Not

surprisingly, however, they try to keep their affairs hid from public view. The evidence is fragmentary, but a number of assertions can be made.

First, *they own a large share of the wealth of the economy.* According to one estimate (Meyerman 2000), the Suharto family owned 18 per cent of the stock of wealth prior to the crisis. Furthermore, it is likely that they own a sizable proportion of equity listed on the Jakarta Stock Exchange. Created in 1977, the bourse was deregulated in 1988, leading to significant share acquisitions by foreigners (MacLeod 1998). Nevertheless, the companies listed were tightly controlled, with the domestic owners having majority shareholdings.

Second, *some of their activities are illegal.* Over the past few years, irregularities in the cronies' business dealings have led to a number of prosecutions.

Third, *they have pilfered large sums from a corrupt banking sector.* Of the 21 largest obligors being pursued by the Indonesian Bank Restructuring Agency (IBRA), 4 are directly connected to Suharto (sons Tommy and Bambang, a brother-in-law of Suharto's daughter, and a close friend) while the largest obligor, Texmaco, had indirect links with him.[7]

Fourth, *they are enjoying the chaos of the twin crisis.* Debt negotiators report a reluctance of a number of large well-connected firms to engage seriously in the

[7] Personal communication: World Bank official.

bargaining process.[8] They surmise that there are advantages to these firms of having the crisis continue. This is an important feature of later modeling. I assume that the cronies can pilfer some other firms, as well as the banks, while the crisis continues.

Another characteristic of the cronies that is important for later modeling is their consumption preferences. I adopt the assumption that they only consume traded goods, to avoid mathematical intractability. This makes the model structure observationally equivalent to a setup where the cronies are foreign capitalists who live in, and run, the domestic economy, though I do not adopt that interpretation. Naturally, it is indefensible to argue that the capitalists in Indonesia consume *literally* no non-traded goods. It is more interesting to ask if this could stand as a reasonable approximation.

It seems certain that urban capitalists consume a greater proportion of traded goods than poor rural consumers. Food is a very large proportion of consumption for poor households, and in rural areas it is likely to be non-traded. The situation is more complex when comparing rich and poor households *within* urban areas. To the extent that urban food is tradable, the aforementioned large share of food in the consumption basket of the poor erodes the reasonableness of the assumption. Furthermore, the urban rich consume more services, especially those of the informal sector, which are non-traded (Stewart 1995). However, when we consider the *very* rich, the assumption again looks more reasonable as we have to take into account such luxury imports as Western education for the cronies' children (secondary and tertiary), holidays and automobiles. So, despite the pragmatic motivation for the assumption, it may not be too far removed from reality.

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[8] Personal communication: Jakarta Task Force Initiative

3 The Asian Crisis and the Negative Spoil

Even though I have chosen to model Indonesia, it is necessary to set it within the context of regional events in the late 1990s. There are two reasons for this. First, the initial depreciation of the rupiah was probably not driven by fundamentals. Arguably, the depreciation of the Thai baht caused the initial decline in the rupiah. Second, the countries in the region had come to be grouped together by the 1990s, probably due to emergence of fund managers as a major source of finance. Portfolio investment had become very important at that time – first channeled through banks, then later on directly through funds management institutions. Although these fund managers adopted a more rigorous diversification strategy, they tended to treat emerging markets as an investment class, rather than develop detailed country-specific expertise (Grenville 1998). To the extent that the Asian economies were grouped together as an investment class while capital was flowing in, it seems sensible to group them together as we consider capital flowing out.

Accounts of the crisis inevitably start with the economic conditions in Thailand, since its demise cannot be attributed to contagion. The Thai macro policy stance up until the 1990s had combined a fixed exchange rate regime with contractionary fiscal policy, allowing a devalued exchange rate and export driven growth. Despite the benefits of this policy, it came apart during capital liberalization in the mid-1980s. A boom led to higher interest rates, but the commitment to a fixed exchange rate resulted in massive unhedged capital inflows. The basic point is that in a Mundell-Fleming world one cannot independently control liquidity, interest rates and the exchange rate (Corbett and Vines 1999).

The next nail in the coffin was the existence of implicit guarantees in the financial system (Dooley 1999). Foreign capital flow liberalization expanded the size of these implicit guarantees dramatically, in a way that was not originally realized. Furthermore, the tendency to overinvest during the euphoria of the 1990s led to many poor quality investments going ahead.

The crisis struck the region when events transpired that would, under normal circumstances, have led to currency depreciations. Poor quality investments began to come to light, and export volumes for a number of countries in the region stagnated (MacLeod and Garnaut 1998).

The crisis struck Thailand first because of additional country-specific factors. The baht was pegged against an appreciating $US, and, real wages had risen during the preceding boom. Both of these combined to create a weak export sector, highly susceptible to an overvalued currency and high interest rates (Corbett and Vines 1999). When speculators smelled the blood, the authorities found it too damaging to this sector to defend the currency with high interest rates. The exchange rate was floated, and most of the other regional currencies followed suit.

The floating of the baht made investors look hard at Indonesia (MacLeod 1998).[9] The 'wake-up call' was particularly damaging given the uncertainty surrounding the future of

[9] The remaining description of the crisis draws heavily on two sources ((MacLeod 1998) and (Radalet 1999)) that will not be cited repeatedly.

the leadership. The fact that the President fell ill in the midst of the crisis heightened these concerns.[10]

After the initial depreciation, the government struggled to maintain credibility. The problems seem to have centered around divisions within the government and the interventionist visions of the former Research and Technology Minister B.J. Habibe (now the former President). More generally, the strong tradition of economic nationalism in the community, the ethnic tensions and a lack of sympathy for the market economy within the bureaucracy made governance difficult.

The floating of the exchange rate was accompanied by sporadic intervention, leading to concerns that the float was not 'clean'. The government then tightened monetary policy, raising interest rates sharply. The property and construction sectors were very hard hit, adding to the growing pool of unemployed workers.

The government called in the IMF, and the first package was announced on 5 November 1997. One of the main features was the immediate closure of 16 private banks. As in Thailand, this only worsened confidence, especially given that there were rumors that as many as 40 banks had been listed for closure. Soon the central bank was involved in a very large liquidity support program for the private banks. Another controversial move was the directive to tighten fiscal policy. The IMF subsequently defended this, saying that it was necessary to make fiscal provision for the repair of the

[10] Nevertheless, the Indonesian government received praise for its initial handling of the crisis (Radelet and Sachs 1998). The currency was immediately floated, thereby preserving reserves, and they eased foreign

financial sector (Fischer 1998). In the event, significant slippage occurred. The final criticism of the IMF was that it used the crisis to insist on an exhaustive list of reforms that could never have been achieved, or even credibly committed to, in the time frame necessary to arrest the currency slide. This was arguably a missed opportunity; the IMF gave investors an exaggerated impression of the country's economic difficulties.

The rupiah strengthened following the announcement of the $US10 billion IMF bailout. The World Bank and the Asian Development Bank together offered an additional $US 8 billion. Other governments promised stand-by loans of around $US 20 billion. In an attempt to make the package seem more impressive than it really was, the Indonesians tacked on an additional $US 5 billion – providing financial assistance to themselves!

However, there was no clear strategy for the use of these funds. Fiscal policy was not to be loosened, the IMF was (at that stage) set against staples subsidies, the IMF charter forbade it to bail out private sector debt and the government was theoretically committed to a clean float in the foreign exchange market. As this aimlessness dawned on the markets, the rupiah continued its slide, especially after the President fell ill. By December 1997 it was trading at around 5000-6000 per $US, around half its value in July.

The budget in early January decimated the government's credibility. The decision to leave the forecasts unaltered by the recent events (not even providing an appendix for reworked estimates) gave the impression of a leadership out of touch with reality. The

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investment rules.

document was also badly written, making policy appear more expansionary than it really was. The obvious displeasure of the IMF and the World Bank, together with the market's apprehension, led to a further slide in the rupiah. Consumers rushed to the supermarkets, and Indonesia became front-page news around the world. The government then had to renegotiate another package. Although the IMF dropped its demands for fiscal austerity, it drew up a much longer list of required reforms.

The President virtually repudiated the second IMF agreement before it began to be implemented. The rupiah had now fallen from 6000 per $US at the end of 1997, to 17000 per $US in January. There was a period of recovery, especially after the President's re-election in March and the appointment of a new cabinet. Following the third IMF agreement in April, the rupiah settled to around 7500-8000 per $US. However, stability was short-lived. Increases in the administered prices of food and electricity led to rioting and anti-Chinese violence. The rupiah fell to 10000 per $US.

Subsequent IMF agreements are noteworthy for their acceptance of the costs of crisis management, on the one hand, and their preoccupation with financial restructuring on the other. With regard to the former, significant fiscal slippage has had to be accepted. The public debt to GDP ratio has risen to over 100 per cent. With regard to financial restructuring, the Indonesian Bank Restructuring Agency (IBRA) is selling off the bad debts of the banks, many of which had to be taken over. The so-called Jakarta initiative for the voluntary restructuring of debt attempts to address the problem of corporate debt, by bringing together debtors and creditors to facilitate agreement. Furthermore,

restrictions on debt-equity swaps have been removed, and legislation now ensures that mergers are tax-neutral. The banking sector has recently regained its solvency for the first time.

The Negative Spoil

What has been the effect of the crisis on Indonesia's external debt position - the 'negative spoil' that must be divided ere this thesis ends?

First, I consider public debt. Prior to the crisis, the debt-to-GDP ratio was 25 per cent; it is now over 100 per cent. Of the increase, 50 percentage points are due to the financial sector bailout (which covered both depositors and creditors) and an additional 25 percentage points are due to the exchange rate revaluation effects on foreign debt. The bailout of the financial sector has been large as a percentage of GDP, as Figure 1 shows.

Figure 1

Costs of Financial Restructuring (% GDP)

Indonesia 97	47
Thailand 97	29
Chile 81-87	29
Mexico 94-99	19
Korea 97	17
Sweden 90-93	4
US 80-92	2

(IMF 2000)

Furthermore, the Indonesian tax base is difficult to broaden. There has been an excessive reliance on oil revenues, and attempts to raise taxes and abolish subsidies have

precipitated the downfall of two regimes (Suharto and Habibe).[11] To the extent that it is difficult to raise taxes for all public debt, it will be difficult to raise money for public external debt. Given these difficulties, it is possible that Indonesia may one day find itself a candidate for debt forgiveness.

However, the problem is not restricted to the public external (i.e. sovereign) debt already in existence. There is a large stock of corporate debt, some of which may end up being socialized. The aggregate debt of private enterprises in Indonesia is estimated at around $US 100 billion. About $US 80 billion is denominated in foreign currency, with $US 30 billion of this foreign-currency debt owed to domestic creditors, and $US 50 billion owed to external creditors (IMF 2000).[12] A substantial proportion of this is reported to be non-performing, but it is unclear how much this represents an inability to pay as opposed to strategic defaulting.[13] In the later modeling, I assume that many corporations are in strategic default, and that the money that could be paid to foreign creditors is finding its way to the cronies. However, I also assume that this only continues until the genuinely non-performing loans are restructured.

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[11] Roughly speaking, Indonesian tax is 20 per cent of GDP, compared with 30, 40 and 50 for the US, UK and mainland Europe respectively (personal communication: Andrew Dilnot, Institute for Fiscal Studies).
[12] There are enormous difficulties in evaluating Indonesian GDP in foreign currency, given the currency fluctuations, though it is of the order of magnitude of around $US 150 billion. Hence, I give the external debt figures in $US.
[13] One argument for suggesting the defaults are strategic is to note that the economy could have gone into a much deeper recession than it actual did. That is, many businesses still seem to function. However, another alternative is that the informal financial sector has come into its own in the crisis. Prior to the crisis, peasants dealt directly with Chinese/Arab money lenders (the former using pawn shops to attract collateral, and the later engaging in direct lending). In many cases, the loans are carried out on the basis of personal relationships, sometimes without the need of collateral. The biggest form of credit are advances on a future harvest. It is possible that a similar thing may be happening on a bigger scale, but a society in chaos may exhibit a certain breakdown of trust in relationships. This may be particularly important here, since the Chinese have been subjected to violence.

Even if the corporate debt is not socialized explicitly, there is still the issue of how helpful the Sovereign (i.e. the authorities in the nation state) is with regard to enforcing contracts. There is substantial concern outside Indonesia that collecting private debt may be just as difficult as collecting sovereign debt. Part of the fear stems from the observed confusion over the ownership of assets in the economy.[14] Thus there is a sense in which 'willingness to pay' - the binding constraint in a sovereign debt contract - is also the binding constraint in the case of corporate external debt. For no contract, however carefully written, can be enforced without a commitment by the Sovereign to clarify basic ownership issues. Such a commitment could reasonably be called a 'willingness to pay'. Though it has been common to stress the importance of the sovereign debt in the onset of crises,[15] the literature contains some balancing remarks about sovereign risk in *private* contracts.

[14] For example, the Far Eastern Economic Review ran an article on April 26, 2001 entitled 'A Victim of Legal Anarchy'. In December 2000, the Canadian insurer Manulife purchased a 40 per cent stake of its bankrupt Indonesian partner Asuransi Jiwa Manulife AJMI at a state run auction. Subsequently, the legitimacy of the transaction was questioned by a British Virgin Islands-registered company claiming to have already purchased the shares.

[15] Writing prior to the Asian crisis, one review of the literature held that most debt crises have been triggered by unforeseen deflation, budgetary problems and low trade openness. Also, the unpaid debt had been sovereign (Lindert and Morton 1989).

'Why, given the public finance problems associated with sovereign borrowing, has so much borrowing been done by governments rather than by private entities? There are probably many reasons. But *given the nature of contract enforcement and bankruptcy procedures in many debtor countries, lending to private borrowers would not have avoided problems of sovereign risk.* Lenders would have had to rely on the borrower's government to *enforce loan contracts*, *protect property rights*, and *administer bankruptcy procedures fairly*. In fact, much of what was borrowed privately was ultimately assumed by borrower governments, even when loans were not guaranteed by the borrower's government.'

(Eaton 1993), page 150. Italics mine.

In the later papers I adopt the modeling strategy of treating all Indonesian external debt as a single entity, not distinguishing between sovereign and private debt. This eases the mathematical analysis considerably, but the above observations suggest that there may indeed be a blurring between the two.

I conclude this description of the Asian crisis by reiterating the 'chicken and egg' nature of policymaking in Indonesia. The IMF suggests that stalled reforms will weaken investor confidence and depreciate the exchange rate. However, they also note that a depreciated exchange rate will threaten fiscal sustainability through its effect on the stock of public debt (IMF 2000). A question mark over fiscal sustainability would surely weaken investor confidence, completing the feedback loop.

The pivotal role of the exchange rate is alarming, given how difficult it is to forecast. There is considerable evidence that the international foreign exchange market is not rational, in the sense that traders do not all hold the *same* expectation, equivalent to the *mathematical* expectation. The most powerful evidence comes from the failure of uncovered interest parity, across so many bilateral rates and over such a long period of

time (since the early 1970s for many major currencies). Survey evidence has also been damning.[16]

As for the link between policy changes and the exchange rate, many central banks now use a monetary conditions index. This is a conflation of a number of indicators of the transmission mechanism supposed to gauge the overall stance of monetary policy. More importantly for the purposes of this discussion, it is a tacit admission that there is not a one-to-one correspondence between interest rates and the exchange rate (as in, say, the Mundell-Fleming model), for otherwise there would be no need to consider both. Therefore attempts to influence the exchange rate through monetary policy must be subject to a wide margin of error.

It has to be admitted that these difficulties in predicting exchange rates are just as alarming for D.Phil. students as they are for policy makers. In my neoclassical trade models, I will demonstrate that the exchange rate is likely to depreciate under certain circumstances. Yet these predictions, along with any others, are subject to the whims of (unmodeled) markets.

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[16] Japanese exporters forecast depreciation while importers forecast an appreciation - Germans extrapolate. In my own fieldwork, I found evidence that some forex traders at Bank Indonesia may not understand statistical independence. One of them suggested to me that if you wish to guess if the next coin toss is going to be a head in a series of coin tosses, you see if there has been a run of heads immediately prior to the current toss. If so, then it is allegedly time for a tail. There have been many attempts to rescue the assumption of rational expectations in the foreign exchange market. None have been very convincing (Frankel and Rose 1995).

4 Theoretical Issues

How is the Asian Crisis to be understood? Was it a tragic accident, or a necessary corrective? The answers to these questions shape the models used in the subsequent analysis, and therefore the bargaining environment that determines the division of the negative spoil.

I begin on a note of caution. As Bliss notes, trying to find *the* cause of the Asian crisis is a bit like trying to ascertain *the* cause of the First World War (Bliss 1999). Many informed observers have come to the conclusion that the depth of depreciations reflected both fundamentals and irrational market sentiment (Fischer 1998). Taking all these caveats on board, I turn to a useful five-fold taxonomy of currency crisis models (Radelet and Sachs 1998).

First, there is the old style Policy Induced Crisis models. Either the government 'runs out of reserves' (Flood and Garber 1984), or they fall prey to a self-fulfilling speculative attack (Obstfeld 1986).

Second, there is a Financial Panic. This is similar to a bank run (Diamond and Dybvig 1983).[17] Short-term debts exceed short-term assets. The key assumptions are that no single private market creditor can supply all credit to pay off short-term debt and that there is no lender of last resort. This leads to two Nash equilibria; one where the funds

[17] The taxonomy is a little loose at this point. Obstfeld argues that his model is consistent with Diamond and Dybvig's contribution.

are not withdrawn, and the other where depositors withdraw funds on an expectation that others will do so.

Third, there is a Bubble Collapse. This is the end of a bubble where the asset price has gone above the fundamental value. There is always a known probability of collapse. So, when it happens, it is unexpected but not unforeseen (Blanchard and Fischer 1989).

Fourth, there is a Moral Hazard Crisis (Krugman 1998). This will be dealt with in detail below. The key to this story is a financial collapse arising from bad investments.

Finally, a Disorderly Workout is similar to a panic. Illiquid or insolvent borrowers provoke a creditor grab-race and a forced liquidation even though the borrower is still worth more as a going concern. Disorderly workouts occur when markets operate without bankruptcy law. Sometimes they are known as 'debt overhang', though this term can also just refer to the presence of unresolved external debt.[18] Coordination problems among creditors prevent the eventual discharge of bad debts (via debt-equity swaps or debt reduction).

These different models can be classified according to whether the crisis could be foreseen, whether it destroys valuable economic activity, whether the original lending was induced by moral hazard and whether there is a case for official intervention.

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[18] I use the term to refer to the gap between the world required rate of return on capital and what is actually paid, from the installed capital.

Figure 2

Taxonomy of Currency Crises

	Policy Induced Crisis	Financial Panic	Bubble Collapse	Moral Hazard Crisis	Disorderly Workout
Anticipation by Market Participants and Analysts?	High	Low	Understand probability of collapse	High. Creditors are basing lending on state guarantees rather than fundamentals	High. Market participants understand lack of coordination among creditors
Destruction of Real Economic Activity?	Not necessarily	High	Low. The end of the bubble may improve resource allocation	Low. The end of moral hazard based lending improves resource allocation	High. Creditor grab race. Debtors face liquidity crisis and premature liquidation
Lending Induced by Moral Hazard?	No	Not necessarily	Possibly	Yes. creditors protected by guarantees	Not necessarily
Case for Official Intervention?	budget restrictions	Lender of Last Resort	No, the sooner it bursts the better	No. State guarantees prolong resource misuse.	Yes. State may provide framework for orderly workout

(Radelet and Sachs 1998)

At first sight, so many possibilities suggest a daunting task for any economist wishing to settle the issue. Furthermore, when one is describing a market reaction, it is possible for many inconsistent theories to be relevant for expectations at the same time, in the sense that they may be the beliefs held by some individuals but not others.[19] It is not therefore surprising that Radalet and Sachs come down on the side of *two* stories; financial panic and disorderly workout. They advance 5 arguments for this conclusion, which can be helpfully related to the above table.

[19] Economists usually sidestep this issue by confining their attention to rational behavior, and adopting the fiction that there is a single market expectation. Yet it is entirely plausible that some market participants drew out money in a state of blind panic, while others did so expecting a monetary easing, while others did so expecting financial collapse.

First, they present powerful evidence that the crisis was unanticipated. They present a table of credit ratings for the particular countries up until the time of the crisis, a table of exchange rate forecasts, and a table of risk premia on securities. In every case it appears that no one had an inkling of what was going to happen. The exchange rate forecasts are particularly telling. In their absence one could argue that, following the Mexican bailout, lenders correctly foresaw the crisis but realized that their investments were guaranteed by the IMF. This could explain a sanguine credit rating or the lack of risk premium, but it could not explain the large errors in the exchange rate forecasts. With reference to the table, this lends support to a financial panic story.

Figure 3

Goldman Sachs Exchange Rate Forecasts
(Forecasts of October 1997 rate, formed in August 1997)

	august 1997 forecast	October 1997 outcome (% error)
Indonesia	2500	3610 (**44.4% error**)
Malaysia	2.75	3.4 (**23.6% error**)
Philippines	28	35.1 (**25.3% error**)
Thailand	32	39.1 (**22.2% error**)

(Radelet and Sachs 1998)

Second, they argue that much of the lending went to businesses without guarantees. Their evidence for this is the widespread bankruptcies and financial distress following the crisis. Referring to the table, this appears to rule out a moral hazard story. However, their argument is at best suggestive, since it is based on *ex post* outcomes. All that is required for moral hazard to be a factor is that people *believed* in guarantees. If one is happy to concede that their beliefs were wrong, moral hazard is not ruled out.

Third, they point out that the crisis has resulted in the seizing up of credit lines to viable enterprises, especially through working capital shortages to exporters.[20] This appears to count against a moral hazard story supporting instead a disorderly workout.

Fourth, confidence has returned to countries like Korea, which they attribute to the fact that creditors and debtors have been brought together for orderly workouts.[21]

Fifth, they assert that the trigger events were the withdrawal of capital rather than the deflation of asset values. If correct, this counts against moral hazard (at least in Krugman's story, described below). They concede that this might not be correct for Thailand, but they could also have said the same about Korea (see table below). However, even if the assertion is wrong for some other countries in the region, it is right for Indonesia.

Figure 4

Stock Market Price Indicies ($US)

	1 Jan 1996	28 Jun 1996	1 Jan 1997	30 Jun 1997	1 Jan 1998	1 Jun 1998
Indonesia	100	114	120	133	30	17
Thailand	100	97	64	42	15	15
Korea	100	89	68	74	19	21
Malaysia	100	116	125	109	38	35

((MacLeod and Garnaut 1998))

[20] They offer an anecdote about an exporter who was unable to get finance even though they could confirm an overseas order.

[21] Confidence may also be helped if there is a perception that Korea is of more strategic significance to the US than, say, Indonesia.

Given Radalet and Sachs' conclusions, I now examine the panic (Diamond and Dybvig 1983) and asset grab stories (Miller and Zhang 1998) in more detail. Krugman's moral hazard story will follow.

4.1 Panic (a 'Bank Run') and Asset Grab

The Diamond and Dybvig financial intermediaries attempt to solve a problem for depositors in a three-period model. Each depositor has at their disposal 2 possible ways of investing a unit of financial capital.

Figure 5

Returns for Different Plans

	2nd period return	3rd period return
plan S (short-run)	1+r	$(1+r)^2$
plan L (long-run)	1+v	$(1+h)^2$

where v is negative, $1+v$ is called the liquidation value and $h>r$. Each investor is randomly assigned a consumption type after they have chosen their investment plan. That is, they are either period 2 or period 3 consumers.

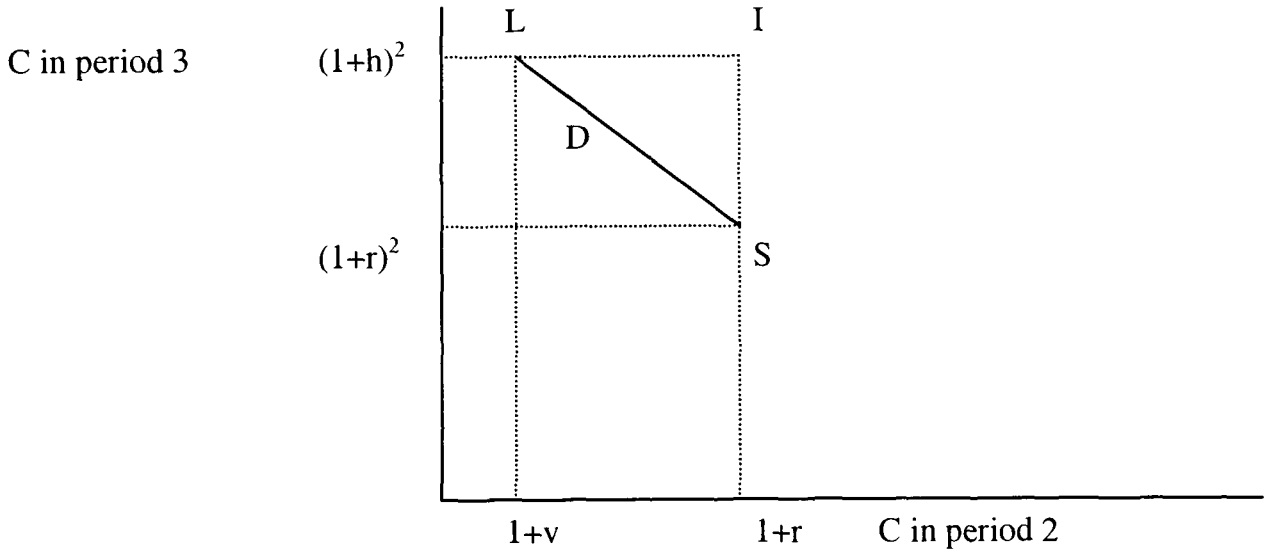
The intuition of their problem is as follows. Plan S is ideal for investors who want to park their money somewhere for a short time. It works well for period 2 consumers because $1+r$ exceeds $1+v$.[22] Plan S is supposed to represent investing in a short term financial asset such as treasury bills. Plan L is ideal for investors who want a long-term investment. It works well for period 3 consumers because $1+h$ exceeds $1+r$. It is supposed to represent investing in a long-term real project.

[22] r is assumed positive.

However, because investors must choose their plan before they know the state of nature (eg. whether they are period 2 or period 3 consumers) they run the risk of a bad draw. In particular, if they pick plan L and draw the type 'period 2 consumer' they will only get the liquidation value $1+v$. Similarly, if they pick plan S and draw the type 'period 3 consumer' they will miss out on $(1+h)^2-(1+r)^2$. This whole theoretical apparatus captures the realistic notion that investors don't know when they will have to consume, and, allows for the existence of an intermediary. The following figure illustrates the dilemma of the investors, and shows how an intermediary can improve things.

Figure 6

Returns for Different Consumption Types



In this diagram, the two states of nature are that the investor is a period 2 consumer (horizontal axis) or a period 3 consumer (vertical axis). Point L shows the return on the *L*ong-term asset under each state of nature. Point S shows the return on the *S*hort-term asset under each state of nature. Point D shows the return under each state of nature where the investor *D*ivides a portfolio of two assets in the ratio of the line bisection. Point I shows the benefits of *I*ntermediation. In either state of nature the investor

receives the payoffs that would have been attainable had the investor known their consumption type *before* picking their plan. How is it that point I is feasible under intermediation?

The intermediary pools the capital of a large number of individuals, investing some in the short-term and some in the long-term asset. Ignoring a bank run, if the intermediary knows what proportion of investors will turn out to be period 2 and period 3 consumers it can allow each investor to withdraw money at will, while still having a predictable aggregate withdrawal in period 2.

To see how this works, suppose that the intermediary were to allow each contributor of capital to withdraw $1+r$ in period 2, and suppose that the intermediary knows that a fraction p of the population will turn out to be period 2 consumers. All the intermediary has to do is to put a fraction p of the funds it receives into the short-term asset and $1-p$ into the long-term asset. Thus, each investor can expect to receive $1+r$ if she consumes in period 2 and $(1+h)^2$ if she consumes in period 3, dominating the range of possibilities available without the intermediary. This is precisely the point I.

However, Diamond and Dybvig point out that such an intermediary is potentially subject to a bank run. Suppose that investors who would not normally wish to withdraw their funds become convinced that other such investors want to withdraw theirs. That is, the belief circulates that all period 3 consumers want to withdraw their funds in period 2. Investors who hold this belief understand that the liquidation value $1+v$ is less than $1+r$

(by assumption) and so they therefore know that the intermediary will not be able to pay out all the investors who want their money early. If they *believe* that others want their money they will *act* by taking out their own money. If everyone else thinks the same, then an unsubstantiated rumor of withdrawals will be a self-fulfilling prophecy.

Radalet and Sachs argue that this model has much to say about Asia. The early 1990s saw a huge inflow of private capital into Asia. Sometimes the inflows represented a staggering 6 per cent of GDP of the recipient countries. However, most of the capital was composed of short-term paper, constantly needing to be rolled over (as above, for the short-term asset). When the panic occurred, the composition of the foreign liabilities was such that it could all be withdrawn rapidly and visibly, reinforcing the panic. As in the above model, the panic also forced the liquidation of real assets. This vision of the Asian crisis, if correct, has a tragic implication. The equilibrium prior to the crisis, just like the equilibrium prior to the bank run, was basically sustainable.

Other models with the same "bank run" flavor, are designed to show the need for a bankruptcy framework (Miller and Zhang 1998). The Diamond and Dybvig model is transformed in such a way that depositors in banks are thought of as international creditors holding a financial asset with a claim on a real asset. In the following payoff matrix, two creditors engage in a so-called asset grab.

Figure 7

Payoffs from an Asset Grab
(no bankruptcy)

		Creditor 2			
		Hold (H)		Grab (G)	
Creditor 1	Hold (H)	A(1+r)/2	A(1+r)/2	0	A
	Grab (G)	A	0	A/2	A/2

The payoff matrix describes the choices two creditors both have in the instant following rumors of illiquidity for a solvent firm. If the firm stays in business, the value of the firm's financial assets are equal to the present discounted value of future earnings, denoted $A(1+r)$.[23] For simplicity, the two investors have an equal stake in the company. The liquidation values ($A/2$,$A/2$) are the returns to the investors if they simultaneously "grab" the solvent firm's assets and sell them for A, the value of real assets. To establish the incentives at play, it is necessary to say something about the payoffs where one investor holds onto her financial asset, while the other grabs the real asset from the firm and sells it. In the above case, selling the real asset makes the financial asset worthless. Therefore (G, H) makes the firm's financial assets worthless (giving zero to Creditor 1 and Creditor 2) but gives A to Creditor 1 since she has the asset to sell.

The model's key concern is the conditions under which the so-called grab race (G, G) will occur. This is not exactly the same thing as asking when (G, G) is a Nash equilibrium. By assumption, we start at (H, H), since the firm is operational. Therefore there are two ways in which a grab race can occur. The first way is when (G, G) is the *only* Nash equilibrium. In this case the grab race is inevitable. The second way is when

[23] Thus r is an equivalent present value return; the one-period rate of return on the firm's real assets A equivalent to the discounted value of all future returns on capital in place.

both (H, H) and (G, G) are Nash equilibria but some change in sentiment (reminiscent of a bank run) shifts us to (G, G).

Now it is obvious from the above payoffs that (G, G) is a Nash equilibrium. The key question is therefore whether (H, H) is as well. This depends upon *r*. It will be a Nash equilibrium if :

A(1+r)/2	>	A	which implies
r	>	1	

that is, if the present discounted value of the firm's future earnings is 100% more than the asset base. In the plausible scenario that this is not so, an asset grab race is inevitable. Otherwise, an asset grab race *may* occur if confidence is shaken and everyone believes that investors will try to liquidate assets.

Considerations such as these have led to the establishment of bankruptcy laws. A stylized bankruptcy law in this simple model may help protect firms from premature liquidation, as the following payoff matrix shows:

Figure 8

Payoffs from an Asset Grab
(bankruptcy in place)

		Creditor 2			
		Hold (H)		Grab (G)	
Creditor 1	Hold (H)	A(1+r)/2	A(1+r)/2	A/2	A/2
	Grab (G)	A/2	A/2	A/2	A/2

The new law says that creditors must be given equal treatment under any liquidation procedures. Hence, if Creditor 1 sells the firm's asset, she must give half the money to Creditor 2. With this new law, a positive *r* guarantees that (H, H) is a Nash equilibrium. This does not rule out a grab race, since (G, G) is also a Nash equilibrium. In fact, a bank-run type grab race is still as "likely" in the sense that moving to (G, G) is no more unattractive than it was in the absence of the law. However, it is no longer inevitable.

Finally, note that this model begins with a rumor of illiquidity rather than insolvency. It therefore follows that a lender of last resort, in conjunction with bankruptcy laws, could reduce the probability of a grab race. Investors would have less basis to fear an asset grab if they knew the solvent firm could be tied over by a provider of liquidity.

The relevance of this model to the Asian crisis is clear. There are no international bankruptcy laws or lender of last resort facilities. The IMF only adopts the latter role imperfectly; arrangements between private creditors and debtors are outside its purview (Fischer 1998). A case can be made that an international lender of last resort may have made the Asian crisis less likely. In any case, we are left with the same conclusion as the panic story; the crisis was an unnecessary tragedy.

Radalet and Sachs' views are not universally held. Other accounts of the crisis suggest that it was a necessary corrective (Krugman 1998). It is suggested that there was a moral hazard arising from financial intermediaries with implicit guarantees. These intermediaries over-invested in the 1990s, causing asset price inflation. This, in turn, led

to an exaggerated perception of their soundness. The Asian crisis was a reversal of this whole process.[24]

4.2 Moral Hazard

Imagine that there is an economy where the intermediaries are owned by 'Suhartos relatives', and, that there are a lot of them.[25] By virtue of their blood-ties, Suhartos relatives are personally exempt from any losses their intermediaries make. This deadly situation leads to the worst possible moral hazard. Their guarantees mean that they will be prepared to invest in an asset that only has positive returns *in a very unlikely state of nature*. Furthermore, the fact that there are many of them means that asset prices will be driven up to the point where no-one earns profits and they only fail to make losses in the most favorable state of the world. Krugman describes this as making investments based on Pangloss (sic) values, rather than expected values.[26] I will now follow Krugman's numerical example that relates this model to Asia.[27]

First imagine a one-stage game, in which intermediaries initially compete to buy an asset with uncertain future payoff – call it land – and then learn what the payoff is. Now assume that the land can earn a future rent of 100 with a probability 1/3, or 25 with a probability 2/3. Without moral hazard, risk neutral investors would be prepared to pay 50, the expected value of the rent. However, given the moral hazard setup above, each of

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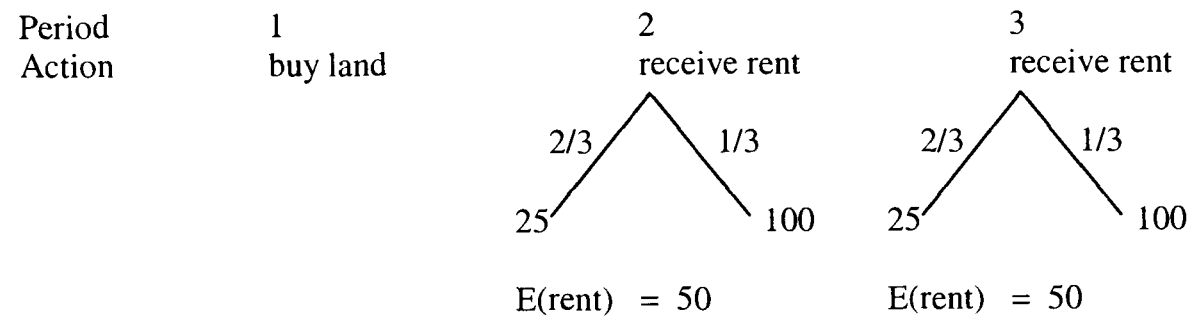
[24] The analysis used by Krugman is partial equilibrium in nature and skims over some important details, but I examine it because it contains some intuitively reasonable insights.
[25] Krugman's model is for a generic Asian economy, rather than Indonesia in particular. The term 'Suharto's relatives' is my own.
[26] Pangloss was a character in one of Voltaire's novels (Candide) who believed that we live in the best of all possible worlds. A Pangloss (noun) is someone who is always optimistic.

Suhartos relatives will be prepared to buy the land for any price less than 100. If the price ends up being 25 they lose nothing, and if it ends up being 100 they make a profit. Competition between the relatives drives the price of land to its Pangloss value of 100.

Now consider a two-stage game (shown below). In period 1 land is bought. In period 2 initial rents are revealed, and land may be resold. Finally, in period 3, a second round of rents are revealed. For simplicity, assume that rents are identically and independently distributed, and that the safe interest rate is zero.

Figure 9

Krugman's Land Payoffs



In an economy without moral hazard it is easy to solve backwards for the price. The expected rent in period 3, and therefore the price of land purchased at the end of period 2, is 50. The expected return on land purchased in period 1 is therefore the expected rent in period 2 (50) plus the expected price at which it can be sold (also 50), giving a first-period price of 100.

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[27] The rest of this section follows Krugman's analysis closely, with some verbatim quotes. This footnote replaces extensive citations and quotation marks.

Enter Suhartos relatives: Again working backwards, at the end of period 2 they will be willing to pay the Pangloss value of the third-period rent (100). In period 1 they will be willing to pay the most they could hope to realize off a piece of land: the Pangloss rent in period 2, plus the Pangloss price of land at the end of that period. So the price of land with intermediation will be 200 in period 1 – twice the undistorted price.

Krugman argues that implicit guarantees are generally only available for one crisis; after one bailout institutional reform prevents the same thing happening with the same group of agents. He therefore suggests that the above model be augmented to allow for only one bailout. This changes things dramatically.

Suppose that it transpires that period 2 rents are 25. If there were no intermediaries this would not change the price of land in the same period, since the expected value of rents for period 3 would not have changed. However, with intermediation, a poor outcome for period 2 means that there must be a bailout. Suharto's relatives walk away unscathed from their ruined intermediaries, and everyone knows that the price of land should reflect the expected rents in period 3, not the Pangloss rents. This is because the Pangloss price can only be supported if a bailout is on offer. By assumption, the bailout in period 2 precludes one in period 3. As a result, the price of land at the end of period 2 drops from 100 to 50.

Notice that this means that there is a magnification effect on the losses of the intermediaries established in the first period. The "real" news about the economy is that

rents in period 2 were 25, not the hoped-for 100. However, land bought for 200 will now yield only 25 in rents plus 50 in resale value, a loss of 125 rather than merely 75. The magnification effect is caused by the circular logic of disintermediation. The prospective end to intermediation, driven by the losses of the existing institutions, reduces asset prices and therefore magnifies those losses.

There is also the possibility of multiple equilibria, based on people's beliefs about government backing.

Suppose that in fact intermediaries have been lucky in period 2, and that the rents do turn out to be 100. If everyone then expects that the government will continue to guarantee intermediaries in the future, the land price at the end of the second period will also be 100. In that case no bailout will be needed; and so the government guarantee for intermediation will in fact continue.

On the other hand, suppose that despite the high rents in period 2 potential creditors become convinced that there will be no guarantee on newly incurred liabilities of intermediaries. Then the intermediaries will not be able to attract funds, and the price of land in period 2 will only be 50. That means, however, that intermediaries that borrowed money in the first period based on Pangloss values, including the Pangloss value of 100 for land sales, will require a bailout – and since the government's willingness to provide for bailouts is now exhausted, investors' pessimism is justified.

This model is like the bank run model in the sense that it has multiple equilibria. However, there is a world of difference between the two descriptions of the Asian crisis. In the Krugman model, the equilibrium prior to the crash is a socially bad one, typified by moral-hazard induced overinvestment. Therefore the collapse of intermediation is beneficial, since it brings this moral hazard to an end. In the model(s) of Radalet and Sachs, however, it is the pre-crisis equilibrium that is best – allowing socially valuable production to continue.[28]

Many observers of the crisis attribute a bit of truth to both explanations (Fischer 1998). The IMF suggests that fixed exchange rates created the unhedged debt mound that subsequently turned into a mountain. They give credence to the Krugman view, by acknowledging a buildup of bad debts from poorly supervised institutions. However, they also suggest that the exchange rate depreciations have been far greater than necessary, which supports a panic or asset grab. In fact, Krugman, while arguing for his position, concurs with Fisher by admitting that the adjustments that have occurred have been excessive.

In this thesis, I follow the IMF (and Krugman) in giving credence to both explanations.

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[28] Just as the view of the Asian crisis is different, so are the resultant policy prescriptions. The last thing that a Krugman crisis needs is a lender of last resort. In fact, a lender of last resort in the Krugman model would be identical to the Presidential guarantor who creates the moral hazard in the first place.

In one of the later papers (chapter 3), I allow for an irrational international investor panic, resembling Radalet and Sachs' Panic and Asset Grab. The modeling device used to capture this is the emergence of a risk premium on foreign borrowing.[29]

I also allow for socially valuable capital flight in the long run, resembling Krugman's Moral Hazard. The modeling device used for this is the end of a capital subsidy regime, coincident with a lender of last resort transfer from the workers to the domestic capitalists. The end of a subsidy to foreign capital inflow can be thought of as the ending of an institutional environment conducive to moral hazard. However, I do not concur with Krugman's analysis when he assumes that 'Suharto's Relatives' (the cronies, in later terminology) walk away with nothing, and that their financial opportunities end, following a bailout. In keeping with Indonesian experience, I assume that the lender of last resort transfer makes its way to the cronies (that is, they walk away with a lot), and, that they can still get their hands on economic resources while there is an unresolved debt crisis. Since the lender of last resort money has gone astray (to the cronies) it does not resolve the banking crisis.

4.3 Other Considerations

Both frameworks presented in this section (namely, the Panic/Asset Grab model and the Moral Hazard model) do not have an exchange rate solution arising from a fully articulated model, being partial equilibrium in nature. One attempt to provide such a framework (Aghion, Bacchetta et al. 1999) assumes that the Asian crisis was

[29] The reader could object to the use of the term 'risk' in this context, since the model in question contains no variance. The point is well taken, but other writers adopt the same usage (McKibbin and Martin 1998).

fundamentally driven by a cycle in the price of non-traded assets used as inputs (such as land). The model examines the boom/bust cycle of an open economy with a deregulated financial sector and asymmetric information, such that the international creditors rely on cash flows as a signal of creditworthiness.

Growth is driven by a combination of two forces. On the one hand, high foreign investment causes greater profitability, leading to greater cash flows and therefore greater creditworthiness, fueling further foreign investment. On the other hand, high profitability drives up the price of a non-traded input so that, eventually, higher input costs chock off profitability and therefore investment. For countries with intermediate degrees of financial liberalization, these two opposing forces lead to cycles in the economy, mirroring cycles in the asset price. When a nominal exchange rate is added, it also moves in tandem with this asset price. Thus, during a boom phase, asset prices rise, the exchange rate appreciates, and profits are high. At the downturn, asset prices collapse and the whole process reverses.

run analysis

There are two theoretical criticisms of this model. First, the driving force of the model is the decline in creditworthiness arising from an increase in asset values (because such increases harm profitability). However, it can easily be argued that the reverse ought to be true. Since assets are used as collateral, rising asset prices should increase creditworthiness (Femminis 1999). Second, the model of the exchange rate used, purchasing power parity, is arguably not appropriate for short run analysis (Frankel and Rose 1995).

One final point concerns the low profile of both fiscal and monetary policy in models of the crisis. Undoubtedly this is a shortcoming, but perhaps not a crucial one. There was nothing particularly alarming about the fiscal or monetary policy stance of the Indonesian authorities prior to the crisis (MacLeod 1998). It may therefore be reasonable to ignore these instruments, at least when discussing the onset of the crisis. I follow this approach in my own modeling. I ignore both policy instruments when describing the onset of the crisis, but I allow the authorities to tax workers later on.[30]

Monetary policy is omitted from the analysis, as are *financial* capital flows. The latter is a potentially important limitation of this work, and reflects the use of real models. This should be borne in mind when I assert that one aspect of the crisis was a freezing of the capital in place. This is designed to capture the many business ventures that were 'trapped' in Asia and doomed to earn a low rate of return until production could be reorganized.[31] In contrast, financial capital was highly mobile.

5 Introducing the Models

In chapters 2 through 4, I set up the models used to divide the negative spoil. For now, I give a brief outline of the models, the volitional structure and the main results.

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[30] In chapter 2, the workers are taxed to pay foreign creditors. In chapter 3, the workers contribute to a (failed) lender of last resort operation. The former would involve the fiscal authorities, while the latter would involve both fiscal and monetary authorities. Alternatively, the workers could own the intermediaries, so that when the intermediaries go bankrupt the workers have no choice but to bear the loss.

[31] If physical (and human) capital could be instantly relocated, the crisis would not have led to low returns in the economy - just instantaneous capital flight up to the point where all projects earned the world rate of return.

In chapter 2, *debt overhang and exchange rate collapse*, I adopt the simplest representation of the economy, the simplest representation of the Asian crisis and the simplest volitional structure.

The model is a refinement of the traditional Hecksher-Ohlin setup. Capital is available elastically from the world at a fixed interest rate, and one of the goods becomes non-traded. As the zero profit conditions show, the wage is obtained from the export sector, and, given the wage, the non-traded price is determined in the non-traded sector.

$$p_x = \overset{first}{w}\, a_{Lx} + \bar{r}\, a_{Kx}$$
$$\downarrow$$
$$p_n = \overset{second}{w a_{Ln}} + \bar{r}\, a_{Kn}$$
$$\leftarrow$$

The point of refining the Hecksher-Ohlin model in this manner is to allow for international capital flows (available at a fixed world rate), and, to include a real exchange rate via a non-traded price.

The Asian crisis is described as a terms of trade shock, and a freezing of the capital in place. As the terms of trade shock works its way through the economy, returns to capital fall, creating a debt overhang. The wage also falls.

The volitional structure assumes that Indonesia wants to pay the debt overhang in full. The workers accept a tax, leading to a collapse in non-traded demand, and to a fall in the non-traded price. The general equilibrium impact of the tax is called an overhang multiplier.

The basic message of chapter 2 is that the workers have already taken a big wealth loss in the form of a wage cut.[32] If they are inclined to pay the overhang, they will take another cut - a large one - due to the so-called overhang multiplier.

In chapter 3, *Indonesian cronies' tardy crisis resolution skills,* every aspect of the model in chapter 2 is made more realistic.

The model now incorporates two domestic factors, allowing for the existence of domestic capitalists. Another sector is added, producing importables. Furthermore, domestic capital is subsidized at the margin, encouraging capital inflow. The solution proceeds as before, except that now the wage determines the return to the domestic factor A.

[32] It would not be correct, however, to claim that this is part of the *negative spoil* since I have reserved that term for the overhang. This wage cut would happen even if the creditors forgave all the interest owed in excess of the marginal product of capital in place.

$$p_x = w a_{Lx} + \bar{r}(1 - s_b) a_{Kx}$$

$$p_n = w a_{Ln} + \bar{r}(1 - s_b) a_{Kn}$$

$$\downarrow$$

$$p_m = w a_{Lm} + s a_{\Lambda}$$

third $\longrightarrow$ *fourth*

The Asian crisis is seen as a removal of the subsidy s_b on capital accumulation (as in Krugman's moral hazard story), and, the emergence of a risk premium (as in Radalet and Sachs' Panic and Asset Grab story). As before, capital freezes at the onset of the crisis. (The terms of trade also has an effect, as before.) While the economy is in a state of unresolved crisis, there is a decline in total factor productivity in the traded goods sector, called corporate decay. This results in an exchange rate depreciation via a reversed Balassa-Samuelson effect. Finally, returns to capital erode due to corporate decay, worsening the overhang.

The volitional structure is based on the picture of the cronies developed above, and my field work. Generally, willingness to pay is the constraint here, so a standard bargaining analysis is necessary. Specifically, I assume that the workers are willing to pay for an overhang up to an exogenous limit. The domestic capitalists are of two sorts. The so-called cronies feel no obligation to pay anything, and they have the power to steal all the overhang payments by the workers (via a lender of last resort operation), and, some of the interest payments destined for the foreign creditors. The other domestic capitalists want to pay the overhang. The cronies have the power to bargain with the international creditors. They are torn by two opposing forces. The faster they cut a deal, the sooner

they can arrest corporate decay. However, while the economy is still in crisis they can expropriate some of interest payments due to foreigners (and the workers' overhang payments).

The basic result of the chapter is that the resolution of the crisis may be stalled, even if there is perfect information. This occurs because the pie that the creditors and cronies bargain over can be smaller when there is agreement, even though the economy is bigger. The smaller pie can occur because agreement implies a large transfer from the cronies to a third party (the workers). Contrary to conventional wisdom, bankruptcy reform does not necessarily hasten this process, even though it improves the payoffs to the creditors. Finally, at the moment a deal is struck, it may be that paying out both party's inside option leaves little else to divide. If this is so, then it matters little who has the power to make offers.

The thesis then changes tack, and I examine a more pessimistic scenario. Here, Indonesia socializes much of its corporate external debt, and then defaults on it. A resolution of the overhang along the lines of the previous analysis is ruled out, perhaps because the political situation hampers any negotiations.

If the past is any guide, reschedulings at the Paris Club of creditors leads to a mounting up of arrears financed through defensive lending.[33] Eventually, the situation emerges

[33] Defensive lending is undertaken to maintain, for whatever reason, the relationship between the creditor and debtor.

where the economy is so deeply in debt that this acts as a disincentive to economic reform.

In chapter 4, *debt forgiveness*, I therefore step into a different theoretical framework. Indonesia becomes like a HIPC, so all the issues related to debt forgiveness become pertinent. An earlier model in the literature (Krugman 1988), shows how debt forgiveness becomes a way of encouraging economic reform in situations where reform is not observable (or at least, not verifiable).[34]

The situation Krugman had in mind was one of asymmetric debtor payoffs. That is, if the debtor gathers resources up to the amount owed, it all goes the creditor's way leaving nothing for the debtor. On the other hand, if the debtor gathers in excess of the amount owed, the excess can be kept.

There is clearly an incentive problem here. The effort the debtor exerts in gathering the resources has a zero *private* benefit up until the amount owed is reached. Yet there is a benefit to the creditor of such effort. Krugman showed that the creditor can choose an *optimal* amount to ask for, in order to minimize the effects of this incentive problem.

[34] An observable, but non verifiable, state of affairs is one where sanctions or rewards cannot be meted out because the evidence for that state of affairs will not 'stand up' in some sense (usually, in court). There is growing disillusion concerning the ability of the IMF and other international organizations to contract on reform effort (Collier 2000).

However, the Krugman Contract can never make marginal private benefit (i.e. the benefit to the debtor) *exactly* equal to marginal social benefit, despite the optimal choice of the amount owed.

Figure 10
The Krugman Contract

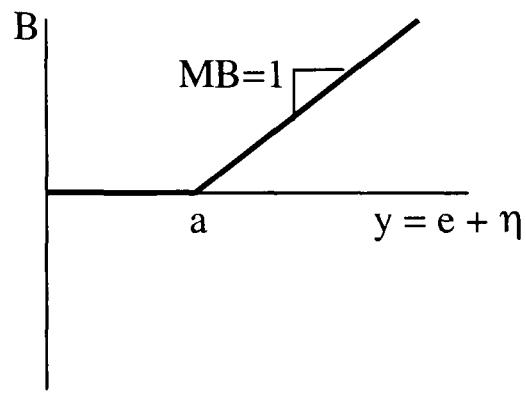

Figure 10 shows the benefit (B) schedule for the debtor. The amount owed a is chosen optimally by the creditor. I assume that the resources gathered y is the sum of effort e, and luck η. If the debtor 'works hard', by exerting a high e, the gathered resources may exceed a. In this case, the debtor keeps every extra unit of resources over the threshold - hence the marginal benefit MB of unity.

Consider the marginal benefit of an increase in e, supposing that η is volatile enough to allow y realizations on both the flat and upward sloping portions of the schedule. Given η, the marginal private benefit of an increase in e will be unity in a good state of nature (high η), and zero in a bad state of nature (low η). The expected marginal benefit, being

a convex combination of the two, must be less than unity. Therefore Krugman's proposed solution produces too little effort. The marginal private benefit will always be less than unity - the marginal social benefit.

When the problem is stated this way, the solution is clear. The contract I design in chapter 4 has the debtor receiving more than the increase in y in the upward sloping portion of the benefit schedule ($MB>1$). That is, if the debtor can pay back the creditor fully, s/he gets a bonus above and beyond being able to keep the extra output. This way, the *expected* private marginal benefit can be made equal to the expected social benefit (unity). This is called a *Hyper*-incentive Contract.

In keeping with Krugman's original contribution, the volitional structure is subtle. On one level, the debtor is willing to pay off the debt. However, the debtor finds adjustment effort 'costly' in some sense, meaning that there are limits to her willingness.

The basic result of Hyper-incentive Contract paper is that better incentives can be offered to the HIPCs (and Indonesia, under this scenario) to help them produce first-best effort.

6 Dividing the Negative Spoil: Some Scenarios

Drawing the main results of the chapters together, we can distinguish three basic scenarios for dividing the negative spoil. Each one presumes that the Indonesian workers

have already suffered a large negative wealth transfer, in the form of a wage cut. I classify the scenarios according to their volitional structure.

First, there is the scenario of high debtor commitment, or, the *1980s South American Route*. Here, the agents in the economy pull together to pay off all the overhang. This is a large burden on the economy, requiring current account surpluses for a number of years. Workers find themselves in a stagnant economy, due to the overhang multiplier. Quite possibly, foreign investors will remain wary of Indonesia leaving the exchange rate depreciated and the debt overhang burdensome. In any case, the real exchange rate will have to remain depreciated to facilitate the transfer to the foreign creditors.

In this scenario, the notional value of the debt matters a great deal (since it is all to be repaid). Therefore the terms of trade (in particular, the oil price) and the exchange rate will assume crucial importance.

Would it be a good outcome for Indonesia to have all the debt overhang 'wrung out of it'? Possibly not. The excesses of the years prior to 1997 required lenders as well as borrowers, and, it seems odd that Indonesia should be in the position of capital exporter at this stage of its development. On this point, I can do no better than quote the IMF.

'From a macroeconomic perspective, Indonesia's recent trade and current account surpluses are crisis-driven anomalies. They imply that scarce national savings are being exported to the rest of the world and represent the counterpart of a lack of access to international capital markets. As a lower middle income country, Indonesia should be able to attract external capital to finance investment which will fuel rapid growth. The

current anomaly is the result of depressed levels of economic activity, low investment demand, and the disruption of relations with external creditors that followed the crisis.'

(IMF 2000) page 65.

The other extreme is low debtor commitment, or the *sub-Saharan Africa route*. Here, Indonesia ends up defaulting on most of its sovereign debt.

As with the HIPC countries, the focus is on reducing the size of the negative spoil. This, in turn, depends upon the success in motivating reform efforts within Indonesia. The crucial issue is then whether it is it possible to effectively observe reform effort. If it is, then something like the recent HIPC initiative may prove to be of help. The clear targets of reform are the legal system, the political system and the tax system. If it is not possible to contract on effort, then a Hyper-incentive Contract may help motivate economic reforms.

Finally, there is the scenario of increasing debtor commitment, or the *Indonesian route*. As is obvious from my naming, I think this is the most likely scenario.

Here, the vested interests in Indonesia stall debt workouts for a considerable period of time, while the legal system, the political system and the tax system undergo gradual reform. The reforms should not, according to my analysis, focus exclusively on the details of voluntary restructuring packages for large corporations. Though these might be of some value, pilferers have no real incentive to clear things up. In the short term, the

creditors will only get the morsels under the tables of the judges subject to 'unlawful external influences' (IMF 2000). In the longer term they may be more fortunate.

All the time the international organizations have a role in keeping up the reform momentum. However, they should take a lesson from the Roman Empire which, it is said, survived for so long because it insisted on a very few key things, albeit strongly.

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Chapter 2

Debt Overhang and Exchange Rate Collapse:

a Simple Neoclassical Model of the Asian Crisis

Debt Overhang and Exchange Rate Collapse:

a Simple Neoclassical Model of the Asian Crisis[35]

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Abstract

I develop a simple neoclassical trade model of debt overhang and exchange rate collapse, by altering the Hecksher-Ohlin model. I make one good non-traded, and make international capital mobile. The response of the economy to a terms-of-trade shock comes in two stages. When the shock first hits, borrowers of foreign capital, who have contracted a fixed repayment, use all the capital in place even though some of it is extramarginal at the world rate. With fixed capital, the non-traded sector looks set to expand, for a given non-traded price, as in the Specific Factors (SF) Model. However, a Wage multiplier depresses demand for the non-traded good, thereby lowering its price and blocking the migration of labour to the non-traded sector. If labour compensates international creditors for the debt overhang, a powerful overhang multiplier causes contraction in the non-traded sector. In the second stage, after the crisis resolution, mobile capital departs as the extra-marginal projects are shut down.

Keywords: Asian crisis; real exchange rate, overhang multiplier

JEL classification: F31

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1 Introduction

The 1997 East Asian Financial Crisis was noteworthy for both the collapse of real exchange rates in the region, and the emergence of a large 'debt overhang'. Between end-1996 and end-1997, the real value of the Singapore and Taiwan currencies depreciated by about one quarter of their value, while Thailand, Korea and Malaysia all saw the real value of their currencies depreciate by about one half. The largest depreciation occurred in Indonesia; the real value of the rupiah plummeted to around one quarter of its end-1996 value, before recovering somewhat. Clearly, many producers of non-traded output with fixed contractual obligations had their balance sheets squeezed to the point of insolvency, creating a debt overhang.[36]

This paper presents a simple model in which these two things are intimately connected. I describe a process in which, in response to a negative external shock, the real exchange rate collapses.[37] Debt financing implies that capital is frozen in place over the life of the contract,[38] and that firms face a wedge between their interest payments and their imploding revenues. This debt overhang causes a further depreciation in the real

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[36] In their most recent report on the Indonesian economy, the IMF notes that the value of the exchange rate is of crucial importance in determining the value of unresolved corporate debt, upon which the entire economic outlook depends (IMF 2000).

[37] Focussing on the *real* exchange rate can be commended by the observation of Krugman that an understanding of the crisis need not rely upon the detail of monetary institutions or, by implication, monetary policy:
"..what worries investors about Indonesia is that many of the country's banks and corporations could go bust, or even that the whole country could descend into chaos. For these concerns a currency board is irrelevant." (Krugman 1998).

[38] If one is financially liable for the use of capital this period, it makes no sense not to use it. Although it is not yet paid, the *obligation* is effectively a sunk cost. The term 'debt financing' is a little loose in a real model - at the beginning of the period, the parties write a contract specifying *both* the amount of machines to be borrowed and the amount of exports earmarked for payment, *regardless of any shocks revealed through the period*. An alternative to the text is just to define a short run where capital is a fixed factor.

exchange rate. Crucial to this process is the effect of the negative shock on the price of non-traded goods. The shock causes a fall in this price that in turn causes an increase in the debt overhang for those who invested in this sector.

Two powerful mechanisms are at work in the model. First, a so-called *Wage multiplier* magnifies the initial effects of a fall in wages arising from an adverse terms of trade shock. Lower wages lead to a fall in demand for non-traded goods, leading to a fall in their price, leading to a further fall in wages as the non-traded value-of-marginal-product schedule collapses. Second, a so-called *debt overhang multiplier* kicks in whenever any attempts are made to recompense international creditors for the debt overhang. In this case, a tax raised from workers has the aforementioned effect of curtailing demand for the non-traded good, leading to a fall in prices, leading to a fall in wages, and so on. Thus, workers trapped by an overhang multiplier are bailing out creditors twice - first directly through the tax, but then through the extra decline in the before-tax wage.

The paper is organized as follows. Section 2 outlines the long run, where capital is mobile. This describes both the initial and final equilibria. Section 3 describes the crisis setup. In Section 3.1, I consider the adjustment of the economy with fixed capital, if the returns to capital are flexible.[39] In Section 3.2, I discuss the case where this is not so. In Section 4, I quantify the importance of the overhang multiplier, assuming that the workers are fully committed to paying the creditor. Section 5 concludes.

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[39] That is, if the creditor only receives the marginal product of capital in place, despite the intermediaries' contractual obligations.

2 The Long-run Effects of a Fall in Export Prices

In this Section I develop a real 2x2 neoclassical trade model, with one non-traded good. This model differs from the Hecksher-Ohlin model in two main ways.

First, capital is internationally mobile at a fixed world rate. Given mobility, a terms-of-trade shock eventually leads to capital reallocation, and a fall in the wage. All returns to capital are paid overseas by a set of intermediaries who own the domestic firms. These intermediaries can be thought of as a financial sector. They borrow machines, effortlessly install them, and promise to pay back the expected marginal product of capital over the contracted period. If everything goes as planned, they earn zero profits.[40]

Second, the price of a non-traded good is endogenous, clearing the market for non-traded goods. The demand side of this market is driven by local wage incomes. Any shock that depresses the local wage will therefore sap demand in the non-traded sector, leading to a fall in the price of the non-traded good, and further falls in the wage. This negative feedback is the so-called Wage multiplier.

[40] I assume, parenthetically, that there are many intermediaries so that their profits are driven to zero.

Mathematically, the set up is Hecksher-Ohlin with a slightly reorganized endogenous/exogenous schema. There, two endogenous returns (w and r) are determined (in part) by two exogenous world prices. Here, w and p_n are determined (in part) by one exogenous world price (p_x) and one exogenous return (r).

2.1 The Long-run Setup

Technology is Cobb-Douglas in the two sectors.[41]

$$Q_x = K_x^{\alpha_x} L_x^{1-\alpha_x} \qquad (1)$$

$$Q_n = K_n^{\alpha_n} L_n^{1-\alpha_n} \qquad (2)$$

Here, the export sector is capital intensive, so that $\alpha_x > \alpha_n$. There are no domestic capitalists and so all returns to capital are paid overseas. Tastes are Cobb-Douglas over the exported good, the non-traded good and an imported good (not produced locally).

$$U = Q_x^{1-\gamma-\theta} Q_m^{\gamma} Q_n^{\theta} \qquad (3)$$

Capital is elastically available at fixed real rate of return. By contrast, there is a fixed endowment of labour.

[41] The Cobb-Douglas formulation makes the analysis of section 4 mathematically tractable. There have been some attempts at Bank Indonesia to construct a general equilibrium model of the economy. The economists there have used this functional form. In the absence of good data, they have also tended to use bank loans as a proxy for capital (personal communication; Bank Indonesia).

$$\bar{L} = L_x + L_n \tag{4}$$

2.2 Solution

Constant returns to scale and profit maximization imply zero profits.

$$p_n Q_n = w L_n + \bar{r} K_n \tag{5}$$

I substitute into the left hand side of this expression from the first order condition for the consumers' utility maximization problem:

$$p_n Q_n = \theta w \bar{L} \tag{6}$$

I replace the second term on the right hand side with the solution to the producers' maximization problem in the non-traded sector. Equating the marginal rate of substitution between labour and capital to the relative factor price ratio in that sector I obtain:

$$\bar{r} K_n = w L_n \frac{\alpha_n}{1-\alpha_n} \tag{7}$$

When *(6)* and *(7)* are substituted into *(5)*, I obtain:

$$L_n = (1-\alpha_n)\theta \bar{L} \tag{8}$$

which is independent of the wage. The solution for L_x immediately follows from the full employment condition.

$$L_x = \bar{L} - (1-\alpha_n)\theta\bar{L} \qquad (9)$$

Thus, an implication of Cobb-Douglas production is that labour allocations do not change when there is a terms-of-trade shock.[42]

The Wage, and Non-traded Goods Prices

To solve for the wage, I use the factor ratio implied by the marginal product of capital condition for the export sector

$$\frac{K_x}{L_x} = [\frac{\alpha_x p_x}{\bar{r}}]^{\frac{1}{1-\alpha_x}}$$

and substitute it into the marginal product of labour condition for the export sector. The solution shows that the lower is p_x, the lower will be the wage that the economy can afford to pay.

$$w = p_x^{\frac{1}{1-\alpha_x}} \left(\frac{1}{\bar{r}}\right)^{\frac{\alpha_x}{1-\alpha_x}} \{(1-\alpha_x)\,\alpha_x^{\frac{\alpha_x}{1-\alpha_x}}\} \qquad (10)$$

Non-traded prices p_n also depend positively on p_x. Using the same steps that I used in the export sector, I obtain an analogous expression to *(10)*, with the subscript n replacing x.

$$w = p_n^{\frac{1}{1-\alpha_n}} \left(\frac{1}{\bar{r}}\right)^{\frac{\alpha_n}{1-\alpha_n}} \{(1-\alpha_n)\,\alpha_n^{\frac{\alpha_n}{1-\alpha_n}}\}$$

The wage is now substituted out, using *(10)*, and the resultant expression solved for p_n.

$$p_n = [\frac{1}{r}]^{\frac{\alpha_x - \alpha_n}{1-\alpha_x}} (p_x)^{\frac{1-\alpha_n}{1-\alpha_x}} \{(\frac{1}{\alpha_n})^{\alpha_n} (\frac{1-\alpha_x}{1-\alpha_n})^{1-\alpha_n} \alpha_x^{\frac{\alpha_x(1-\alpha_n)}{1-\alpha_x}}\} \qquad (11)$$

Comparison of *(10)* and *(11)* reveal that the relationships between factor returns and prices normally associated with the Stolper-Samuelson theorem hold here as well.[43] In particular, if p_x falls then the real wage, however measured, must fall, since w falls by more than both p_x and p_n (and the import price numeraire). Economically, this reflects the fact that the eventual departure of capital following a terms-of-trade shock depresses the marginal product of labour, as I shall now argue.

2.2.2 *Capital Allocations*

It is possible to derive the following allocations.[44]

$$K_x = (\bar{L} - (1-\alpha_n)\theta\bar{L})[\frac{\alpha_x p_x}{r}]^{\frac{1}{1-\alpha_x}} \qquad (12)$$

$$K_n = \{\alpha_n \bar{L}\theta(1-\alpha_x)\alpha_x^{\frac{\alpha_x}{1-\alpha_x}}\}[\frac{p_x}{r}]^{\frac{1}{1-\alpha_x}} \qquad (13)$$

Equations *(12)* and *(13)* show how the stock of mobile capital depends on p_x. Clearly, if the equilibrium prior to the crisis is favorable, with a low interest rate and a high export

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[42] I am grateful to Adrian Pagan for providing an alternative derivation of (9). From (2), the real wage is equal to $(1-\alpha_n)Q_n/L_n$, and therefore P_nQ_n is $wL_n/(1-\alpha_n)$. After (6) is substituted in, (9) follows immediately.

[43] It is not difficult to show the Stolper-Samuelson ordering $\hat{r} > \hat{p}_x > \hat{p}_n > \hat{w}$ applies when world interest rates rise, or when the terms of trade declines (with r held fixed in the latter case).

[44] First, set the (fixed) world nominal rate equal to the value-of-marginal-product of capital in the export sector. Then, substitute in the solution for L_x, solving for K_x. For the non-traded sector I use (7), substituting in reduced forms for L_n and w.

price, the stock of capital is large. Taking the long-run perspective, the terms of trade shock will ultimately depress the capital stock in both sectors. Since - as has already been shown - neither of the solutions for L_x or L_n vary with p_x, the capital-labour ratio will be lower in both sectors, leading to a fall in the marginal product of labour, as claimed above.

3 The Crisis Setup

The long run discussed above is that which applies when capital has been reallocated. In the short run, I assume this is not possible; capital is a fixed factor.[45] Not surprisingly, I will demonstrate in Section 3.1 that a fall in the export price causes the rate of return to this trapped export-sector factor to fall. However, this happens not just in the traded sector *but also in the non-traded sector*, because of a fall in the price of non-traded goods.

In Section 3.2, I assume that the intermediaries sign debt contracts with the creditors at the beginning of the period, prior to the terms-of-trade shock being revealed. These contracts are not renegotiable in the short run, specifying, by their very nature, fixed repayments. Obviously, the results of Section 3.1 then imply the presence of an overhang. I derive a solution where the workers are fully committed to paying off this overhang.

[45] This has already been justified by using the debt contract argument. That is, since the intermediaries are locked into paying for the capital, they may as well use it.

3.1 Fixed Capital and Free Rates of Return in the Crisis Setup

I first proceed by solving a model with fixed capital stocks, given by *(12)* and *(13)* and *free* rates of return r_n and r_x. I leave the second stage of the analysis until Section 3.2, where I posit the existence of debt contracts, and require that the world rate of interest still be paid in the short run.

3.1.1 The Crisis Setup with Free Rates of Return

As before, I begin with technology, tastes and endowments. These are identical to the long-run model except that there are now fixed capital endowments given by the solutions to *(12)* and *(13)*, *before* any change in the export price. In this section I place a bar above K_x and K_n, to denote that they are fixed.

3.1.2 Solution

The zero profits condition for the non-traded sector now yields the following equation:

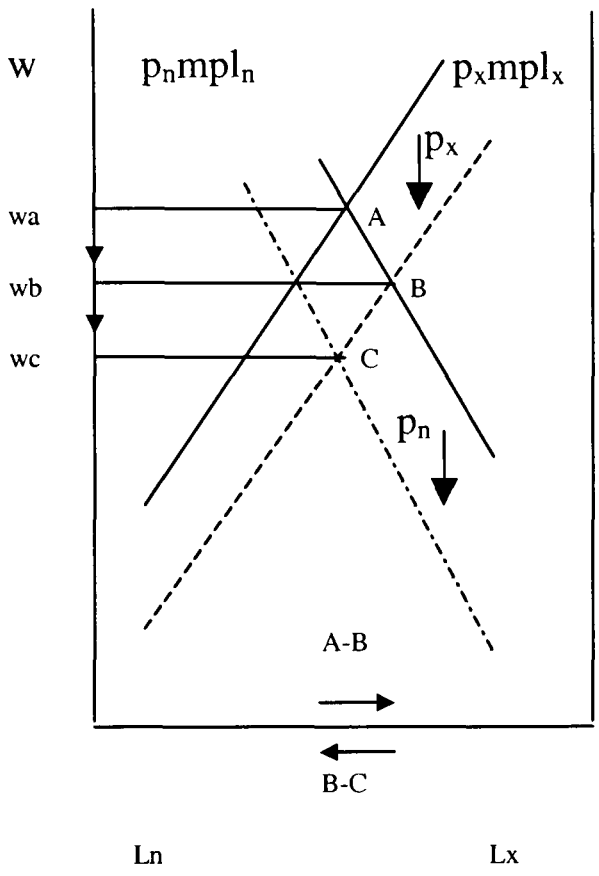
$$p_n Q_n = w L_n + r_n \overline{K}_n .$$

As before, I substitute *(6)* into the left-hand side of this expression and replace the second term on the right hand with the analog of *(7)* - the new solution to the producers' maximization problem in the non-traded sector.

$$r_n \overline{K}_n = w L_n \frac{\alpha_n}{1-\alpha_n}$$

Upon substitution, it is straightforward to verify that the labour allocations are identical to *(8)* and *(9)*.

The solution here contrasts with that in the familiar Specific Factors (SF) model, where a terms-of-trade shock reduces the output of the shocked sector and expands the output of the non-shocked sector.



- With p_n fixed, a decline in the price of the exported good creates unemployment in that sector at w_a. The wage falls to clear the labour market. Sector n expands. The SF model equilibrium moves from A to B.
- However, if p_n falls, it counteracts against the forces that expand the n sector. In the algebraic solution, it falls so much that L_n (and hence Q_n) return to their original levels. The wage falls by further than it does for the SF model. Equilibrium moves from B to C.

3.1.3 A Wage Multiplier

The reason why p_n falls is that the wage has fallen, eroding the demand for the non-traded good. Absent the option to trade away net demand (which would exist if the output of the sector were tradable), the price of the non-traded good *must* fall. In this model, the resultant fall in the wage and the non-traded goods price acts so as to block *any* migration of labour to the export sector. This complete offset depends upon Cobb-Douglas tastes

and constant returns to scale.[46] Nevertheless, this Wage multiplier process would survive other taste assumptions. In general, *the decline in the wage necessary to clear the labour market after an adverse shock itself erodes revenues in an expanding non-traded sector.* Without SF model labour migration the wage has to fall further to fix unemployment, working entirely through the resultant collapse in non-traded prices.

It is obvious from the diagram that the wage and the non-traded price fall by exactly the same proportion as the export price, given the fixed labour allocations.[47] In fact, the returns to capital in both sectors are proportional to the export price too. The marginal conditions for capital usage in the export and non-traded sectors are shown in the following pair of equations. The labour allocations are shown with a bar, to indicate that they are fixed with respect to changes in p_x.

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[46] Production need not be Cobb-Douglas. Taking log changes through (6) implies that $\hat{Q}_n = \hat{w} - \hat{p}_n$. Now fixed capital implies a one-to-one mapping of output changes onto labour changes. That is, increased (decreased) output necessitates increased (decreased) labour input. Furthermore, profit-maximizing firms equate the real wage to the marginal product of labour. That being so, the equation in this footnote states that labour changes and marginal product changes are positively related. Yet this seems impossible, since adding labour to fixed capital will reduce the capital-labour ratio, thereby reducing the marginal product of labour. Symmetric reasoning shows that the equation cannot describe a decrease in labour. The only way out of this conundrum is to recognize a third possibility, that there is *no* change in labour. I have confirmed that this property indeed survives when I use CES technology.

[47] This is straightforward to show algebraically. To obtain an expression for the wage I simply write down the profit-maximizing marginal condition for labour in the export sector, noting that solved L_x is fixed with respect to export price changes, as is K_x. To obtain an expression for p_n, I equate the w solution from the export sector to the corresponding marginal condition in the non-traded sector, noting that both capital and labour stocks are fixed, and solve. The exponential on p_x in both solutions is unity, establishing the claim in the text.

$$r_x = \alpha_x \left(\frac{\overline{K_x}}{L_x}\right)^{\alpha_x - 1} p_x$$

$$r_n = \alpha_n \left(\frac{\overline{K_n}}{L_n}\right)^{\alpha_n - 1} p_n .$$

Given that that p_n is proportional to p_x, it is clear that both returns to capital deflate proportionately with the export price. In fact, it is straightforward to show that these returns are the same.

The overall effect of the Wage multiplier (when added to the initial SF model effect) is thus to deflate all endogenous prices and returns in the economy in proportion to the terms-of-trade shock. However, this is still an *adverse* shock because the exogenous import price, p_m is not deflated.[48]

3.2 Fixed Capital and Fixed Rates of Return in the Crisis Setup

The above solution assumes that the return to capital is free, in both sectors, to fall to reflect the fall in the marginal revenue product of capital. If, however, debt contracts are such that capital must continue to earn the fixed world rate of interest then there is an overhang. This is the gap between the payments required and the lower value-of-marginal-revenue product for capital (in both sectors) that now obtain. The size of this debt overhang is the stock of capital that was contracted to earn the world rate, multiplied by the decline in the marginal product of that (fixed) capital. This, of course,

[48] This is the only place where the import price is important in this 2x2 (production) model.

is endogenous since it depends upon the endogenous marginal-of-marginal-revenue product of capital in both sectors.

$$\Omega = \left[(\bar{r} - r_n)\overline{K_n} + (\bar{r} - r_x)\overline{K_x}\right] \qquad (14)$$

I assume that workers are fully committed to paying for this burden.[49] For simplicity, I assume that the required transfer is effected by a tax on labour, and is paid to the creditor via the financial intermediaries that own the firms.[50] Equivalently, the government taxes the workers and bails out the intermediaries, or settles with the creditors directly.

Extracting purchasing power from labour sets in train an additional *overhang multiplier* process that further contracts the non-traded sector: the wage, the demand for the non-traded good, and the price of the non-traded good follow each other in a downward spiral.

3.2.1 The Crisis Setup with Fixed Rates of Return: Paying for the Overhang

The demand function for non-traded goods is now as follows.

$$p_n Q_n = \theta w(1-t)\bar{L}, \qquad (15)$$

Also, the tax rate t must be high enough to pay off the overhang. That is:

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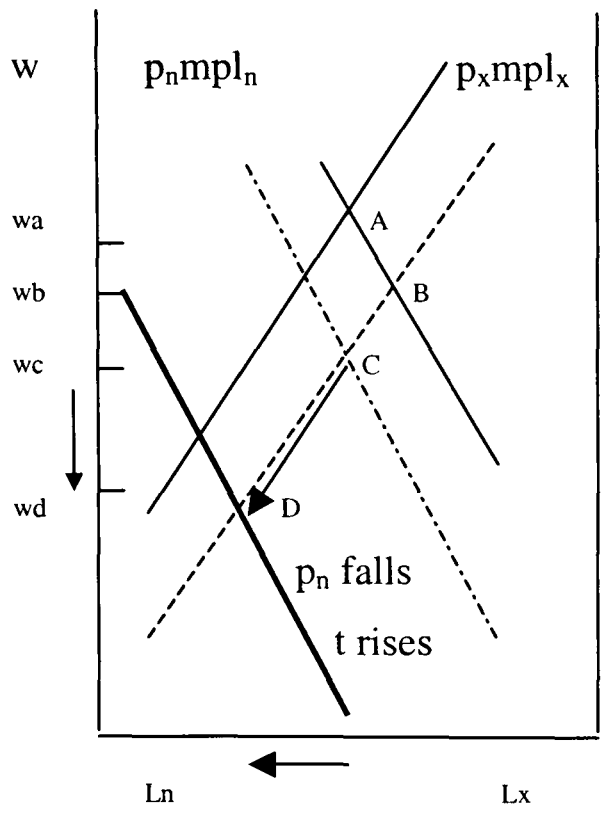
[49] Alternatively, the workers and creditors would have to bargain over how much is to be paid.
[50] In a richer model, the transfer could be thought of as the cut in absorption from an IMF program.

$$w\bar{L}t=\left[(\bar{r}-r_n)\overline{K_n}+(\bar{r}-r_x)\overline{K_x}\right] \qquad (16)$$

The overhang multiplier process can be described with equations *(15)* and *(16)*. From equation *(16)*, the tax rate must be positive, following a negative external shock, so as to compensate producers for the decline of the marginal revenue products of capital. As a result, equation *(15)* says that the demand for the non-traded good must fall relative to what it would have done had the foreign owners of capital 'taken a haircut' (covered the loss). This implies a further fall in the price of the non-traded good, and, a fall in demand for labour in the non-traded sector at the prevailing wage. The (pre-tax) wage must therefore fall to clear the labour market and, from equation *(15)*, the demand for the non-traded good falls again, and so on. Thus, compared with the standard SF model 'cross diagram', there is a third stage in the adjustment process (in addition to the Wage multiplier already discussed), where p_n actually falls so far that it forces labour out of the non-traded sector and into the export sector. As it does so, the wage falls further relative to what it would have done in the absence of the overhang. That, in turn, raises the size of the overhang that has to be paid.



- With p_n fixed, the SF model equilibrium moves from A to B, as before.
- The lower wage at B w_b sets in train the *Wage multiplier*. The wage and p_n follow each other down to C, where the wage is w_c. The real return to capital falls in both sectors, as before.
- In the additional stage, workers pay a tax. This reduces the demand for the non-traded good, and therefore its price. As p_n falls, so does the wage, in turn depressing p_n. The economy moves to D under the additional influence of the *overhang multiplier*.

3.2.2 Solution

Analytic solutions for this setup are not possible. The system consists of equation *(16)* for t, and the following equations for L_n, L_x, w, p_n, r_x and r_n.

The labour allocations are obtained in the manner of previous solutions. Commencing with the non-traded zero profit condition, and using the productive efficiency condition I obtain the following.

$$L_n = (1-\alpha_n)(1-t)\theta\bar{L} \equiv L_n(t) \qquad (17)$$

$$L_x = \bar{L} - (1-\alpha_n)(1-t)\,\theta\bar{L} \equiv L_x(t) \qquad (18)$$

These two equations confirm what is obvious from the diagram; the larger t, the greater the contraction in the non-traded sector.

The wage is equal to the value of marginal product in the export sector.

$$w = (1-\alpha_x)(\frac{\overline{K_x}}{L_x(t)})^{\alpha_x} p_x \equiv w(t) \qquad (19)$$

The equation for p_n follows by noting that the wage is also equal to the value of marginal product in the non-traded sector. Equation *(19)* is then substituted for the wage, and the resultant expression solved for p_n.

$$p_n = \frac{1-\alpha_x}{1-\alpha_n}(\frac{\overline{K_x}}{L_x(t)})^{\alpha_x}(\frac{L_n(t)}{\overline{K_n}})^{\alpha_n} p_x \equiv p_n(t) \qquad (20)$$

The solutions for r_x and r_n follow from the marginal product of capital conditions in the two sectors, with (20) substituted for p_n.[51]

$$r_x = \alpha_x(\frac{\overline{K_x}}{L_x(t)})^{\alpha_x - 1} p_x \equiv r_x(t) \qquad (21)$$

$$r_n = \alpha_n \frac{1-\alpha_x}{1-\alpha_n}(\frac{\overline{K_x}}{L_x(t)})^{\alpha_x} \frac{L_n(t)}{\overline{K_n}} p_x \equiv r_n(t) \qquad (22)$$

Equations (16) to (22) thus represent the full system.

[51] I assume that capital is not mobile within the crisis-ridden economy. It was not necessary to be specific about this in section 3.1.2, since both sectors had the same return to capital (unlike (21) and (22)).

A computational short cut to the solution is made possible by observing that all these equations are implicit functions of t. Thus, the most straightforward solution method is to solve numerically for t first by simplifying *(16)*, and then solving *(17)* through *(22)*. In equation *(16)*, equations *(21)* and *(22)* are substituted for the value-of-marginal-product of capital, *(19)* for the wage, and *(12)* and *(13)* for the fixed stocks of capital. The simplified *(16)* below must be solved numerically; p_{x0} is the initial value of export prices.

$$1+\frac{\left(1-\alpha_x-\theta(\alpha_n-\alpha_x)\right)}{\alpha_x+\theta(\alpha_n-\alpha_x)}t=\frac{p_{x0}}{p_x}\left[\frac{1-(1-\alpha_n)(1-t)\theta}{1-(1-\alpha_n)\theta}\right]^{\alpha_x} \qquad (23)$$

4 The Strength of the Overhang Multiplier

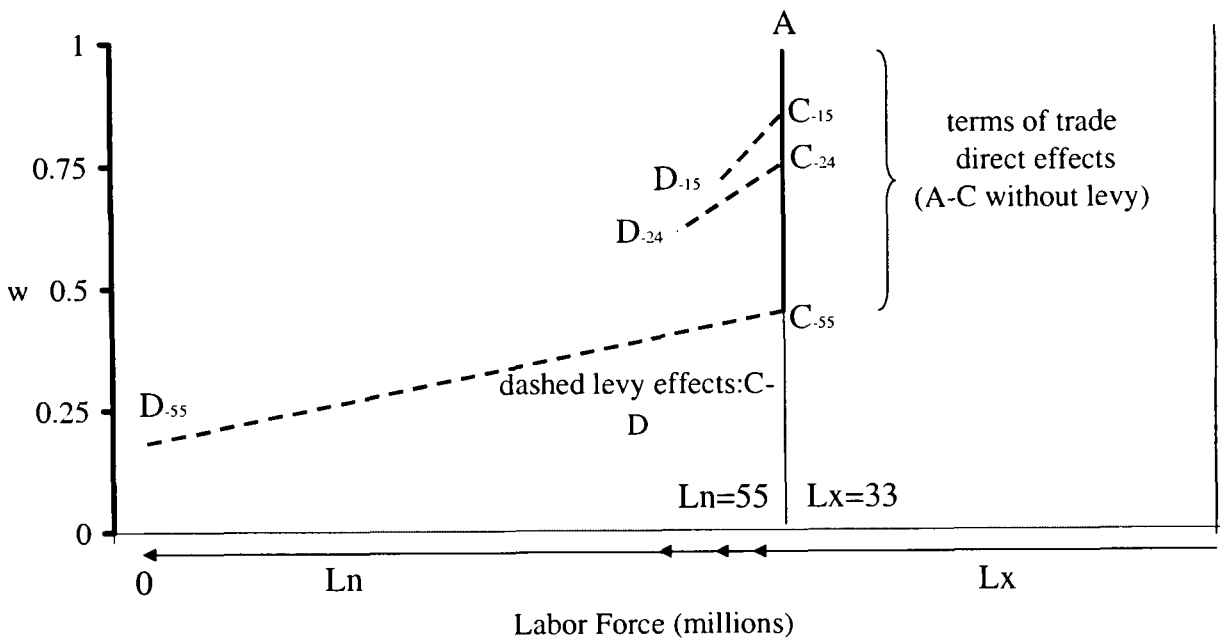
I use the above solution algorithm for an economy with similar deep parameters to Indonesia.[52] The following figure shows the magnitude of the tax to be raised for various terms-of-trade shocks, and the impact that this has on the non-traded sector. For each term-of-trade shock, the initial effect - whereby wages are deflated by the magnitude of the shock - is shown as a movement from A to C_{tot} (c.f. the previous diagram), with the

[52] Data is from a recent country report (IMF 2000), tables 2, 17-19 and 39. Assuming half of 'clothing' and 'miscellaneous' consumption is imported, and exportables enter with a weight of .2, the consumption share of non-tradables is between .63 and .75; I use θ=.7. The capital exponential in the non-traded sector is inferred from (8), after estimating the size of the labour force in that sector, giving a value of α_n=.1. The estimate is derived as follows: I assume labour in the 'Mining and Quarrying' and 'Trade' sectors, and half of the labour in the 'Manufacturing' and 'Other' sectors, are employed in the traded sector. This comes to a total of L_x=33 million persons. The other L_n=55 million must be employed in the non-traded sector, given that the total labour force is 88 million. Without data on the capital stock, it is difficult to obtain an estimate for capital's share in the export sector. Nevertheless, Indonesia's share should be high since it is an oil exporter. For the US economy as a whole (aggregating traded and non-traded), capital's share is about 0.25 (Branson 1989). Somewhat arbitrarily, I used α_x=.6.

subscript indicating the magnitude of the terms of trade shock. The effect of the tax to pay the overhang is then shown as a dashed line, to D_{tot}.

Impact of Terms of Trade Shocks on Non-traded Sector

(based on Indonesian data)

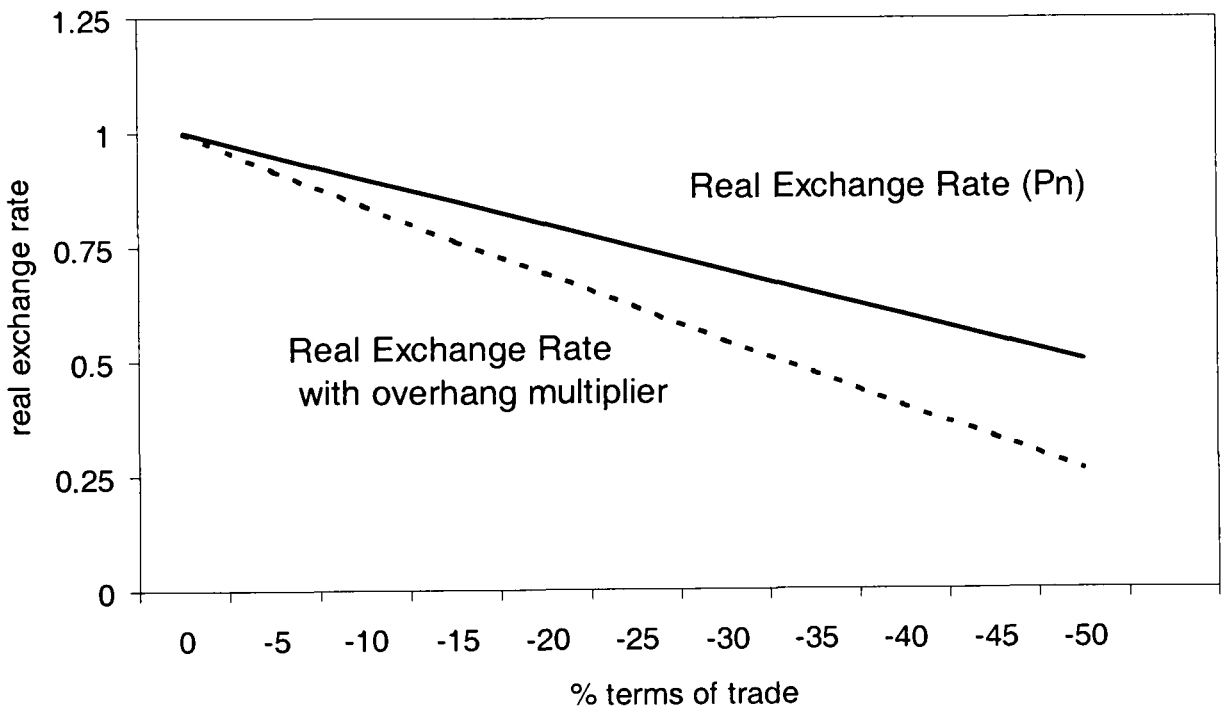


The analysis has now completely reversed the SF model result. In the presence of an overhang, the export sector must *expand*, to cover the overhang interest payments. A terms-of-trade shock of around 25 per cent will lower the before-tax wage by 35 per cent and the after-tax wage by 50 per cent. There will be a fall in non-traded output of around 15 per cent.[53] A terms-of-trade shock of 55 per cent would eliminate all non-traded output, and drive the after-tax wage to zero.

[53] The last figure follows from Cobb-Douglas production, and a high exponent on labour in the non-traded sector (.9).

The other effect of honoring contractual obligations to creditors in the model is the resultant *additional* depreciation of the real exchange rate (measured as p_n).[54] The following graph shows the required depreciation of the real exchange rate for different terms-of-trade shocks. The higher line is the depreciation where the returns to capital are flexible and so there is no overhang. The lower line shows the necessary depreciation when the whole debt is to be cleared.[55]

Real Depreciation and the Terms of Trade



[54] Unlike the Hecksher-Ohlin model, it is possible to define a real exchange rate either as the real wage (since no purchasing power arises from capital), or as the ratio of non-traded to traded goods prices. I adopt the latter convention, and use the import numeraire as the traded good.

[55] The results of this section are robust to different assumptions about capital mobility within the economy. If I allow capital within the economy to be mobile, it makes the overhang multiplier slightly less severe, since capital can be relocated efficiently across industries thereby equalizing marginal products. However, the impact is not huge. For example, a 50 per cent terms of trade shock depresses wages by 70 per cent with intra-economy capital immobility and by 64 per cent with mobility. The impacts on the real exchange rate are 74 per cent and 66 per cent respectively.

5 Conclusion

As the dust settles after the East Asian Economic Crisis, economic theory is wrestling with difficult questions concerning the role of the exchange rate as an adjustment tool. In the model, the real depreciation following an adverse shock creates serious difficulties for policy makers. These difficulties boil down to not being able to earn the world rate of return on overseas borrowing, in the presence of debt contracts. Attempts to cut absorption run foul of an overhang multiplier, setting in train a further real depreciation.

Although it has not been explored explicitly in this in the paper, it is important to note that the difficulties facing policy makers are subtle; they are not necessarily eliminated if the authorities can maintain fixed nominal exchange rates. What matters in this model is the wedge between the required world rate of return on capital, and the return available in the domestic economy. As the authorities in Argentina are learning, a discrepancy may exist even if debt contracts are written in local currency with a perfectly credible fixed exchange rate regime.[56] If this intuition is correct, then Indonesia may be as much a lesson about the dangers of debt financing as it is a lesson about currency mismatch.

The model could be extended to allow for come other catalysts to the crisis. It has been suggested that the extra-marginal projects were partly the result of implicit subsidies

[56] For example, if an exchange rate is held fixed, following a terms-of-trade shock, the ensuing recession could, in some macroeconomic models, depress the returns to capital in the domestic economy. This could open up a gap between returns, even if the debt contract was written in local currency. Of course it is true that a contract written in local currency, without a risk premium, could prevent such a gap occurring if the

(Dooley 1999), and, that a fundamental reassessment of the region's investment potential led to the emergence of a risk premium (McKibbin and Martin 1998). Finally, the adverse impact of the crisis on traded sector productivity could in principle lead to a real depreciation via a reversed Balassa-Samuelson effect. One last extension would be to create some domestic capitalists, and allow the unpaid debt to be the focus of a bargain.

The main contribution of the paper has been to set the overhang multiplier within a very simple theoretical framework. Once this is done, it is relatively easy to undertake calibration exercises to see how powerful the overhang multiplier can be. This highlights the difficulties for Indonesia in having the full debt overhang 'wrung out of it' by international creditors. It raises the possibility that Indonesia will, like Latin America in the 1980s, experience a 'lost decade' of growth.

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exchange rate were to depreciate, but that would just be an example of the contract not stipulating that the world rate of return be paid.

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Chapter 3

Indonesian Cronies' Tardy Crisis Resolution Skills:

A Bargain Delay with Perfect Information

Indonesian Cronies' Tardy Crisis Resolution Skills:

A Bargain Delay with Perfect Information[57]

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Abstract

A neoclassical trade model provides a macroeconomic backdrop for a debt overhang bargain. One party to the bargain, the 'cronies coalition' receives a time-decaying inside option by stalling. Once a bargain is struck, the structure of the economy changes and Nature halts an exogenous transfer from the workers to the cronies. As a result of this, bargaining delay is possible despite perfect information. I demonstrate that order protocol (who has the power to make take-it-or-leave-it offers, and when) has no bearing on the time that the bargain is struck. In the event of delay, order protocol may not even impact on the payoffs. Furthermore, reforming bankruptcy codes will increase creditor recovery of debts, but it need not speed up crisis resolution. Increased bankruptcy penalties weaken the debtor's position, making resolution easier, but they also embolden the creditor, making resolution harder.

Keywords: debt overhang, bargaining delay, perfect information, crony capitalism

JEL classification: F34

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1 *'There's no art to find the mind's construction in the face' Macbeth 1.4*

Perhaps Duncan was right, but even if economists in Jakarta have more to hide than the Thane of Cawdor, they may lack his duplicity. Anyway, the economist's face appeared both animated and sincere when he told me of his vision for the recovery of Indonesia. The economy had to take a hit, resolve its debt overhang crisis, and get back to positive growth. Only this way would the terrible chaos be ended, and the build up of public liabilities be serviced.

It's funny when sincerity and earnestness break out of otherwise deadpan faces. It happened again during my visit to Jakarta. I had endured another day of intense humidity, smog and traffic, only to find myself sitting in front of a debt negotiator who was sharing his obvious flair for the minutia of corporate accounting with me. The effect was soporific, yet I fought off sleep long enough to ask him to comment on the delays in bargaining that had plagued the Jakarta Task Force Initiative[58], and, whether he thought there were some parties stalling for a bailout from taxpayers.

His face changed. *'Personally, I think this is the main game here. This country is owned, and run, by 100 people'.* He told me that these cronies where in a business-as-usual mode, and that the crisis had actually helped them avoid paying debts that they could really afford. Eventually, they would be forced to support restructuring, but there were a lot of reasons to be tardy about it just now.

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[58] The Jakarta Task Force Initiative is a corporate debt restructuring agency seeking to implement the principles of the London Approach in the wake of the 1997 Indonesian crisis.

This paper shows how cronies may have stalled the recovery in Indonesia, and asks if there are any policies that can terminate their last tango in Jakarta. However, the main results may be transferable to other economies where a negotiating party in a reform process possesses an attractive inside option.[59]

The layout is as follows. Section 2 outlines a neoclassical trade model that describes the macroeconomic bargaining environment. Section 3 develops a stylized description of the bargaining process. Section 4 solves the bargain, and Section 5 concludes.

2 The Macroeconomic Bargaining Environment

In this section I develop a real 3x3 neoclassical trade model, with one non-traded good, and a fixed domestic factor. Economically, the model has affinities with some Asian economies prior to the 1997 crisis.[60] Theoretically, it refines the classic Hecksher-Ohlin model in four ways.

First, there is an additional non-traded sector. The price of the non-traded good is endogenous, clearing the market for non-traded goods. The demand side of this market is driven by local wage incomes. Any shock that depresses the local wage will therefore sap demand in the non-traded sector, leading to a fall in the price of the non-traded good, and further falls in the wage.

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[59] An inside option is the payoff received in the event of temporary disagreement between alternate offers. The classic example is the use of a house while a buyer and seller haggle over the price (Muthoo 1999).

Second, one of the traded sectors has a fixed domestic factor whose return does not have to equal the world rate.[61] The owners of this fixed factor are the domestic capitalists, a subgroup of whom - the 'cronies' - act as a coalition in the overhang bargain. It is assumed that the domestic capitalists do not consume the non-traded good.[62]

Third, all other capital is internationally mobile at an exogenous world rate in the absence of a crisis.[63] All returns to foreign capital are paid overseas by a set of intermediaries who own the domestic firms. These intermediaries can be thought of as a financial sector.[64] They borrow machines, effortlessly install them, pay back the marginal product of capital plus any marginal capital subsidies over the contracted period and earn zero profits.[65]

Fourth, foreign capital inflow is (initially) subsidized at the margin, with revenue raised by lump sum taxes on the domestic capitalists. The cessation of this subsidy, together

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[60] The economies in mind are Indonesia and, to a lesser extent, Korea.
[61] This could be either land or sunk capital equipment.
[62] This assumption implies that some of the domestic fixed factor could be owned by foreigners without having general equilibrium effects. That is, the assumption of full domestic ownership is without loss of generality. It is, of course, indefensible to argue that the capitalists in Indonesia consume literally no non-traded goods. It is more interesting to ask if this could stand as a reasonable approximation. It seems very likely that urban capitalists consume a greater proportion of traded goods than poor rural consumers. Food is a large proportion of consumption for poor households, and in rural areas food is likely to be non-traded. The situation is more complex when comparing rich and poor households *within* urban areas. To the extent that urban food is tradable, the aforementioned large share of food in the consumption basket of the poor erodes the reasonableness of the assumption. Furthermore, the urban rich consume more services, especially those of the informal sector, which are non-traded (Stewart 1995). However, when we consider the *very* rich, the assumption again looks more reasonable as we have to take into account such luxury imports as Western education (secondary and tertiary), holidays and automobiles.
[63] It is not possible to introduce international capital mobility (and hence interest rate fixity) in the unadorned Heckscher-Ohlin model, since the price of labour is over-determined. Capital in the Heckscher-Ohlin is mobile *between* sectors, but not internationally.
[64] Being a real model, they match borrowers and lenders of physical capital.
[65] I assume, parenthetically, that there are many intermediaries so that their profits are driven to zero.

with emergence of a risk premium, was an important causal factor of the 1997 Asian Economic Crisis.[66]

In 2.1, the long-run setup is examined. This describes the equilibrium before and after the crisis, when foreign-owned capital is mobile. The two messages of 2.1 are that an end to a subsidy regime would result *ceteris paribus* in capital flight, and, that it will redistribute income towards domestic capitalists. In 2.2, I describe the situation during the crisis, between the two long-run equilibria. The crisis consists of three elements. First, there is a freeze on capital mobility, resulting in a discrepancy between what is earned on capital in place, and the world rate.[67] This discrepancy causes a *debt overhang*. Second, there is a decline in the productivity of the economy, which I call *corporate decay*. Third, there is a *bank rescue levy on workers* as they fund a lender-of-last-resort operation.

This last feature of the crisis proves to be crucial for the result that bargain delays are possible despite perfect information. The removal of the bank rescue levy upon resolution may make it sub-optimal for the debtor to agree to a deal, even though agreement would make the whole economy bigger.

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[66] Elsewhere a terms of trade shock has been used as a simplified explanator, though it has been (correctly) pointed out that this shock was insufficient to explain all that followed (McKibbin and Martin 1998). In fact, every explanator on its own seems inadequate (Fischer 1998). What I do in the text is to write as though over investment and the emergence of a risk premium were the main factors (as in (Dooley 1999) and (McKibbin and Martin 1998)). However, altering the export price in the reduced form solutions also gives the reader access to the comparative statics for a terms of trade shock.

[67] Capital is assumed immobile both internationally and internally (between sectors).

2.1 *The Long-run Setup*

Technology is Cobb-Douglas in the three sectors, with identical capital coefficients.[68] For notational ease, I call the traded sectors 'exportables' and 'importables', though nothing hinges on these terms. Traded prices are exogenous.[69]

$$Q_x = K_x^{\alpha} L_x^{1-\alpha} \qquad (1)$$

$$Q_m = \Lambda^{\alpha} L_m^{1-\alpha} \qquad (2)$$

$$Q_n = K_n^{\alpha} L_n^{1-\alpha} \qquad (3)$$

All the usual profit-maximizing marginal conditions hold except that the accumulation of foreign capital is subsidized at the margin for the non-traded sector and exportables sector. Domestic capitalists own Λ, and therefore earn $s\Lambda$ minus the lump sum tax. Both K_x and K_n are owned by foreigners, who are paid by the export of traded goods.[70] When lump sum taxes are raised from the domestic capitalists and paid to the foreigners (in the form of marginal subsidies), the trade surplus and the capital outflow go up one-for-one

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[68] This is not particularly realistic; in Indonesia, the oil export industry is far more capital intensive than the non-traded sector. The assumption clears away all Stolper-Samuelson effects that complicate the algebra considerably, while adding little to the bargaining insights.

[69] This is a reasonable approximation for Indonesia, given the prominence of oil exports.

[70] The trade surplus equals the capital outflow, so that the balance of payments is zero. The reference to being paid in exports reflects the absence of financial flows in a real model.

with the lump sum tax. A subsidy s_b directed towards, say, exportables leads to capital being put in place that is extra-marginal, at the unsubsidized world rate of interest.[71]

$$\bar{r}(1-s_b) = mpk_x\, p_x$$

For domestic workers, tastes are Cobb-Douglas over the exportable good, the non-traded good and the importable good.

$$U = Q_x^{\,1-\gamma-\theta}\, Q_m^{\,\gamma}\, Q_n^{\,\theta} \qquad (4)$$

Domestic capitalists do not consume non-traded goods. For simplicity, they only consume importable goods.

In contrast to capital, there is a fixed endowment of labour.

$$\bar{L} = L_x + L_m + L_n \qquad (5)$$

Solution

Constant returns to scale and profit maximization imply zero profits.

$$p_n Q_n = w L_n + \bar{r}(1-s_b) K_n \qquad (6)$$

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[71] Given that international creditors consume traded goods whose prices do not change, this interest rate is both real and nominal.

We substitute into the left-hand side of this expression from the first-order condition for the consumers' utility maximization problem, assuming that the market for non-traded goods clears:

$$Q_n^d = \frac{\theta w \bar{L}}{p_n} \quad \& \quad Q_n^d = Q_n$$

$$\Rightarrow \quad p_n Q_n = \theta w \bar{L} \qquad (7)$$

We replace the second term on the right hand side of (6) with the solution to the producers' maximization problem in the non-traded sector. Equating the marginal rate of substitution between labour and capital to the relative factor price ratio in that sector we obtain:

$$\bar{r}(1-s_b)K_n = wL_n \frac{\alpha}{1-\alpha} \qquad (8)$$

When *(7)* and *(8)* are substituted into *(6)*, we obtain:[72]

$$L_n = (1-\alpha)\theta \bar{L} \qquad (9)$$

The solution for the other labour allocations depends upon the solution for the wage. For the latter, the profit-maximizing marginal condition that determines capital inflow into exportables can be written so that the after-subsidy interest rate is a function of the

[72] I am grateful to Adrian Pagan for pointing out an alternative derivation of (9). From (3), the real wage is equal to $(1-\alpha)Q_n/L_n$, and therefore P_nQ_n is $wL_n/(1-\alpha)$. After (7) is substituted in, (9) follows immediately. The derivation in the text is used because (8) is required later.

capital-labour ratio. This is then inverted, so that the capital-labour ratio is a function of the world interest rate. (Recall that the interest rate is exogenous, unlike its counterpart in the Heckscher-Ohlin model). This capital-labour ratio can then be substituted into the profit maximizing marginal condition for labour in the exportables sector, giving a reduced form for w.

$$w = (1-\alpha) p_x^{\frac{1}{1-\alpha}} \left(\frac{\alpha}{r(1-s_b)}\right)^{\frac{\alpha}{1-\alpha}} \qquad (10)$$

A high subsidy attracts foreign capital, raising the marginal product of labour and therefore the wage. For p_n, we use the same method to derive an expression for w using the marginal conditions in the non-traded sector.

$$w = (1-\alpha) p_n^{\frac{1}{1-\alpha}} \left(\frac{\alpha}{r(1-s_b)}\right)^{\frac{\alpha}{1-\alpha}} \qquad (11)$$

An inspection of (10) and (11) immediately implies that (the endogenous) p_n equals p_x.

We can now derive the remaining labour allocations. To that end, we take the profit-maximizing marginal condition for labour demand in the importables sector and substitute in (10) for the wage on the left-hand-side. With reorganization, we obtain an

expression that shows that workers were discouraged from finding employment in the importables sector during the subsidy regime.

$$L_m = (\frac{\bar{r}(1-s_b)}{\alpha})^{\frac{1}{1-\alpha}} p_m^{\frac{1}{\alpha}} (\frac{1}{p_x})^{\frac{1}{\alpha(1-\alpha)}} \Lambda \qquad (12)$$

The reason is straightforward. The importables sector does not benefit from the subsidy as it uses the fixed factor. However, exportables do benefit, and draw in labour as production expands.[73]

Given L_m, L_x follows from full employment

$$L_x = [1-(1-\alpha)\theta]\bar{L} - (\frac{\bar{r}(1-s_b)}{\alpha})^{\frac{1}{1-\alpha}} p_m^{\frac{1}{\alpha}} (\frac{1}{p_x})^{\frac{1}{\alpha(1-\alpha)}} \Lambda \qquad (13)$$

and s follows from the profit-maximizing condition for the fixed factor in the importables sector, with (12) substituted in.

$$s = \bar{r}(1-s_b)(\frac{p_m}{p_x})^{\frac{1}{\alpha}} \qquad (14)$$

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[73] However, the labour usage in the non-traded sector does not increase with a subsidy, despite the fact that the sector expands from the capital inflow. With Cobb-Douglas production, the increase in the non-traded capital-labour ratio necessary to lower the marginal product of capital (in response to the subsidy) can be achieved solely by capital inflow. For exportables, it is accomplished by capital inflow above and beyond an increase in labour.

Thus the return on the domestically owned fixed factor is negatively related to the subsidy. It is straightforward to derive the capital allocations.[74] Not surprisingly, both capital allocations are increasing in the subsidy offered at the margin for capital inflow. In the next section, we shall consider what happens to this economy when these capital allocations become fixed in the midst of a crisis. K_n and K_x with bars above them will refer to the stocks of capital during the crisis.

$$K_n = (1-\alpha)\theta\bar{L}\ [\frac{\alpha p_x}{r(1-s_b)}]^{\frac{1}{1-\alpha}} \equiv \bar{K}_n \qquad (15)$$

$$K_x = \{1-(1-\alpha)\theta\}\bar{L}[\frac{\alpha p_x}{r(1-s_b)}]^{\frac{1}{1-\alpha}} - \Lambda(\frac{p_m}{p_x})^{\frac{1}{\alpha}} \equiv \bar{K}_x \qquad (16)$$

Thus, the (lower) long run equilibrium capital stocks (as opposed to the capital stocks fixed in the midst of the crisis) are given by (15) and (16) with a zero subsidy, and with the emergence of a risk premium r_p. For completeness, these are given below.

$$K_n^{LR} = (1-\alpha)\theta\bar{L}\ [\frac{\alpha p_x}{r(1+r_p)}]^{\frac{1}{1-\alpha}} < \bar{K}_n$$

$$K_x^{LR} = \{1-(1-\alpha)\theta\}\bar{L}[\frac{\alpha p_x}{r(1+r_p)}]^{\frac{1}{1-\alpha}} - \Lambda(\frac{p_m}{p_x})^{\frac{1}{\alpha}} < \bar{K}_x$$

It is now possible to justify the two main claims of this subsection: that an end to a subsidy regime would result *ceteris paribus* in capital flight, and, a redistribution of income towards domestic capitalists.

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[74] For the non-traded sector, begin with (8) and substitute in the solutions for w and L_n. For the export sector, begin with the analogue of (8) and substitute in the solutions for w and L_x.

Equations (15) and (16) make it clear that foreign creditors want to withdraw capital when the subsidy is removed. This is necessary to ensure that the returns available in the economy rise to the (unsubsidized) world rate of return. This was one aspect of the onset of the Asian crisis. As an environment ridden with moral hazard drew to a close, it became impossible to sustain the subsidy of certain industries that were supporting extra-marginal projects (Krugman 1998). The emergence of a risk premium raised the required world rate of return even further, requiring even greater capital flight, so that $K^{LR}{}_x$ and $K^{LR}{}_n$ could be attained. This risk premium could be interpreted as a kind of 'bank run' (Diamond and Dybvig 1983) by international investors.

Such a relocation of capital, if it occurs, causes a redistribution of income.[75] In the model, domestic capitalists are no longer liable for the subsidy *and* gain from the movement of labour from the exportable sector (13) to their sector (12), with the fixed factor. The real return to the fixed factor therefore rises (14), while the *real* return to labour falls in all sectors (the nominal wage falls (11), and all prices are unchanged).[76] In keeping with international evidence (Rodrik 1999), the conflict over this potential redistribution is assumed to be one factor leading to a productivity slowdown.

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[75] For Indonesia it seems plausible that non-crony capitalists suffered expropriation prior to the crisis. Income tax receipts are low, and real wages had risen dramatically over the development period (Stewart 1995). While it is difficult to be sure, perhaps owners of legitimate business activities had been the source of wealth for the cronies, rather than workers. As to why the original subsidy regime was in place, one can only appeal to politics, speculating that some of the extra-marginal projects (such as a national car) may have been politically valued.

[76] The reduced form solutions show that the additional effects of a terms-of-trade shock reinforce this redistribution (see (14)). In fact, a terms-of-trade decline is qualitatively identical to the removal of the subsidy in every respect. That is, in every reduced form solution, the partial with respect to the terms of trade is the same sign as the partial with respect to the subsidy rate. It is not surprising that this is so, as both cause capital outflow.

2.2 *The Crisis Setup*

As was noted earlier, the crisis consists of three elements.

First, there is a *freeze on capital mobility*, resulting in a discrepancy between what is earned on the frozen capital stocks (15) and (16), and the world rate. The discrepancy comes in two parts. The last units of installed capital were always extra-marginal at the world rate, but they were covered by the subsidy. However, this subsidy is now gone. The second part of the discrepancy arises because of the emergence of a risk premium. The total discrepancy, in both the non-traded and exportables sectors, multiplied by the respective capital stocks (15) and (16), give the contribution of each sector to the overhang.

Second, there is a decline in the productivity of the economy, which I have called *corporate decay*. One reason for corporate decay has already been given: increased social conflict arising from prospective redistribution. This is assumed to harm sophisticated production (in the traded sectors), and, create extra demand for financial sector expertise. However, as I will suggest presently, the intermediaries are in no state to provide such advice. Another reason for corporate decay is a disruption of foreign direct investment that slows down (or stops) technological transfer to tradeables. Finally, there is the possibility that direct creditor sanctions will harm the economy until an agreement is reached.

Third, there is a *bank rescue levy on workers* as they fund a lender-of-last-resort operation. The idea for this comes from the Indonesian experience. A massive liquidity support operation for the ailing banks led to rise in the public-debt-to-GDP ratio, which now exceeds one hundred per cent. In the model, a consequence of raising the levy is a collapse in worker purchasing power in the economy, leading to a real depreciation as the non-traded price falls (Menzies and Vines 2001). As well as being realistic, this feature of the model leads to an important simplification for the bargain discussed in Sections 3 and 4. I assume that *this levy represents the full participation of the workers in the debt workout*. As the levy is assumed to be exogenous,[77] the workers do not act strategically.

As was noted earlier, this last feature of the crisis proves to be crucial for the result that bargain delays are possible despite perfect information. The removal of the bank rescue levy upon resolution may make it sub-optimal for the debtor to agree to a deal, even though agreement would make the whole economy bigger. The point is that the pie to be split between the debtor and creditor is not the whole economy, but the economy net of exogenous payments to the workers and non-crony capitalists.

As before, we begin with technology, tastes and endowments. The first element of the crisis, namely the freeze in capital mobility, is evident from the appearance of fixed capital in all the production functions.

[77] It is possible to make this levy endogenous, but the resultant system becomes non-linear, and general results are no longer possible (Menzies and Vines 2001).

$$Q_x = \Psi^t \overline{K}_x^{\alpha} \; L_x^{1-\alpha} \qquad (17)$$

$$Q_m = \Psi^t \Lambda^{\alpha} \; L_m^{1-\alpha} \qquad (18)$$

$$Q_n = \quad \overline{K}_n^{\alpha} \; L_n^{1-\alpha} \qquad (19)$$

The second element of the crisis, namely corporate decay through time, is evident from the term Ψ^t (where $\Psi<1$) in tradeables production.

The third element of the crisis, namely the bank rescue levy b_r, is apparent in the analogue to equation (7). Worker income is now based on *after*-levy income. The levy will act to depress profits in the non-traded sector, by sapping workers' spending power.

$$Q_n^d = \frac{\theta w \overline{L}(1-b_r)}{p_n} \quad \& \quad Q_n^d = Q_n$$

$$\Rightarrow \quad p_n Q_n = \theta w \overline{L}(1-b_r) \qquad (20)$$

Solution

The zero profits condition for the non-traded sector now yields the following equation:

$$p_n Q_n = w L_n + r_n \overline{K}_n .$$

As before, we substitute *(20)* into the left-hand side of this expression and replace the second term on the right hand side with the analog of *(8)* - the new solution to the producers' maximization problem in the non-traded sector.

$$r_n \overline{K}_n = w L_n \frac{\alpha}{1-\alpha}$$

Upon substitution, it is straightforward to verify that the labour allocation for the non-traded sector has the following form.

$$L_n = (1-\alpha)(1-b_r)\theta\bar{L} \qquad (21)$$

The levy takes purchasing power from workers, who then have less to spend on non-traded goods. The sector suffers a decline in profitability, and labour leaves until (zero) profits are restored.

By equating the wages from the profit-maximizing marginal conditions for labour in each of the traded goods sectors, L_x can be expressed as a function of L_m. Given (21), the full employment condition (5) can then be used to solve for L_m. (The solution for L_x can then be written down.)

$$L_x = \frac{\bar{L}(1-\theta(1-b_r)(1-\alpha))}{1+(\frac{p_m}{p_x})^{\frac{1}{\alpha}}\frac{\Lambda}{\bar{K}_x}} \qquad (22)$$

$$L_m = \frac{\bar{L}(1-\theta(1-b_r)(1-\alpha))}{1+(\frac{p_x}{p_m})^{\frac{1}{\alpha}}\frac{\bar{K}_x}{\Lambda}} \qquad (23)$$

It has already been observed that a levy will depress activity and input usage in the non-traded goods sector. Equations (22) and (23) just reiterate this property; a bank

rescue funded by labour will cause a glut of non-traded goods, and unemployment in the non-traded sector. As non-traded prices fall to clear the market for non-traded goods, and wages fall to clear the labour market, workers go to the traded goods sectors. To see that wages must fall, use the profit-maximizing marginal condition for labour in either traded good sector and substitute in (22) and (23) for L_x or L_m.

$$w = (1-\alpha)\Psi^t \left(\frac{p_m{}^{\frac{1}{\alpha}}\Lambda + p_x{}^{\frac{1}{\alpha}}\overline{K_x}}{\overline{L}(1-\theta(1-b_r)(1-\alpha))} \right)^{\alpha}$$

$$= \Psi^t \tilde{w} \qquad (24)$$

Clearly this is decreasing in b_r, as required. But (24) also demonstrates the impact of the second element of the crisis, namely corporate decay. The decline in productivity will erode wages.

To see the negative impact of the levy and corporate decay on non-traded prices, substitute (24) for w into the profit-maximizing marginal condition for labour in the non-traded goods sector, and solve for p_n.

$$p_n = \Psi^t \left(\frac{\theta\overline{L}(1-b_r)(1-\alpha)}{\overline{K_n}} \frac{p_m{}^{\frac{1}{\alpha}}\Lambda + p_x{}^{\frac{1}{\alpha}}\overline{K_x}}{\overline{L}(1-\theta(1-b_r)(1-\alpha))} \right)^{\alpha}$$

$$= \Psi^t \tilde{p}_n \qquad (25)$$

The returns to capital in the non-traded sector also suffer from the levy and from corporate decay. Taking the profit-maximizing marginal condition for capital in that sector, and substituting in the solutions for p_n and L_n, gives the following.

$$r_n = \alpha \Psi^t \frac{\theta \bar{L}(1-b_r)(1-\alpha)}{\overline{K_n}} \left(\frac{p_m{}^{\frac{1}{\alpha}} \Lambda + p_x{}^{\frac{1}{\alpha}} \overline{K_x}}{\bar{L}(1-\theta(1-b_r)(1-\alpha))} \right)^{\alpha}$$

$$= \Psi^t \tilde{r}_n \qquad (26)$$

Finally, as labour shifts into the traded sectors under the influence of the levy, the returns to non-labour factors rise. Both solutions rely on the relevant marginal conditions, with the labour usage solutions, (22) and (23), substituted in. As always, corporate decay erodes returns.

$$r_x = \Psi^t \alpha \left(\frac{\bar{L}(1-\theta(1-b_r)(1-\alpha))}{\overline{K}_x + (\frac{p_m}{p_x})^{\frac{1}{\alpha}} \Lambda} \right)^{1-\alpha} p_x$$

$$= \Psi^t \tilde{r}_x \qquad (27)$$

$$s = \Psi^t \alpha \left(\frac{\bar{L}(1-\theta(1-b_r)(1-\alpha))}{\Lambda + (\frac{p_x}{p_m})^{\frac{1}{\alpha}} \bar{K}_x} \right)^{1-\alpha} p_m$$

$$= \Psi^t \tilde{s} \qquad (28)$$

The equations for w, r_n, r_x and s show that corporate decay - modeled as a decline in total factor productivity in the traded sectors - has a rather simple implication. All these returns deflate by the corporate decay factor, Ψ per period.[78] Once the crisis is resolved it is assumed that the Ψ^t term becomes unity, ending the decay. Since the domestic capitalists and the foreign creditors only consume traded goods, and these prices have not changed, their *real* returns decline by the same decay factor, Ψ per period.[79]

Another interesting feature of the solution is that the provision of the lender of last resort facility leads *ceteris paribus* to a real depreciation, without relying on monetary channels. The price of the non-traded good falls relative to the (exogenous) price of both traded goods. This real depreciation story is an alternative interpretation of the events that unfolded in Indonesia following the massive bank bailout. A monetary explanation for the exchange rate collapse emphasizes that the unsterilized provision of liquidity support to the banking sector amounted to a loosening of monetary policy.[80] The above story

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[78] A terms-of-trade decline produces similar, but not identical, effects. All returns, and non-traded prices, decline except s. The latter result is due to the fact that labour shifts from the export sector (22) to the import sector (23). This lowers the Λ-to-L_m ratio, raising the marginal product of Λ.

[79] The observant reader will note that corporate decay is a type of Balassa-Samuelson effect. Productivity decline in the traded goods sectors (relative to the non-traded sector) leads to a real depreciation, as is evident by an examination of (25), the equation for p_n.

[80] Personal communication: IMF official in Jakarta.

emphasizes the real impact of transferring resources from workers to capitalists who have a relative (or, in this model, absolute) preference for traded goods.[81]

3 Bargaining Over Debt: a Stylized Framework

My analysis of the overhang bargain starts at the time of the crisis. At the beginning of the period, the international creditors announce the emergence of a risk premium. This could be the result of rational analysis by the creditors, or, the result of an aversion to Asian investments along the lines of the bank run literature (Diamond and Dybvig 1983). The intermediaries (hereafter, the 'banks') then sign a contract with the international creditors based on the higher rate. The banks commit to return some capital to the creditors, so that the banks can earn the world rate plus the premium on the remaining installed capital. Then, it emerges that the subsidy is going to end, perhaps because of the collapse of a moral-hazard-induced implicit subsidy (Krugman 1998). This creates a crisis for the banks. They had already intended to return some capital to the creditors so that the returns from the remaining installed capital could cover the risk premium, but now they face bankruptcy unless they can negotiate returning even more.

Based on the unfolding of events in the Asian Crisis, I assume that this throws the economy into chaos.[82] In particular, it becomes impossible to reorganize production by

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[81] This is a possible explanation, even though the exchange rate collapse preceded the banking crisis. If rational agents in the forex market saw what was coming, then they could engineer such a depreciation prior to a forthcoming banking crisis. Of course, if one is a little cynical about the rationality of the forex market, it could be said that they overreacted, creating a greater crisis than would have happened without them acting on their predictions (Fischer 1998).

[82] As has already been noted, there were other causal factors, such as a terms of trade shock.

withdrawing *any* extra-marginal units of foreign-owned capital.[83] This leads to a banking crisis. Workers try to cover some of the banks' obligations to the creditors through a lender of last resort operation,[84] but all the money gets diverted to the cronies who have the ability to pilfer the banks.[85] It is now unclear where interest payments in excess of the marginal product of capital in place are going to come from, creating the overhang crisis. Furthermore, the crony domestic capitalists, who have influence in all sectors of the economy, stand ready to expropriate some interest payments that could, in fact, be paid.

The key question is whether the creditors can strike an agreement with the banks over the payment of (some of) the overhang. I assume that the workers have paid all that they can through the lender-of-last-resort operation, even though it has not made its way to the creditors. The only persons able to provide the funds to pay the overhang are the cronies.

Suppose no agreement can be reached. The situation faced by corporations then starts to deteriorate. Although individual corporations have access to retained earnings net of manager pilfering, they cannot access financial sector expertise, as the banks are

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[83] In the absence of this simplifying assumption, some extra-marginal capital would stay, and some would go. The extra-marginal capital that had already been committed in the contract would stay (the rental obligation represents a sunk cost, so the intermediaries may as well keep the capital for the period). However, the extra-marginal capital that was going to be sent away because of the emergence of the risk premium would go, since this had been written into the contract.

[84] At the height of the Indonesian banking crisis (late-1997 and early 1998) Bank Indonesia extended liquidity support worth 20 % of GDP to the banks, and subsequently issued a blanket guarantee to creditors and depositors.

[85] Prior to the effective takeover of Indonesian banks, it was possible to bribe bank officials to produce documentation overstating the proportion of a loan that had been repaid, or, to approve a loan based on fraudulent collateral claims (personal communication: Indonesian Bank Restructuring Agency official).

preoccupied with having their assets stripped by cronies.[86] This advice is desperately needed, in an environment of political and social upheaval. Furthermore, technological transfers from other countries cease, due to an inability to attract foreign direct investment. This hits the traded goods sector particularly hard, as it is the main beneficiary of technical progress. All these effects are grouped together under the heading of 'corporate decay' and were modeled in Section 2 by the total factor productivity decay factor, Ψ per period.

Such a situation would seem to argue for an immediate workout of the debt overhang, at least in a standard Rubinstein's Alternating Offer bargain (Muthoo 1999).[87] The observed fact that some workouts have been a long time coming suggests that hidden information may be the culprit. This is certainly possible, as some of the information about the Asian economies was indeed hidden.[88] Nevertheless, in what follows I do not go down that route. I lay the primary responsibility for the delay at the feet of the cronies. Put simply, the crisis affords the cronies their last chance to expropriate wealth. If the agreement is struck, Nature halts exogenous payments from the workers to the cronies. The cronies will therefore only aid in crisis resolution when corporate decay has reached an advanced state.[89]

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[86] There was a catastrophic delay in Indonesia between the time of the first bank closures in April 1998, and the full assertion of control over the banks by IBRA in February 1999. Such a delay inflated the cost of the bailout considerably (Enoch, Baldwin et al. 2001).

[87] In a situation of repeated interaction, there are systemic benefits if a negligent debtor suffers real losses (Friedman 2000). However, in the presence of perfect information, the question is why there should be a delay - in a standard model 'punishment' can occur immediately in the form of a lower pie share.

[88] There was, apparently, a dearth of skilled Indonesian accountants prior to the crisis (MacLeod 1998).

[89] One consideration that has made me emphasis the role of the cronies in Indonesia is the apparent lack of commitment by big debtors in debtor/creditor negotiations, and, the extraordinarily pervasive business interests of the former associates of President Suharto (personal communication: Jakarta Initiative Task

Put another way, I assume that the resolution of the crisis, while making the whole economy bigger, can make the pie that the creditor and debtor bargain over smaller. This happens because of the exogenous side-payments made from the debtor (the cronies) to the workers in the event of agreement. If these payments did not occur, there would never be a disagreement. In my model, the outcome of delay is still Pareto efficient, but only if these exogenous side payments are non-negotiable.

To focus the argument, assume that the overhang bargain between workers, domestic capitalists and foreign creditors is at core a bargain between two active players, who implicitly direct two passive players. The domestic workers and the 'non-crony' domestic capitalists implicitly accept orders from the cronies until the crisis is resolved. I have just assumed that the workers will accept bailing out the banks (in turn, paying the cronies who siphon money out of the banks) at an exogenous rate b_r for the duration of the crisis. The non-crony domestic capitalists are powerless to negotiate over the overhang, but will accept and implement any agreement their crony masters negotiate on their behalf.[90]

The two active players are, firstly, the coalition of all foreign creditors (hereafter 'the creditor')[91] and, secondly, the crony domestic capitalists (hereafter 'the debtor'). I assume that the crony capitalists, who own a share z_I of the domestic fixed factor Λ, have significant political power while the economy is in the crisis. This power allows them to

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Force official). According to one estimate (Meyerman 2000), the Suharto family owned 18 per cent of the stock of wealth prior to the crisis.

[90] As in Korea, this could be because crony access to government allows them powers of suasion over the passive capitalists.

expropriate a share z_2 of the interest payments able to be paid to the foreign creditors,[92] and, as I have stated before, all of the bank rescue tax.

Crucially, I assume that the end of the crisis will coincide with the end of their opportunities for expropriation. From the moment capital is freed up, the cronies lose their access to the bank rescue tax.[93] This is the exogenous side payment halted by Nature in the event of an agreement. It reflects the political support for stripping the cronies of their privilege. Furthermore, once extra-marginal capital is repatriated, normal payments for the rental of the (reduced) capital stock are honored, so that there is no expropriation of interest payments (in the form of exports) owed to foreign capitalists. All that is left for the cronies, is their fair share z_1 of the return to the fixed factor.[94]

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[91] In its role as lender (not policy advisor), the IMF is included in this coalition.

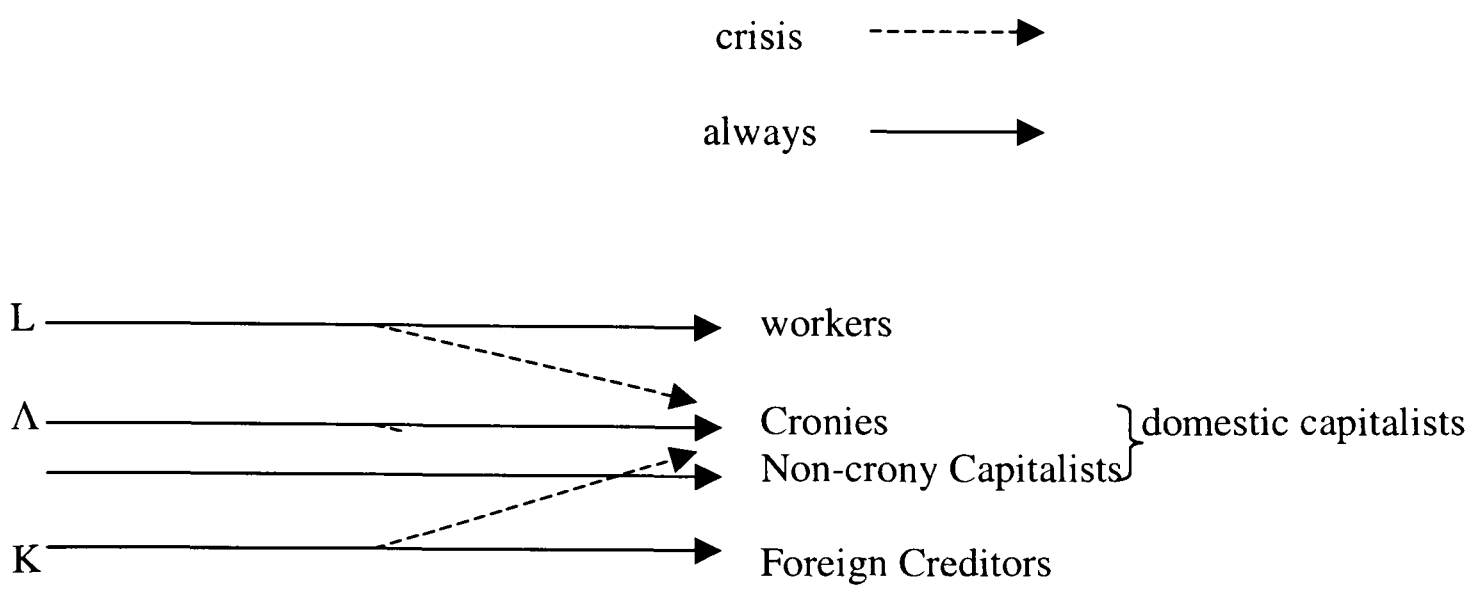
[92] The chaos in Indonesia has allowed some companies to repudiate their debts even though they are capable of paying them (personal communication: Jakarta Initiative Task Force official). This possibility even extends to firms that are bankrupt. Disturbing evidence is emerging that former owners are asset stripping such firms after bribing the trustees (IMF 2000).

[93] Though, strictly speaking, there is nothing to expropriate since the end of the crisis removes the need for the levy.

[94] This assumption is realistic for Indonesia, but not for Korea. In the latter, the IMF largely accepted the status quo of government links to the chaebol banks in 'Korea Inc.'. By permitting the government to continue to direct the banks over which it has murky control, the seeds of a future crisis have been planted. In Indonesia, the IMF is taking a much harder route by refusing to allow such close government involvement (Meyerman 2000). However, if Indonesia survives its crisis, it will do so with the lines of demarcation between various economic entities much more clearly, and helpfully, drawn.

Diagram 1

Returns to the Factors



The Timing

For simplicity, assume a two period model, with time index $t=1,2$. There is no discounting. The economy is either in crisis (C modeled by the crisis setup) which means that there is disagreement, DisA, that period. Alternatively, it is not in a crisis (not-C modeled by the long run setup) which means that there has been an agreement, A, that period. Three economic situations are possible over the two periods - (C, C), (C, not-C) or (not-C, not-C) - contingent upon the respective outcomes of the negotiations - (DisA, DisA), (DisA, A) or (A, A). The outcome (A, DisA) cannot happen by assumption - once an agreement is reached, it sticks.

In both periods, $\gamma_c(t)$ is a proposed payment to be subtracted from the creditor's payoff and added to the debtor's payoff.[95] I assume that the creditor proposes $\gamma_c(1)$ in period 1,

[95] I will refer to the creditor transferring $\gamma_c(t)$ *to* the debtor, though in principle $\gamma_c(t)$ may be positive or negative.

and the debtor proposes $\gamma_c(2)$ in period 2.[96] Later, I will examine the effects of changing the offer protocol (who has the power to make these take-it-or-leave-it offers, and when).

The Payoffs

If there is disagreement in period t (the relevant state of the economy being C for crisis), the debtor receives $\psi^t \Phi_d$, where Φ_d is defined using variables from equations (24) to (28). In the second period, the debtor loses a bankruptcy case worth $\rho(1+\delta)$, transferring ρ to the creditor. The positive pronumeral δ may be interpreted as a court cost mark-up, a bribe, or a discount arising from the disposal of assets seized by the creditor.[97]

$$\left.\begin{aligned} y_{debt}\{DisA,t\} &= z_1 s\Lambda + b_r w\bar{L} + z_2(r_x\overline{K_x} + r_n\overline{K_n}) \\ &= \Psi^t[z_1\tilde{s}\Lambda + b_r\tilde{w}\bar{L} + z_2(\tilde{r}_x\overline{K_x} + \tilde{r}_n\overline{K_n})] \\ &= \Psi^t\Phi_d \qquad\qquad t=1 \\ y_{debt}\{DisA,t\} &= \Psi^t\Phi_d - \rho(1+\delta) \qquad t=2 \end{aligned}\right\} \quad (29)$$

Recall that Λ is the domestic fixed factor, s is its return, z_1 is the share of the domestic fixed factor owned by the cronies (with $(1-z_1)$ owned by the passive domestic

[96] Where there is no risk of confusion, I drop the time argument of the transfer γ_c.
[97] It is often the case that extracting penalties from an overseas debtor results in more damage to the debtor than gain to the creditor (Lindert and Morton 1989). One reason for this is that assets are sold for low prices at fire-sales.

capitalists[98]), b_r is the bank rescue tax levied on the whole labour force (paid w) and z_2 is the share of interest payments that are expropriated by the cronies (despite the fact that they could be honored).

For the creditor, the payoff to disagreement is given by the share of interest payments not pilfered by the cronies $(1\text{-}z_2)$. In period 2, the creditor is guaranteed the compensation fee ρ through the courts.[99]

$$\left.\begin{aligned} y_{cred}\{DisA,t\} &= \Psi^t(1-z_2)(\tilde{r}_x\overline{K_x}+\tilde{r}_n\overline{K_n}) \\ &= \Psi^t\Phi_c \qquad\qquad t=1 \\ y_{cred}\{DisA,t\} &= \Psi^t\Phi_c \quad + \quad \rho \qquad t=2 \end{aligned}\right\} \qquad (30)$$

If the parties agree (the relevant state of the economy being not-C for no crisis), the debtor is entitled to receive no more than their fair share of the return on the domestic fixed factor, plus a transfer from the creditor in the period of the initial agreement.

$$y_{debt}\{A,t\} = z_1 s\Lambda \quad + \quad D\gamma_c(t) \qquad (31)$$

The dummy D takes the value unity if agreement is reached in period t, and zero if it is reached at some other time. That is, the transfer occurs only once, at the time of the agreement. Following capital reallocation, the creditor will receive the world rate on the

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[98] As was noted earlier, it makes no substantive difference if the domestic fixed factor is partially owned by foreign creditors. In this case, the share is less than $(1\text{-}z_1)$.

[99] If there is agreement in period 1, there is no need to specify compensation in the event of a disagreement in period 2, since that contingency is assumed to be impossible. That is, agreement in period 1 implies agreement in period 2.

capital installed domestically. From the definition of a world rate, the exiting capital can earn this rate elsewhere.[100] The pronumeral rK is used to denote the total return. In the period of the initial agreement, the creditor also pays a transfer to the debtor.

$$y_{cred}\{A,t\} = \bar{r}(\overline{K_x} + \overline{K_n}) \quad - \quad D\gamma_c(t) \equiv rK \quad - \quad D\gamma_c(t) \qquad (32)$$

Note that payoffs for both parties, net of the transfer γ_c, are time invariant when there is agreement. In contrast, the *eroding* opportunities in the event of disagreement make delayed agreement a possible outcome.

4 Bargaining Solution

I solve this problem by backward induction. All of the solutions use the fact that agreements of the following form, with transfer γ_c and inside option pair (c,d),

[100] It must be assumed that the risk premium earned in the domestic economy is of no benefit to the creditor, being offset by some unmodeled loss. Otherwise, capital would return via arbitrage.

$$\begin{bmatrix} y_{debt}\{A,t\} \\ y_{cred}\{A,t\} \end{bmatrix} = \begin{bmatrix} a+\gamma_c \\ b-\gamma_c \end{bmatrix}$$

$$\begin{bmatrix} y_{debt}\{DisA,t\} \\ y_{cred}\{DisA,t\} \end{bmatrix} = \begin{bmatrix} c \\ d \end{bmatrix}$$

must be acceptable to both parties. The chosen value of the transfer must ensure that both parties are no worse of by agreeing.[101] This, in turn, implies a unique (and obvious) condition for a feasible agreement.

$$\begin{bmatrix} a+\gamma_c \\ b-\gamma_c \end{bmatrix} \geq \begin{bmatrix} c \\ d \end{bmatrix} \qquad \Rightarrow$$

$$b-d \geq \gamma_c \qquad and \qquad \gamma_c \geq c-a \qquad \Rightarrow$$

$$a+b \geq c+d$$

Thus, an agreement can be struck if the sum of the agreement payoffs is at least as great as the sum of the disagreement payoffs.[102]

In interpreting the solutions that follow, it must be remembered that γ_c is a surplus division parameter. The participation constraints for both parties can be represented as follows. The values of γ_c are increasing as we move from the left to the right of the page,

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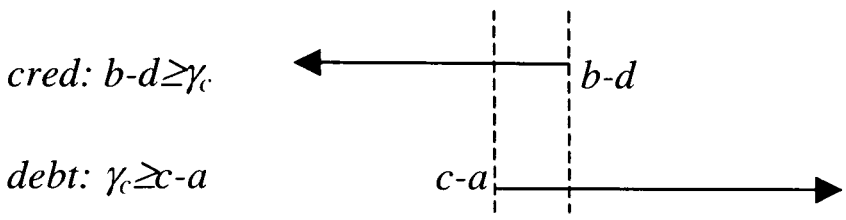
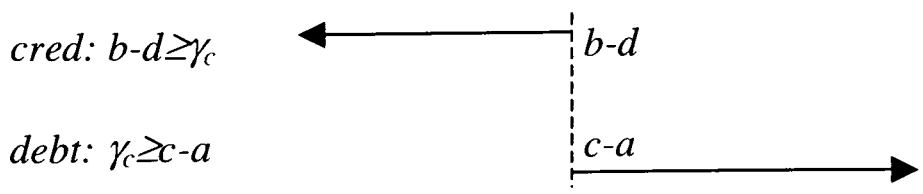
[101] I am assuming an offer will be accepted by any party if they are indifferent between accepting and rejecting.

[102] I assume U(x)=x without loss of generality. Provided that U'( )>0, an inequality of the form $U(a+\gamma_c) \geq U(c)$ just reverts back to the inequality in the text, after U^{-1} is applied to both sides.

and the arrows indicate higher utility for the parties. Given the way I have described the transfer (*from* the creditor *to* the debtor), the debtor would like it to be as high as possible (arrow pointing right), and the creditor would like it to be as low as possible (arrow pointing left).



Values of γ_c able to make both parties happy exist between the dashed lines. Whoever has the power to make a take-it-or-leave-it offer will push the other party down to the minimum acceptable utility, capturing all the gains (the distance between the dotted lines). However, in a case referred to later, we note that if *a,b,c* and *d* are such that there is only one possible value of γ_c, it doesn't matter who makes the offer.



Armed with these two pieces of analytic apparatus, we begin our solution at the last period.

Period 2

In the event of an agreement in period 1, there would be agreement in period 2 with the payoffs in period 2 given by (31) and (32) (with D set to zero). In the event of a period 1 disagreement, the bargain continues into period 2 and the debtor proposes receiving a transfer γ_c from the creditor. If the creditor refuses, the economy is in crisis. The creditor extracts a fine ρ from the debtor through the courts.

$$\begin{bmatrix} y_{debt}\{DisA,2\} \\ y_{cred}\{DisA,2\} \end{bmatrix} = \begin{bmatrix} \Psi^2\Phi_d - \rho(1+\delta) \\ \Psi^2\Phi_c + \rho \end{bmatrix}$$

If the creditor agrees to the proposed transfer, the economy is not in crisis.

$$\begin{bmatrix} y_{debt}\{A,2\} \\ y_{cred}\{A,2\} \end{bmatrix} = \begin{bmatrix} z_1 s\Lambda + \gamma_c \\ rK - \gamma_c \end{bmatrix}$$

To attain agreement, the sum of the agreement payoffs must exceed the sum of the disagreement payoffs.

$$z_1 s\Lambda + rK \geq \Psi^2\Phi - \delta\rho \qquad (33)$$

$$(\Phi \equiv \Phi_d + \Phi_c)$$

As to what agreement is reached, the debtor uses the power to make a take-it-or-leave-it offer to propose the maximum transfer consistent with the creditor participation.

$$\gamma_c = rK - \rho - \Psi^2\Phi_c \qquad (34)$$

That is, the maximum the creditor is prepared to pay to the debtor is the full value of his payoff in the case of agreement (rK) less what he could obtain if there were disagreement. It wouldn't make sense for him to offer more than this since a higher payoff could be obtained by disagreeing. In the resultant agreement, the creditor is paid his inside option.[103]

$$\begin{bmatrix} y_{debt}\{A,2\} \\ y_{cred}\{A,2\} \end{bmatrix} = \begin{bmatrix} z_1 s\Lambda + \{rK - \rho - \Psi^2\Phi_c\} \\ \rho + \Psi^2\Phi_c \end{bmatrix} \qquad (35)$$

The debtor obtains her payment from a non-crisis economy ($z_1 s\Lambda$) plus the most generous offer that could possibly have been extracted from the creditor.

Period 1

In period 1, the creditor proposes the value of the transfer γ_c to the debtor. If the debtor refuses, the economy is in crisis, and the payoffs depend upon the outcome for period 2, which in turn depends upon whether (33) holds. It is rational for the debtor and the creditor to consider the payoffs over both periods.

[103] There is no need to examine the feedback of the agreement onto the macroeconomy. This is because of the assumption that cronies, like foreign creditors, only consume traded goods. The division of the overhang therefore has no general equilibrium effects. To imagine what would happen in the event of a feedback (with the domestic capitalists consuming non-traded goods) we would have to have the income of domestic capitalists affecting the demand for non-traded goods in (20). While this would be more realistic, it makes analytic solutions impossible.

$$\begin{bmatrix} y_{debt}\{DisA,1\}+y_{debt}\{2\} \\ y_{cred}\{DisA,1\}+y_{cred}\{2\} \end{bmatrix}=\begin{bmatrix} \Psi\Phi_d+y_{debt}\{2\} \\ \Psi\Phi_c+y_{cred}\{2\} \end{bmatrix}$$

$$\left.\begin{aligned} &=\begin{bmatrix} \Psi\Phi_d+y_{debt}\{DisA,2\} \\ \Psi\Phi_c+y_{cred}\{DisA,2\} \end{bmatrix} \; if \quad z_1 s\Lambda+rK < \Psi^2\Phi-\delta\rho \\ &=\begin{bmatrix} \Psi\Phi_d+y_{debt}\{A,2\} \\ \Psi\Phi_c+y_{cred}\{A,2\} \end{bmatrix} \; if \quad z_1 s\Lambda+rK \geq \Psi^2\Phi-\delta\rho \end{aligned}\right\} \quad (36)$$

It turns out that we can focus on the second case.[104] Proceeding under the assumption that (33) holds (i.e., that there is a period 2 agreement) we have the following disagreement payoffs from substituting (35) into (36)

$$\begin{bmatrix} y_{debt}\{DisA,1\}+y_{debt}\{A,2\} \\ y_{cred}\{DisA,1\}+y_{cred}\{A,2\} \end{bmatrix}=\begin{bmatrix} \Psi\Phi_d+[z_1 s\Lambda+\{rK-\rho-\Psi^2\Phi_c\}] \\ \Psi\Phi_c+[\rho+\Psi^2\Phi_c] \end{bmatrix}$$

If the debtor agrees, the economy is not in crisis, and the agreement sticks for period 2. The payoffs reflect the economy functioning normally for two periods.

$$\begin{bmatrix} y_{debt}\{A,1\}+y_{debt}\{A,2\} \\ y_{cred}\{A,1\}+y_{cred}\{A,2\} \end{bmatrix}=\begin{bmatrix} 2z_1 s\Lambda+\gamma_c \\ 2rK-\gamma_c \end{bmatrix} \quad (37)$$

[104] If one proceeds under the assumption of a period 2 disagreement, it is shown in the appendix that the condition for a period 1 bargain (that the sum of the period 1 agreement payoffs exceeds the sum of the disagreement payoffs) contradicts the condition for a period 2 disagreement.

As before, the condition for an agreement is that the sum of the agreement payoffs is at least as great as the sum of the disagreement payoffs.

$$rK + z_1 s\Lambda \geq \Psi\Phi \qquad (38)$$

As for the agreement struck in period 1, the *creditor* uses the power to make a take-it-or-leave-it offer to propose the *minimum* transfer consistent with debtor participation.

$$\gamma_c = \Psi\Phi_d + [z_1 s\Lambda + \{rK - \rho - \Psi^2\Phi_c\}] - 2z_1 s\Lambda$$

$$= \Psi\Phi_d - z_1 s\Lambda + \{rK - \rho - \Psi^2\Phi_c\} \qquad (39)$$

That is, the lowest transfer (from the creditor) the debtor is prepared to put up with is what she would get if she disagreed, less the advantage to her of agreeing.[105] The subtraction of two lots of $z_1 s\Lambda$ reflects the creditor's ability to 'drive a hard bargain'. He can extract from the debtor the present value to her of an agreement in period 1.

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[105] Unlike (34), the required transfer from (39) could, for large very values of z_2 and b_r, exhaust the creditor's ability to pay from current resources rK. Absent the ability to borrow future output, (38) and rK≥(39) would be joint conditions for period 1 agreement. In this special case, one of the conclusions of the paper - that reducing z_2 or increasing ρ does not facilitate agreement - would no longer be true.

We obtain the agreement payoffs by substituting (39) into (37).

$$\begin{bmatrix} y_{debt}\{A,1\}+y_{debt}\{A,2\} \\ y_{cred}\{A,1\}+y_{cred}\{A,2\} \end{bmatrix} = \begin{bmatrix} \Psi\Phi_d+[z_1 s\Lambda+\{rK-\rho-\Psi^2\Phi_c\}] \\ z_1 s\Lambda+rK-\Psi\Phi_d+[\rho+\Psi^2\Phi_c] \end{bmatrix} \quad (40)$$

Thus the total payoffs reflect the strength of the players in each period. In period 2, it is the debtor who uses her power to take the full benefit of an agreement, net of the inside option that the creditor must be paid to ensure agreement (the period 2 payoffs from (35) are isolated in square brackets on the right hand side). In period 1, it is the creditor who uses his power to take the full benefit of an agreement, net of the inside option that the debtor must be paid to ensure agreement.

The foregoing analysis makes it possible to derive a number of theorems. I do so diagrammatically and mathematically.

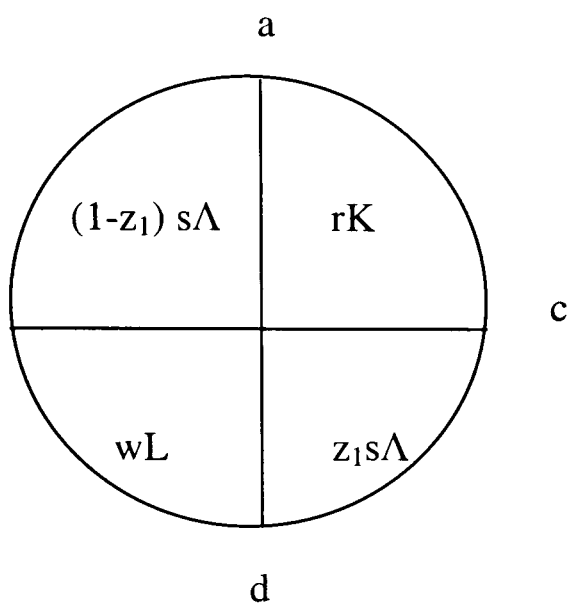
Diagrammatic Representation of the Theorems

For simplicity, the following diagrams are drawn ignoring the *general equilibrium effects of the removal of* b_r, ignoring eventual *capital flight* and showing *equal shares for the agents*. The output of the economy is divided into the returns to the factors.

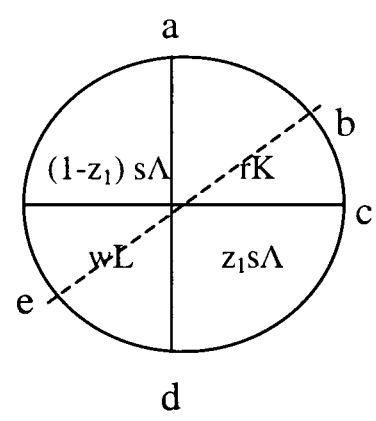
First, I show why there can be a disagreement at all. Since the economy - the sum of the returns to the factors represented by circles below - will be bigger if there is an agreement, why couldn't Pareto improvements always be made to guarantee an agreement? The following two diagrams show the shares upon agreement and

disagreement. The partitions of the pie (the economy) are equally divided for expositional clarity, and, corporate decay means that the disagreement pie is smaller. For ease of notation, I use *rK* for the capital share and *wL* for the labor share.

Agree



Disagree



In the disagreement pie, the payoffs to the South-East of the dotted line are given to the cronies (clockwise segment be) with *wL* divided in the ratio b_r (to the cronies) and $1\text{-}b_r$ (to labor) and *rK* divided in the ratio z_2 (to the cronies) and $1\text{-}z_2$ (to the creditor).

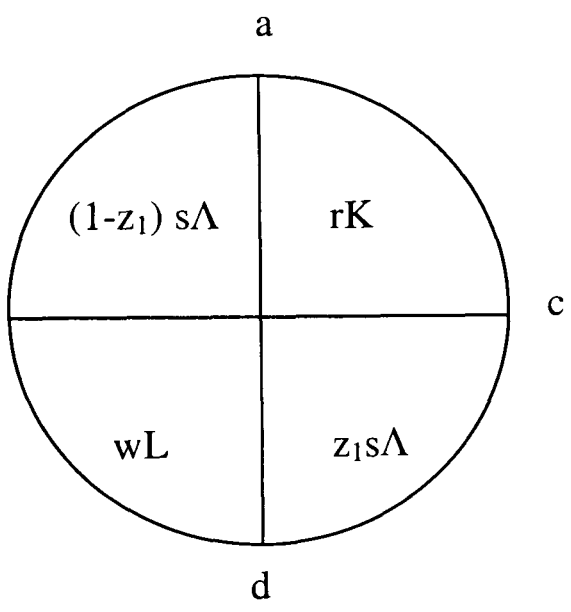
The reason disagreement is possible is that disagreement segment ae (all segements read clockwise) may exceed agreement segment ad. That is, even if the creditor were to offer the debtor all of his agreement payoff (net of disagreement segment ab, which the creditor could obtain by disagreeing) the debtor would still be better off disagreeing.

But why couldn't we start with the disagreement payoffs and strike a deal (thereby making the economy bigger) that would improve everyone's payoff?

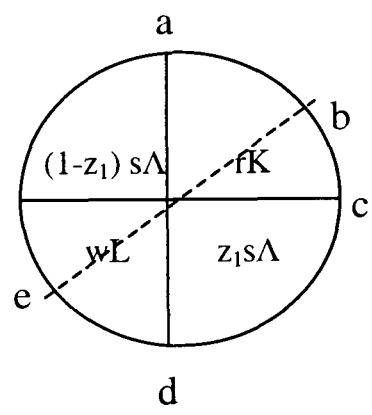
It is the assumption that a deal involves the complete end of the expropriation from the workers ($b_r=0$) that blocks such Pareto improvements. This is the exogenous payment halted by Nature. As I have already pointed out, although the economy is bigger upon agreement, the pie that the creditor and the debtor bargain over may be smaller, since the workers having enlarged their piece. As the above diagram shows, disagreeing may be Pareto efficient, given that Nature halts the transfer from the workers to the debtor.

Theorem 1: *Delay in reaching agreement is possible despite perfect information.*

Period 1 Agree

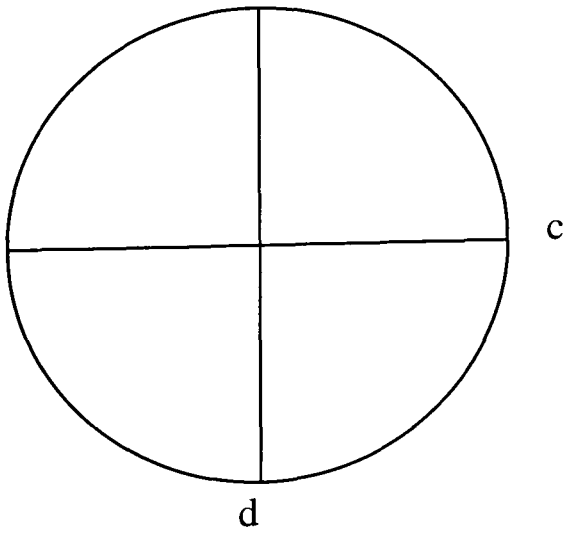


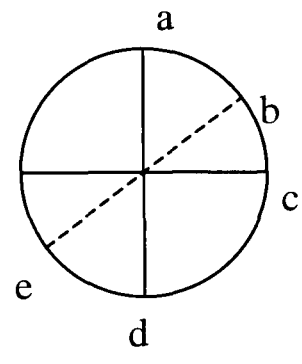
Disagree



Period 2

(shares as above) a





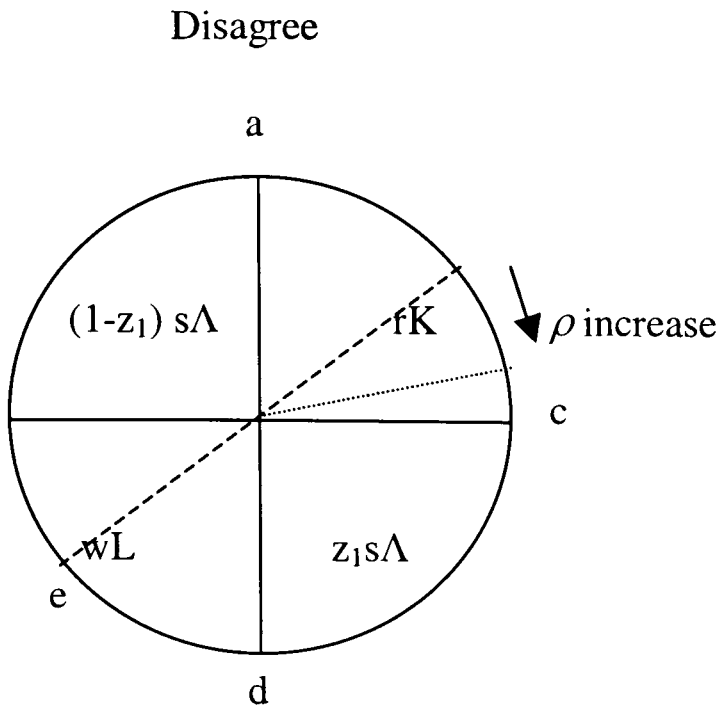
The right hand circle is smaller in period two because of corporate decay. Clearly, it is possible for period 2 agreement segment ad to exceed period 2 disagreement segment ae, implying that agreement is reached in period two. But it is also possible that period 1 agreement segment ad is less than period 1 disagreement segment ae, implying disagreement in period 1. This establishes Theorem 1.

Also, disagreement in period 2 implies disagreement in period 1. That is because the disagreement payoff in period 1 is a scaled up version of the disagreement payoff in period 2 (since corporate decay is in place). This is confirmed mathematically in the appendix.

Theorem 2: *Order protocol (who makes take-it-or-leave-it offers, and when) has no bearing on the time a bargain is struck.*

All that order protocol does is determine the shares that are received in an agreement. This is distinct from when a bargain is struck. In this respect, my model is identical to Rubinstein's alternating offer model.

Theorem 3: *Increasing the power of the creditor to recover losses through the courts increases their payoff, but it may not make an agreement more likely.*



If a bankruptcy penalty is put in place, it will increase the payoff the the creditor in the event of disagreement, but reduce the payoff to the debtor. Therefore, it makes the debtor more willing to settle *but it makes the creditor happier with disagreement* and the effects cancel. Clearly the disagreement segment ae is unchanged. Contrariwise, a drop in b_r will reduce the debtor's disagreement payoff (and the disagreement segment ae) whilst not increasing the creditor's disagreement payoff. It therefore makes agreement more likely. This point is taken up in the conclusion.

When the debtors disagreement payoff shrinks by more than the creditors payoff rises *(δ>0)*, the difference is effectively 'lost' to the economy, or at least transfered to some other party besides the debtor (cronies) and the creditor. In this case the disagreement segment ae shrinks, making agreement more likely. I now establish all these theorems mathematically.

Mathematical Proof of the Theorems

Theorem 1: *Delay in reaching agreement is possible despite perfect information.*

The proof immediately follows from (38) and (33). It *is* perfectly possible that the debtor's position is such that it is better to disagree, and let the crisis continue in period 1 (that is, (38) is violated), but that it becomes optimal to resolve the crisis in period 2 (that is, (33) holds). This establishes Theorem 1.

The policy relevance of Theorem 1 is that the provision of accurate information during a crisis may not be enough to move a stalled overhang bargain. If the process remains tied up by a powerful group with a large inside option, the sword of reform must cut there.

Theorem 2: *Order protocol (who makes take-it-or-leave-it offers, and when) has no bearing on the time a bargain is struck.*

Agreement will be reached in period 1 if (38) holds, and in period 2 if (33) holds. When these conditions hold, there is a surplus to bargain over.[106] Order protocol only becomes relevant when deciding on the value of γ_c, which determines the division of that surplus.

Lemma 1: *In the event of delayed agreement, order protocol may have no effect on the final payoffs (even if one player is allowed to make all the offers).*

[106] But the surplus may be zero. See Lemma 1.

In a two period model, delayed agreement means that there is disagreement in period 1, and agreement in period 2. Suppose that (33) is *just* met (i.e., with equality) in period 2, allowing an agreement to be reached. In this case, it is the claim of this lemma that order protocol is irrelevant to the payoffs.

For there to be agreement in period 2, the transfer γ_c must be within the limits that allow *both* debtor and creditor to participate. I repeat the disagreement and agreement payoffs for period 2, and then show the admissible range of γ_c.

$$\begin{bmatrix} y_{debt}\{DisA,2\} \\ y_{cred}\{DisA,2\} \end{bmatrix} = \begin{bmatrix} \Psi^2\Phi_d - \rho(1+\delta) \\ \Psi^2\Phi_c + \rho \end{bmatrix}$$

$$\begin{bmatrix} y_{debt}\{A,2\} \\ y_{cred}\{A,2\} \end{bmatrix} = \begin{bmatrix} z_1 s\Lambda + \gamma_c \\ rK - \gamma_c \end{bmatrix}$$

Whoever makes an offer, the debtor will only participate if it leads to an outcome no worse than disagreement.

$$z_1 s\Lambda + \gamma_c \geq \Psi^2\Phi_d - \rho(1+\delta) \quad \Rightarrow \quad \gamma_c \geq \Psi^2\Phi_d - \rho(1+\delta) - z_1 s\Lambda \qquad (41)$$

Whoever makes an offer, the creditor will only participate if it leads to an outcome no worse than disagreement.

$$rK - \gamma_c \geq \Psi^2\Phi_c + \rho \qquad \Rightarrow \qquad rK - \Psi^2\Phi_c - \rho \geq \gamma_c \qquad (42)$$

Thus, the range of possible values of γ_c, that will determine the division of the surplus, is as follows:

$$rK - \Psi^2\Phi_c - \rho \;\geq\; \gamma_c \;\geq\; \Psi^2\Phi_d - \rho(1+\delta) - z_1 s\Lambda \qquad (43)$$

But we have assumed that (33) is met with equality during the second period. This turns out, from (43) to imply only one feasible value of γ_c.

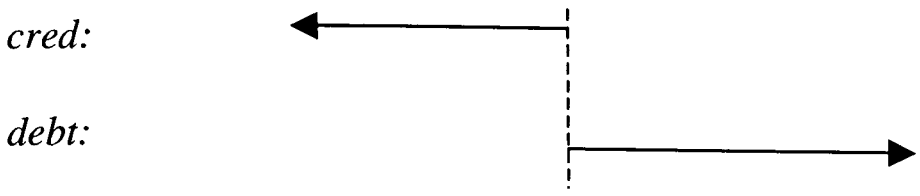
$$z_1 s\Lambda + rK = \Psi^2\Phi - \delta\rho \qquad \Rightarrow$$

$$rK - \Psi^2\Phi_c - \rho = \Psi^2\Phi_d - \rho(1+\delta) - z_1 s\Lambda \qquad \Rightarrow$$

$$rK - \Psi^2\Phi_c - \rho \;=\; \gamma_c \;=\; \Psi^2\Phi_d - \rho(1+\delta) - z_1 s\Lambda \qquad (44)$$

But this says that the value of γ_c will be the same regardless of whether the creditor can get away with the minimum possible transfer to the debtor ($\Psi^2\Phi_d$-$\rho(1+\delta)$-$z_1 s\Lambda$), or, the debtor can extract the maximum possible transfer from the creditor (rK- $\Psi^2\Phi_c$-ρ). *These amounts are the same in period 2.*

When γ_c is substituted into the agreement payoffs, each player receives their inside option and no more. By assumption, the sum of the agreement payoffs equal the sum of the disagreement payoffs in period 2, and, each player must be paid their inside options (disagreement payoffs) to participate. Therefore, nothing is left over to divide. We recall the earlier diagram, showing no gains to trade when γ_c took on a single value.



We can now complete the argument of Lemma 1. Since the lemma only considers those cases where there is a delay, there is disagreement at the first instant. *Clearly it does not matter who has the power to make offers in the event of a disagreement.* The debtor is not interested because the inside option is too attractive. To make the debtor interested, the creditor would have to propose such a high transfer that it would not be optimal for him to agree to his own proposal!

Since a bargain has not been struck, the economy is in crisis and corporate decay is taking place. If (33) is *just* met in the second period, *there is only one possible transfer.* But that implies there is *no advantage to making an offer in period 2*, and the payoffs will all be the same regardless of who makes it. Thus, there is no advantage to making an offer in either period, establishing Lemma 1.

In one sense, there is nothing unexpected about Lemma 1. Whoever has the power to make a take-it-or-leave-it offer still captures the surplus. The subtle twist here is that *there is no surplus to capture at the instant that the bargain is struck.*

The results of Theorems 1 and 2 appear to be rather general, and would apply to other bargaining situations where the gains to trade are not there at the beginning of the

problem, but appear later on. Of course, if the problem started with a surplus, *neither* of these theorems would hold. In fact, that there *are* gains to trade at the beginning of most standard bargaining models is something of a *deus ex machina.* If these gains are negative to start with, but then become non-negative at a later stage, there may be no gains from trade when the bargain occurs. In such an environment, the bargaining protocol may be irrelevant.

Theorem 3: *Increasing the power of the creditor to recover losses through the courts increases their payoff, but it may not make an agreement more likely.*

It is commonly believed among economists working in Indonesia that delays in corporate restructuring reflect the inability of creditors to wield the threat of bankruptcy.[107] Yet this belief does not stand up to scrutiny in this model.

To see this most clearly, suppose that there are no court costs, and no bribery is possible ($\delta=0$). Suppose that the imposition of bankruptcy means that ρ changes from being zero (no bankruptcy threat) to being strictly positive (bankruptcy threat in place). What the dissenters from Theorem 3 correctly see is that greater debtor loss in the event of a disagreement makes the debtor more willing to put up with a lower γ_c. To illustrate this, consider the second period. We have the following requirement for an agreement for the debtor and creditor respectively.

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[107] For example, when the IMF listed the primary obstacles to restructuring, 'First and most important, the legal system has failed to pose a credible threat to debtors that refuse to restructure' (IMF 2000).

$$\begin{bmatrix} z_1 s\Lambda + \gamma_c \\ rK - \gamma_c \end{bmatrix} \geq \begin{bmatrix} \Psi^2\Phi_d - \rho \\ \Psi^2\Phi_c + \rho \end{bmatrix} \qquad \Rightarrow$$

$$\gamma_c \geq \Psi^2\Phi_d - z_1 s\Lambda - \rho \qquad (debt)$$

$$rK - \rho - \Psi^2\Phi_c \geq \gamma_c \qquad (cred)$$

It is indeed correct, from the debtor's participation inequality, that a higher value of ρ will reduce the minimum transfer that the debtor would accept. In a sense, the debtor becomes less fussy, willing to accept a deal with a lower transfer from the creditor because the creditor's power in the courts is increasing. But *does this make it more likely that a deal with be struck*?

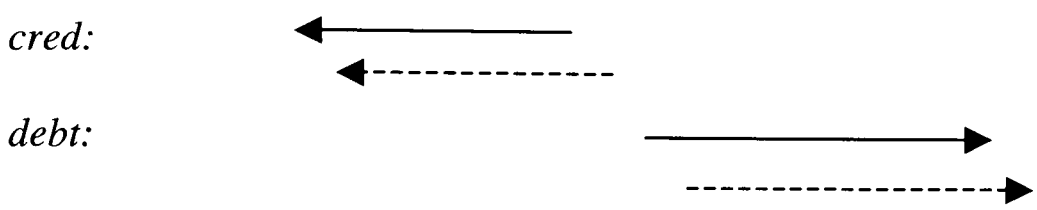
The answer is 'no'. What the dissenters from Theorem 3 do not see is that an increase in ρ also emboldens the creditor. From the creditor's participation inequality, the creditor's maximum acceptable transfer is now lower. A deal can only be struck if the creditor's maximum acceptable γ_c is greater than or equal to the debtor's minimum acceptable γ_c. Unfortunately, if this condition is violated initially (as it must be if no deal occurs), increasing the court transfer ρ will move down these two values by the same amount, leaving the chasm between them intact. This establishes Theorem 3.

In terms of the earlier diagrams, there is initial disagreement

cred: ←

debt: →

but increasing ρ will only succeed in decreasing *both* the debtor's minimum acceptable transfer, and the creditor's maximum acceptable payment, by the same amount,



leaving the chasm intact.

This is not to say that the creditor's payoff will not rise. It is indubitable (from (35)) that it will, since any feasible bargain involves paying out the creditor's inside option. The point being made is just that there is a distinction between the payoffs, and the likelihood of agreement. This kind of bankruptcy reform affects the former, but not the latter.

Things become more complex when we consider the effects of a non-zero δ.[108] Once this is allowed for, increasing the in-court transfer ρ may indeed facilitate agreement. Increasing ρ means that (33) may hold when it would otherwise not, allowing an agreement to be reached. Consider the intuition for the case where δ represents the discount on an asset disposed of at a fire-sale. The presence of the discount means that, for increasing ρ, the debtor becomes less fussy (puts up with a lower γ_c) faster than the creditor is emboldened, because the creditor is losing the discount on the transfer. The edges of the chasm inch closer until (for sufficiently high ρ) it closes altogether, allowing a bargain to be struck.

Using similar reasoning, (33) makes it clear that a higher court penalty δ for the debtor helps facilitate agreement. However, this need not be accomplished through encouraging inefficient disposal of assets, or bribery! The other possibility is to charge debtors administrative fees when they are obliged to come to court for bankruptcy hearings.

On balance then, reform of bankruptcy laws in Indonesia will have offsetting effects on the likelihood of bargain resolution in a given period. In particular, it is likely that the creditor's position will be strengthened (a higher ρ), but that fire-sales will be achieved at less of a discount (a lower δ). While it is therefore difficult to be precise about the overall effect on the likelihood of resolution, it is clear that the proponents of tougher bankruptcy laws have overstated their case.

5 Conclusion

I return to the question posed in the introduction. A*re there any policies that can terminate the cronies' last tango in Jakarta?* This is equivalent to asking what policies make the inequality conditions for striking a bargain more likely to hold.

To answer the latter question, I begin by writing out inequality (33), in full.[109]

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[108] It is widely perceived, both within and outside the legal system, that bribery occurs (IMF 2000), and, discounts at fire-sales seem eminently reasonable.

[109] The pronumeral s on the left hand side is from (28), with $b_r = 0$ and with $\Psi = 1$. This return is lower than the value of s during the crisis, aside from the effects of corporate decay.

$$z_1 s\Lambda + (\overline{\overline{rK_x}} + \overline{\overline{rK_n}}) \geq \quad \Psi^2[z_1\tilde{s}\Lambda + b_r\tilde{w}\bar{L} + (\tilde{r}_x\overline{K_x} + \tilde{r}_n\overline{K_n})] - \delta\rho.$$

One clear policy stands out.[110] Denying cronies access to the bank rescue levy removes the second term on the right-hand-side, making it virtually certain that this inequality holds.[111] What makes delay more likely is that the cronies can expropriate additional wealth via the bank rescue tax.[112] However, if it is no longer possible to expropriate this wealth, there will be less reason for delay.

This result says as much about the importance of adequate financial sector prudential supervision, as it does about how to manage a crisis after the fact. For denying bank rescue funds to institutions that have been siphoning money to cronies amounts to nothing less than the suspension of the lender of last resort facility. Given the systemic risks of such a policy, it is hardly practical.

Furthermore, laying aside perfect information for a moment, it is very difficult to decide which banks deserve to fail at the outset of a crisis, especially since the cronies would have gone to considerable lengths to hide their activities. Nevertheless, subject to all

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[110] One policy would be to try and maximize the corporate decay (minimize Ψ). If the IMF accelerates the ruin of the economy, the cronies will want to resolve the crisis. This might explain the rapid reforms in China following the Cultural Revolution, but it is not a good guide for policy in Indonesia! More seriously, if private creditors withdraw assistance from their debtors, it may speed up the bargain.

[111] The undistorted return s on the fixed factor would have to be very low indeed for it not to hold.

[112] In Indonesia, the pilfering continues. Currently the cronies are currently trying to benefit from a market-based disposal of bad loans. With the aid of populist anti-foreign-investment propaganda, they seek to limit the demand for non-performing loans being on-sold, by only making them available to local purchasers. The loans can then be sold cheaply to the agents of the cronies, leaving the taxpayer with a substantial loss.

these caveats, it may be possible to go some way towards limiting the lender of last resort pilfering by the cronies.

Given the benefits of denying the bank rescue tax, it might be thought that limiting the share of foreign capital payments siphoned to the cronies, z_2, would help bring on an agreement. Surprisingly, this is not the case. The inequality does not mention z_2, indicating that this strategy would not help to make an agreement more likely. The reasoning is exactly analogous to the discussion about bankruptcy. Decreasing z_2 will certainly weaken the debtor's position (reducing Φ_d in (41)) but it will equally embolden the creditor (increasing Φ_c in (42) by the same amount). Getting the cronies 'claws out of the system' will increase the creditor payoffs, but it will not hasten agreement.

To conclude, I reiterate the policy implications of the main results.

First, Theorem 1 implies that the provision of extra information may not help achieve a speedy resolution. That is not to say that more information is a bad thing (especially in a country like Indonesia), but it is just to warn that the primary reason for the tardy progress may be the activities of the cronies.

Second, Theorem 2 says that various order protocols, that differ only in who has the power to initiate offers, all boil down to the same thing; no agreement, until the debtor falls on hard times. Lemma 1 says that if there has already been delay, the actual shares (in addition to the timing of the agreement) may also be unaffected by order protocol.

Finally, Theorem 3 warns those who hope in bankruptcy reforms to think more carefully. Bankruptcy reforms embolden the creditor, as well as weakening the debtor, so a deal may still prove elusive.

If only I had realized that institutional details are not so important when cronies are stalling! I could have given in to the soporific environment of the debt negotiator's Jakarta office. But then, this paper may never have been written.....

Appendix

In the text I claimed that it was unnecessary to consider the possibility of period 2 disagreement when working out a period 1 condition for agreement.

Consider the disagreement payoffs if the first inequality in (36) is true. This describes the following situation: if the players were to arrive at the second period free to disagree (i.e. if there had been a first period disagreement) then they would do so. The payoffs are:

$$\begin{bmatrix} y_{debt}\{DisA,1\} + y_{debt}\{2\} \\ y_{cred}\{DisA,1\} + y_{cred}\{2\} \end{bmatrix} = \begin{bmatrix} (\Psi + \Psi^2)\Phi_d - (1+\delta)\rho \\ (\Psi + \Psi^2)\Phi_c + \rho \end{bmatrix} as \;\; z_1 s\Lambda + rK < \Psi^2\Phi - \delta\rho.$$

$$\begin{bmatrix} y_{debt}\{A,1\} + y_{debt}\{A,2\} \\ y_{cred}\{A,1\} + y_{cred}\{A,2\} \end{bmatrix} = \begin{bmatrix} 2z_1 s\Lambda + \gamma_c \\ 2rK - \gamma_c \end{bmatrix}$$

The condition for period 1 agreement is that the sum of the agreement payoffs exceed the sum of the disagreement payoffs. That is

$$2(z_1 s\Lambda + rK) \geq (\Psi + \Psi^2)\Phi - \delta\rho$$

But from the original condition for period 2 disagreement

$$2(\Psi^2\Phi - \delta\rho) > 2(z_1 s\Lambda + rK) \geq (\Psi + \Psi^2)\Phi - \delta\rho \qquad \Rightarrow$$

$$\Psi(\Psi - 1)\Phi > \delta\rho$$

which is impossible, given δ>0 and Ψ<1.

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Chapter 4

Debt Forgiveness; the Case for Hyper-incentive Contracts

Debt Forgiveness; the Case for Hyper-incentive Contracts[113]

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Abstract

I review two proposals for debt forgiveness; the Highly Indebted Poor Country Initiative (HIPC) and the Jubilee 2000 Coalition Initiative (J2K). I then consider the workhorse model of debt forgiveness (Krugman 1988). I show that this solution is a sub-optimal contract, where the incentive parameter ignores the cost of effort. An optimal debt-overhang contract is derived, with an incentive parameter greater than the marginal social benefit of extra effort. This Hyper-Incentive Contract eliminates hidden-effort moral hazard, and provides a fuller rationale for case-by-case debt-overhang contracts.

Key words: Debt overhang; Debt forgiveness; Optimal contracts; Moral hazard

JEL classification: F34

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1 Introduction

When the history of the year 2000 is writ large for future generations, one wonders what event will capture the popular imagination. One contender is the forgiveness of substantial amounts of poor-country foreign debt. At the June 1999 Cologne summit, the G-7 entertained writing off approximately $US100 billion, subject to certain conditions. Though progress continues to be slow, the popular and political will now exists to tackle the issue of unredeemable debt.

As evidence of this, I scrutinize the two current proposals for debt relief; the Highly Indebted Poor Country initiative (HIPC) and Jubilee 2000 proposal (J2K). The HIPC proposal provides case-by-case debt relief subject to economic reform conditions. It comes at the issue of unredeemable debt 'from above', at the instigation of private banks, the IMF, the World Bank, and ultimately the US government. In contrast, J2K draws its support from a groundswell of popular support for poor countries, and, from the questioning of free market liberalism, evidenced by the Seattle WTO conference. As one might expect, the J2K coverage is broader and the debt relief deeper than HIPC. However, J2K is burdened with a somewhat dismissive view of orthodox economic development,

Orthodox economics has a role to play in this debate, given that 'the best laid schemes of people and politicians go oft astray'.[114] I therefore examine a model of debt forgiveness

[114] Apologies to Robert Burns, 'The best-laid schemes o' mice and men Gang aft a-gley' *To a Mouse*, and, apologies to those who correctly point out economists' schemes sometimes do likewise.

(Krugman 1988), asking if it provides optimal contracts for case-by-case debt forgiveness, as required by both HIPC and J2K. I show that his solution assumes a sub-optimal incentive parameter. The key insight of this paper is that the optimal incentive parameter exceeds the marginal social benefit of extra effort. This *Hyper*-Incentive Contract Pareto dominates Krugman's solution.

In Section 2, I describe the HIPC and J2K proposals. In Section 3, I give Krugman's solution to the debt overhang problem. I outline the intuition of a Hyper-Incentive Contract in Section 4, followed by a rigorous Principal/Agent treatment in Section 5. Section 6 asks if the necessary transfers are feasible. Section 7 concludes.

2 Proposals for Debt Forgiveness: HIPC and J2K

2.1 HIPC

The stage setting for HIPC goes back to the oil crisis of the 1970s. The Organization of Petroleum Exporting Countries (OPEC) cartel achieved a sizable transfer of wealth from the industrialized world between the time of the first oil price hike in 1974, until the collapse of the oil price in 1985. The so-called petro-dollars were saved by the OPEC nations, and then recycled back through the world financial system to developing countries, many of whom were experiencing balance of payments difficulties due to higher energy prices. In the early 1980s, a high interest rate policy was instigated by the US Federal Reserve to reduce US inflation. This, together with weakened world demand,

adversely impacted upon debtors' debt service costs and export revenues respectively. The international debt crisis emerged in 1982, when Mexico rescheduled its debts. Capital flows to many developing countries ceased, and a drawn out process of debt rescheduling commenced.

For the poorest countries, most of the debt was sovereign, and owed to OECD governments and international agencies. Rescheduling occurred at the so-called Paris Club of creditors. If the club believed, usually on the say-so of the IMF, that the country was making a significant adjustment effort, the debts would be rescheduled (i.e. payments delayed). However, for many years the Paris Club stuck to the principle that the rescheduling must never occur at concessional rates, implying that the net present value of the debt was maintained. Once the danger to the international financial system passed, there seemed to be little political will to tackle the issue of unredeemable debts. Political-economy considerations (Evans 1999) suggests four obstacles: the absence of a crisis, the insignificance of the countries in the world economy, the reluctance of institutions to acknowledge past mistakes, and the reluctance of the United States, until the Clinton administration, to get involved.

Despite the 1987 introduction of the IMF's much-heralded Enhanced Structural Adjustment Facility (which Evans says was largely a reaction to mounting arrears on IMF loans to the poorest countries), the situation did not change substantially for over a decade. The 1989 Brady plan provided some relief to the Latin American countries (and US banks), but bypassed the poorest countries, most of which are in sub-Saharan Africa.

Over time, the 'no net present value reduction' principle eroded leading, in 1996, to the unveiling of the HIPC initiative by the IMF and the World Bank.[115] Under HIPC, very poor countries could apply for the writing off of sovereign debt provided that they pursued sound economic policies for a sustained period of time (the so-called conditionality requirement). Another innovation was that HIPC aimed to treat each country on a case-by-case basis. The 41 HIPC countries have debts totaling $205 billion. Following the June 1999 Cologne summit, there is a commitment to write off approximately $100 billion, providing conditionality is satisfied.

The G-7 finance ministers stopped short of pledging tax increases to compensate HIPC creditors. Instead, they called on the Multilateral Development Banks (MDBs) to carefully examine any ways of realizing efficiency gains. They also promised to consider giving resources to an expanded HIPC Trust Fund (the HIPC Trust Fund was set up to help all MDBs finance debt forgiveness). This, together with a so-called Millenium Fund (taking private sector contributions), will be key to lowering debt service payments.[116]

Absent tax increases, the debt initiative will have to be financed directly through government contributions. This means that either it will not be financed at all, or it will be financed at the cost of many governments' normal aid budgets (Morrison 1999).

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[115] This principle started eroding at the G-7 Toronto summit. Subsequent 'Toronto terms' were sometimes concessional.

[116] Debt principal relief does not necessarily imply debt service relief. Although a reduction in the debt stock should translate roughly into a proportional cut in the service repayments, it is not so for the HIPCs.

2.2 *J2K*[117]

In the early 1990s, Non-Government aid agencies (NGOs) campaigned and lobbied for debt relief through the so-called Debt Crisis Network. In 1994, Martin Dent (professor in Keele University UK) linked up with Bill Peters (an ex-Diplomat) and Isabel Carter (the Community News Editor of Tearfund) to create Jubilee 2000. In April 1996, the Jubilee 2000 campaign commenced, with funding from three Christian aid organizations: CAFOD (catholic), Christian Aid (ecumenical) and Tearfund (evangelical). In 1987, the campaign was launched in the US and elsewhere. In October of that year, Jubilee 2000 (UK) became a formal coalition of aid agencies.

J2K described its aims as (a) a one-off cancellation of the unredeemable debts (b) of the world's poorest countries (c) by the year 2000, (d) under a fair and transparent process.

The inspiration for condition (a) allegedly came from the Jubilee year in the Bible, though the Jubilee year was neither one-off nor confined to unredeemable debts.[118] The one-off condition probably also owed something to game theory, since a one-off cancellation would seem to remove an incentive to refrain from lending in the lead up to

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Much of the debt service is not being paid anyway, so there is a point up to which debt forgiveness will not reduce interest payments.

[117] This section is based upon personal communications with the Jubilee 2000 organizers, London.

[118] In Deuteronomy 15, the Israelite people were commanded to cancel fellow-Israelite debts and free Israelite slaves every seven years (though it is not called a Jubilee in this passage). Leviticus 25 is the actual Jubilee legislation. Every 50 (or 49) years, on the so-called day of the atonement, the people were commanded to 'proclaim Liberty'. All land was to return to its original family, redefining all land sales as leases (with the exception of houses in walled cities, under some circumstances). In the same passage, charging interest, or selling food to those in need at a profit, is prohibited.

a (regular) Jubilee. However, J2K never suggested a pre-commitment technology that would have made subsequent forgiveness impossible.

J2K shared aim (b) with HIPC, though it wanted more countries covered and more money spent. It earmarked 52 countries (compared with 41 under HIPC) with debts totaling $350 billion ($205 billion under HIPC) for relief of $200 to $300 billion ($100 billion under HIPC).

Aim (c) was largely directed at marketing, and has clearly passed its 'used by' date.

The proposal received criticism for its ambiguity about conditionality. Stressing 'conditionality from below' (i.e. conditions of a debt relief contract emanating from the debtor country's Civil Society) the coalition refrains from endorsing Western-style economic policies as a means of alleviating poverty. However, even if the centrality of poverty reduction is granted, advocates of 'conditionality from below' need to answer the following questions.

First, the price mechanism is a socially cheap way of providing information and incentives. *In the absence of a well-functioning price mechanism, how is allocation of resources to be achieved?* Second, moderate and stable inflation is necessary for prices to do this job effectively. *How will hyper-inflation help the poor?* Third, unless the fiscal authorities have long term financing credibility (either through a well functioning tax system, or small outlays), the fear of an eventual hyper-inflation tax will prove

disruptive. *What does it do to the poor to adjust to government subsidies and benefits only to have them suddenly taken away in a financing crisis, or eroded in a hyperinflation?*

This limited economic orthodoxy needs defending, judging from the J2K web page. It is hard to find any mention there of fiscal or monetary discipline, or of the importance of price signals. The recent silence of the centrally-planned cadavers in Eastern Europe (and elsewhere) should not allow us to forget their message.

3 Krugman's Model of Debt Forgiveness

The review of the current debt forgiveness proposals indicates that there is now both a popular and political will to address the issue of unredeemable debt. What economic model of debt rescheduling can guide policy makers?

In an important paper, Krugman (1988) outlined a model that has become something of a workhorse in this area.[119] The following situation was envisaged by Krugman.

	Creditor		***Debtor***	
Period	***y> a***	***y≤a***	***y> a***	***y≤a***
1.	-1	-1	*- C(e)*	*- C(e)*
2.	a	y	y - a	0
1. and 2. combined	a-1	y-1	y *- C(e)* - a	*- C(e)*

[119] The model continues to be used, and adapted. In a recent paper, Fernandez-Ruiz used a very elegant version of it to illustrate a dynamic interaction between debtors and creditors (Fernandez-Ruiz 1996).

A Creditor wishes to roll over one unit of debt in the hope of minimizing losses. In the first period, the creditor refinances the unit of debt, and the debtor exerts costly effort $C(e)$, where e is any unobservable adjustment with marginal disutility, such as increased competitiveness, or public sector efficiency.[120] The creditor sets a, the size of the transfer falling due in period two, and therefore the implicit interest rate r ($r=a-1$, and may be negative). I ignore discounting. Output y depends upon effort, and a uniformly distributed error η with zero mean and variance σ^2. That is, $\eta \in (-\sqrt{3}\sigma, \sqrt{3}\sigma)$.[121]

$$y = e + \eta$$

Clearly y spans $(e-\sqrt{3}\sigma, e+\sqrt{3}\sigma)$ and $E(y) = e$.

For simplicity, I follow Fernandez-Ruiz (1996) in specifying quadratic costs.

$$C(e) = \lambda e^2/2$$

In the second period, the benefits for the debtor are non-linear, depending on the outcomes for y. If s/he is lucky (meaning $y > a$) s/he keeps the excess of output over the

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[120] Krugman's model captures one aspect of debt relief well, and one not so well. The idea that debt relief removes a tax on effort is part of the thinking behind HIPC, and this is exactly where the main emphasis of Krugman's model lies. However, the HIPC initiative has assumed that effort is observable (at least partly), since it has relied on conditionality, and this is obviously not the case in Krugman's framework. Oddly enough, their is growing sense of disillusionment with conditionality (Collier 2000) and so this old model may yet come back into vogue.

[121] Simple distributions are commonplace. Fernandez-Ruiz (1996) use a Bernoulli trial with the probability of success equal to effort. The normal distribution is unsuitable because it cannot be integrated.

loan repayment. If unlucky, s/he just sends all the output the creditor's way.[122] Algebraically, the benefit to the debtor (B) is:

$$\left.\begin{array}{lllll} B & = & y & - & a \quad If\, y > a \\ & = & 0 & & If\, y \leq a \end{array}\right\} \qquad (1)$$

A weakness of Krugman's approach, which will be rectified when we come to the Hyper-Incentive contract, is that there is no participation constraint. Or, to put the matter in terms of the sovereign debt literature, there is no default outside option. Given the option to default, it is implausible that the debtor may not want compensation, at least in expected value terms, for getting no payoff in a bad state of nature.

The expected value of the debtor's payoff takes account of the implicit 'limited liability'.

$$E(B) = \int_a^{e+\sqrt{3}\sigma} (y-a)\left(\frac{1}{2\sqrt{3}\sigma}\right)dy \qquad if \quad e-\sqrt{3}\sigma < a < e+\sqrt{3}\sigma$$

For simplicity, Krugman defines debtor utility[123] as:

$$E(Ud) = E(B) - C(e) \qquad (2)$$

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[122] I assume the debtor's payoff in a bad state of nature does not mean zero consumption, perhaps because of an (unmodeled) source of subsistence consumption. That is, the model only describes the formal economy.

[123] The inclusion of variance in (2) leads to mathematical intractability. As we shall see presently, the non-linear benefit function leads to polynomials of degree two in effort. The inclusion of variance would lead to polynomials of degree four. Nevertheless, this omission may not be as bad as it seems at first sight, since the debtor is already 'insured', in a loose ex post sense. Given the floor in the benefit function, her maximum loss is $-\lambda e^2/2$. Fernandez-Ruiz (1996) uses the utility function in the text without explanation. When I subsequently introduce a participation constraint, I shall strengthen the debtors implicit insurance, so that she is given an expected reservation utility, in addition to a maximum loss.

To find the optimal e, we set the marginal expected private benefit equal to marginal cost.

$$\frac{(e+\sqrt{3}\sigma-a)}{2\sqrt{3}\sigma} \quad = \quad MEB \quad = \quad MC \quad = \quad \lambda e$$

$$\Rightarrow \qquad e \quad = \frac{\sqrt{3}\sigma-a}{2\sqrt{3}\lambda\sigma-1} \qquad (3)$$

with the following second order condition.

$$1-2\sqrt{3}\lambda\sigma<0$$

The equation for e can be interpreted as the debtor reaction function. For a given a, the effort choice maximizes debtor utility. Krugman's important insight is that this is downward sloping in a x e space. Creditors face a tradeoff; more forgiveness (lower a) increases effort and the chance of collecting a, but a is also a cap on what can be collected. The optimal e is substituted into expected creditor utility

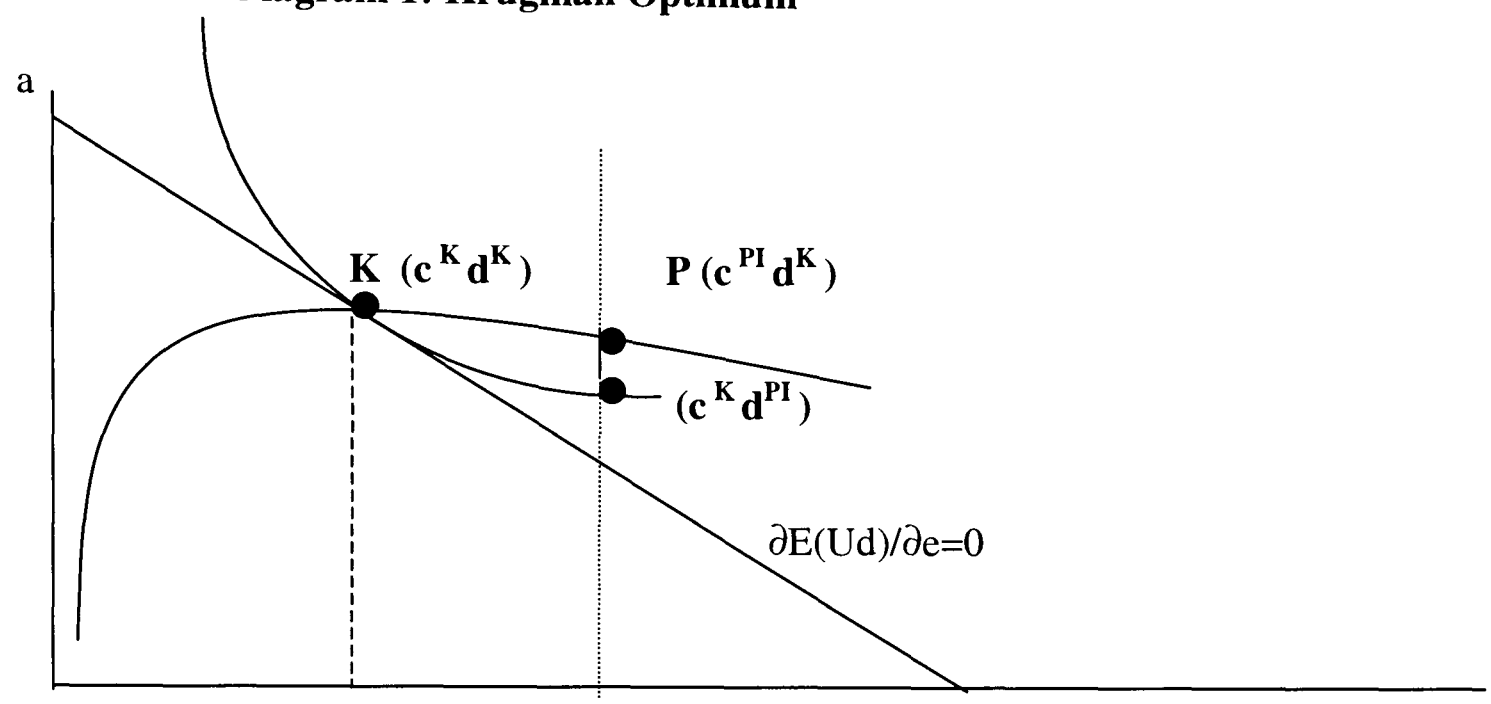
$$\begin{aligned} Uc &= y-B-1 \\ E(Uc) &= e-E(B)-1 \end{aligned} \qquad (4)$$

and differentiated to yield an optimal a, which is a function of λ. This Krugman (debt forgiveness) contract provides micro-foundations for case-by-case debt relief, since λ may differ across countries.[124] Graphically, I denote the debtor utility available from the Krugman contract as d^K and the creditor utility as c^K. The former is decreasing in a, for

[124] To calculate the rate of forgiveness on the face value, recall that $a-1=r$. To calculate the market discount, substitute optimal e and a into $E(Uc)$ and compare this to unity, the original rescheduled amount.

given *e*, and the latter is increasing in *a*, for given *e*. Equation (3), the debtor reaction function, is the line labeled $\partial E(Ud)/\partial e=0$.

Diagram 1: Krugman Optimum



e_K < $1/\lambda$ e

Given the reaction function, the Krugman optimum is *K* in *a x e* space, where the debtor obtains d^K and the creditor obtains c^K. Upon substitution into *(2)* and *(4)*:

$$\mathrm{E}(Ud) = \frac{-1+2\sqrt{3}\sigma\lambda}{24\lambda^3\sigma^2} \equiv d^K \qquad (5)$$

$$E(Uc) = -1+\frac{1}{4\sqrt{3}\lambda^2\sigma} \equiv c^K \qquad (6)$$

Now it is clear from Diagram 1 that *K* is an inefficient bargain of the kind encountered in labour market analysis (McDonald and Solow 1981). There are Pareto improved points

in the lens South-East of K. One such point is P, where the debtor is kept at d^K and the creditor attains utility c^{PI}, where PI stands for 'Pareto Improved'. To calculate c^{PI} algebraically, I find the intersection of the creditor and debtor iso-utility curves insisting on only one solution (thus finding the tangency). This gives me the location of the contract curve, and the relationship between $E(Ud)$ and $E(Uc)$ on the contract curve. Given this, I substitute in d^K for $E(Ud)$ and find $E(Uc)$. Adding *(2)* and *(4)*, and substituting in for $C(e)$, I obtain the following expression for the value(s) of e for which two arbitrary iso-utility curves meet:

$$E(Ud)+E(Uc) \quad = \quad e-\frac{\lambda}{2}e^2-1$$

$$\Rightarrow \quad e \quad = \quad \frac{1\pm\sqrt{1-2\lambda\,(E(Ud)+E(Uc)+1)}}{\lambda}.$$

A single solution (i.e. a tangency defining the contract curve) implies two conditions.

$$e \quad = \quad \frac{1}{\lambda}$$

$$E(Ud)+E(Uc) \quad = \quad \frac{1}{2\lambda}-1$$

From the first condition, the contract curve is a vertical straight line at $e=1/\lambda$. Thus the point P sits on this line. At P, the creditor utility is found by substituting d^K from *(5)* into $E(Ud)$ in the second condition. The resultant expression can be shown to be greater than the value of creditor utility at K (given by equation *(6)*).

$$E(Uc) \quad = \quad \frac{1-2\lambda\sigma(\sqrt{3}+6\lambda\sigma(2\lambda-1))}{24\lambda^3\sigma^2} \quad \equiv \quad c^{PI} \qquad (7)$$

Unfortunately, the debtor and creditor cannot bargain over an unobservable *e*, rendering c^{PI} unattainable. There is a moral hazard that the debtor will commit to $1/\lambda$, but then choose a lower *e* from the reaction function. Therefore *P* is infeasible with a Krugman Contract, due to the inefficiency arising from hidden effort. It is the task of the remainder of the paper to show that the utilities of *P* are attainable using a so-called Hyper-Incentive contract.

4 The Intuitive Case for Hyper-Incentive-Contracts[125]

It was no accident that the contract curve in Diagram 1 was defined by $e=1/\lambda$. Adding the utilities of the creditor and debtor, as we did in the derivation of the contract curve, gives us the attainable social value (the 'cake') for various effort levels.

$$cake \quad = \quad E(Uc) + E(Ud) \quad = \quad e - \frac{\lambda}{2}e^2 - 1$$

Now it is obvious from the above that the expected marginal *social* benefit of an increase in *e* is unity. Setting this equal to the marginal cost (λe) a social optimum is attained at

[125] I am grateful to David Vines for helping me develop the intuition of this section.

$e=1/\lambda$. However, the Krugman Contract can never make marginal private benefit (i.e. the benefit to the debtor) equal to marginal social benefit, as I shall now show.

Diagram 2: The Krugman Contract

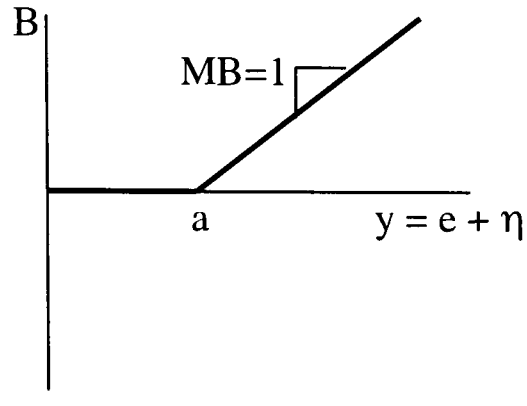


Diagram 2 shows the benefit schedule for the debtor, defined by equation *(1)*. Consider the marginal benefit of an increase in e, supposing that η is volatile enough to allow y realizations on both the flat and upward sloping portions of the schedule. Given η, the marginal private benefit of an increase in e will be unity in a good state of nature (high η), and zero in a bad state of nature (low η). The expected marginal benefit, being a convex combination of the two, must be less than unity. Therefore a Krugman Contract produces too little effort. The expected marginal private benefit will always be less than unity - the marginal social benefit.

When the problem is stated this way, a solution is clear. A contract can be designed where the debtor receives more than the increase in y in the upward sloping portion of the benefit schedule ($MB>1$). That is, if the debtor can pay back the creditor fully, s/he gets

a bonus above and beyond being able to keep the extra output. This way, the *expected* private marginal benefit can be made equal to the expected social benefit (unity). It will be shown that this Hyper-Incentive contract attains the utilities of the Pareto improved point *P*, in Diagram 1.[126]

5 The Formal Case for Hyper-Incentive Contracts

More formally, I rename the creditor the principal and the debtor the agent.[127] Instead of equation *(1)*, I propose a 'wage' for the debtor, and make a notional transfer of the output to the creditor. I think of the creditor as then choosing to 'pay' a multiple *b* of it back to the debtor.[128]

$$\left.\begin{array}{lllll} w = & -a & + & by & If\ y > a/b \\ = & 0 & & & If\ y \leq a/b \end{array}\right\} \qquad (8)$$

[126] Other solutions may be possible, but I have not been able to confirm their global optimality. One candidate is suggested by the recently announced UK policy of keeping interest payments on debt in trust, to be returned later. This is suggestive of a policy where the debtor receives a lump sum payment for clearing the debt. It is straightforward to derive a solution assuming the participation constraint binds (see the next Section). However, I have not been able to prove that the constraint does indeed bind.

[127] The framework chosen is appropriate, because the creditor desires the debtor to perform an unobserved action, leading potentially to moral hazard. However, since wage variance is omitted from the utility function, it is not to be understood in terms of the usual insurance vs. incentive tradeoff.

[128] If the contract breaks down after the output is produced, but prior to repayment of the loan, then clearly it matters who really owns the output. As will be argued presently, the inclusion of a participation constraint means that the contract will be entered into voluntarily, since participating is made at least as attractive as the outside option of defaulting. Of course, a participation constraint is calculated using expected values, raising the issue of default after the realization of the shock. Like Krugman, I not address this issue, but rather assume that debtors and creditors can credibly commit themselves to honor the terms of the contract perhaps because reneging in one relationship creates problems in other relationships (Cole and Kehoe 1998).

$$E(w) \quad = \int_{a/b}^{e+\sqrt{3}\sigma} (-a + by)\left(\tfrac{1}{2\sqrt{3}\sigma}\right) dy \qquad if \quad e - \sqrt{3}\sigma < \frac{a}{b} < e + \sqrt{3}\sigma \tag{9}$$

I now replace *E(B)* by *E(w)* in equation *(2)*. The optimal *e* is then obtained by differentiation.

$$e \qquad = \frac{b\sqrt{3}\sigma - a}{2\sqrt{3}\lambda\sigma - b} \tag{10}$$

Note that the optimal *e* depends upon both *a* and *b*. As before, it is decreasing in *a*. Since *e* is increasing in *b*, I call the latter the incentive parameter. The sign of the partial with respect to *b* follows from the second order condition.

$$b - 2\sqrt{3}\lambda\sigma < 0$$

I assert that the participation constraint - that the debtor must attain at least a reservation utility - binds with equality. That is, the debtor is pushed right down to her reservation utility (proved in the Appendix). I therefore differentiate the sum of the utilities ((*2*) and (*4*)) with respect to *b*.[129]

$$cake \quad = e[b] - \frac{\lambda}{2} e[b]^2 - 1$$

$$\frac{\partial cake}{\partial b} \qquad = e[b]'(1 - \lambda e[b]) = 0 \qquad \Rightarrow \qquad e[b] = \frac{1}{\lambda}$$

The second order condition holds at the optimum (i.e., given that *1-λe[b]=0*).

$$\frac{\partial^2 cake}{\partial b^2} = -\lambda(e[b]')^2$$

This problem is more complex than the Krugman problem because the optimal e, which is a function of b, must be made to equal the value $1/\lambda$. In other words, b must be chosen by the principal to make it privately optimal for the agent to set e equal to $1/\lambda$.

However, if that were the only choice variable, there would be no guarantee that the value of b so chosen would satisfy the participation constraint. As has already been noted, this is a weakness of Krugman (1988), where an optimal a is derived without reference to a participation constraint. Fortunately, choosing a provides a way of satisfying that constraint. The full solution thus involves equating the two expressions for optimal e

$$\frac{1}{\lambda} \quad = \quad e \quad = \quad \frac{b\sqrt{3}\sigma - a}{2\sqrt{3}\lambda\sigma - b}$$

meeting the participation constraint with equality

$$E(Ud) = E(W) \quad - \quad \frac{\lambda}{2}e^2 = \text{umin} \Rightarrow$$

$$\frac{(-a + b(e + \sqrt{3}\sigma))^2}{4b\sqrt{3}\sigma} \quad - \quad \frac{\lambda}{2}e^2 = \text{umin} \qquad (\text{umin} \geq 0)$$

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[129] If the participation constraint binds with equality, maximizing the sum of the utilities is the same as maximizing creditor utility.

and solving. The resultant expressions for a and b are the parameters of the Hyper-Incentive contract.

$$\left.\begin{aligned} a &= \frac{2\sqrt{3}\lambda\sigma(\sqrt{3}\sigma - 2\text{umin})}{1 + 2\,\text{umin}\,\lambda} \\ b &= \frac{2\sqrt{3}\lambda\sigma}{1 + 2\,\text{umin}\,\lambda} \end{aligned}\right\} \qquad (11)$$

The inclusion of *umin* in the solutions for a and b underscores the fact that the Hyper-Incentive contract deals with the problem of sovereign debt default, at least in expected value terms. In the Krugman contract, there is the presumption that the debtor will sign up to the contract, regardless of how bad it is expected to be. This is unrealistic, since willingness to pay rather than ability to pay is the criteria by which sovereign debt contracts are to be judged (Eaton 1993). Even though it is assumed that debtor and creditor can pre-commit to the terms of the contract *once signed*, the above contract recognizes the existence of a default option if the debtor refuses to sign. In this case, the creditor gets none of the loan back, and the debtor gets *umin*, the default outside option.[130]

To demonstrate that the Pareto improved utilities d^K and c^{PI} are attainable under the Hyper-Incentive contract, we assume that *umin* in *(11)* is equal to d^K. What could be the economic justification for this?

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[130] Following Krugman, there is no creditor participation constraint, reflecting the fact that the creditor is locked into 'defensive lending'. That is, the creditor wants to maintain a relationship with the debtor, for unmodeled reasons.

If we are prepared to assume that the current proposals for debt forgiveness - namely J2K and HIPC - are in some sense optimal, then it is possible to describe them as stylized Krugman contracts. This is based on the fact that debtors would keep any output in excess of full debt repayments.[131] If debtors apply rational choice, then the default options for those debtors enrolled in *HIPC* must be no better than the d^K.

Thus the subsequent analysis applies only to countries that are enrolled in HIPC, or those who would if they could. For the sake of argument, I am assuming that Indonesia's outside (default) option is less valuable than d^K. I can therefore substitute d^K in equation *(5)* in for *umin*, giving:

$$\left.\begin{aligned} a &= \frac{2\sigma(\sqrt{3}-6\lambda\sigma+36\lambda^3\sigma^3)}{-1+2\lambda\sigma(\sqrt{3}+6\lambda\sigma)} \\ b &= \frac{24\sqrt{3}\lambda^3\sigma^3}{-1+2\lambda\sigma(\sqrt{3}+6\lambda\sigma)} \end{aligned}\right\} \qquad (12)$$

By construction, when these values for a and b are used to calculate $E(w)$, and then $E(Ud)$, the debtor utility at point K in Diagram 1 is obtained.

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[131] Actually, the incentive and information structure of the HIPC initiative, as it is administered in reality, is very complex. As I noted in an earlier footnote, there has been a presumption in the administration of the HIPC initiative that effort is at least partly observable. Furthermore, contingent on necessary reform effort, countries with the largest debts receive the greatest relief. Finally, the overall assistance package comprises a complex cocktail of both loans and grants. Nevertheless, to the extent that the World Bank and IMF believe that debt forgiveness *of itself* (i.e. aside from conditionality) will stimulate reform, Krugman's simple incentive structure can be justified as a stylized approximation. Furthermore, as was noted earlier, there is a growing recognition that effort may not, after all, be so easily observed. In many countries, reform efforts have moved on from macro stabilization policies to public sector reform and privatization, which are more complex administratively and politically (Collier 2000). Arguably, it is more difficult to observe effort under these circumstances.

The Hyper-Incentive Contract attains the utilities of the infeasible Pareto-improved point P in Diagram 1. When optimal a and b are used to calculate $E(Uc)$, it is equivalent to c^{PI} in *(7)*, and effort is $1/\lambda$. The debtor and creditor are not at point P, however, since the Hyper-Incentive Contract a from *(12)* exceeds the value of a from the Krugman contract. The reason why the debtor can attain d^K, despite having a larger a and having to exert more effort, is that she receives an extra incentive from a larger (than unity) b.

Of course, the participation constraint can be made to bind on the creditor. In this case, the contract attains the utilities of the Pareto-improved point at the bottom of the lens in Diagram 1. Considerations of equity, justice or compassion - which have not been modeled - may dictate this course of action.[132]

It remains to prove that b exceeds unity, justifying both the intuition of Diagram 2 and the prefix 'Hyper'. We rewrite the second order condition.[133]

$$2\sqrt{3}\lambda\sigma - 1 > 0 \qquad \Rightarrow$$

$$\lambda = \frac{1+\varepsilon}{2\sqrt{3}\sigma}, \quad \varepsilon > 0$$

Upon substitution of λ into the expression for b in *(12)*, we find that b exceeds unity.[134]

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[132] Counter-arguments typically appeal to moral hazard. For a discussion strongly critical of the IMF, see the J2K web page article 'dictators and debt' (Hanlon 1998). For example, 'the issue of moral hazard in the case of Rwanda has been raised. IMF officials in Rwanda explained that the conflict should not be `rewarded' and that rapid debt cancellation would be seen to reward genocide'. It is fair to point out, however, that these alleged reservations did not preclude Rwanda from being admitted to the HIPC process.

$$b \quad = \frac{24\sqrt{3}\lambda^3\sigma^3}{-1+2\lambda\sigma(\sqrt{3}+6\lambda\sigma)} = \frac{1+3\varepsilon+3\varepsilon^2+\varepsilon^3}{1+3\varepsilon+\varepsilon^2} > 1$$

Other economic environments with kinked benefit schedules can also give rise to Hyper-Incentive Contracts. For example, a sharecropping contract is one in which a Landowner receives a share of output from a Tenant, with a possible side-payment (Ray 1998). Consider a limited liability version of this contract where the landowner gets all of the output up to a/b, and then a share (1-b) of output above that. This creates a tenant benefit schedule exactly equivalent to (8). If we follow Krugman by excluding variance from utility, a Hyper-Incentive Contract is optimal.[135]

6 Implementing the Hyper-Incentive Contract

Key to the analysis has been the observation that contracts must be offered where the slope of the upward sloping portion of the benefit (or 'wage') schedule *exceeds* the marginal social benefit of increased effort. This *hyper*-incentive raises operational questions. In the real world, where debtors actually own *y*, how will they be paid more than their value of marginal output?

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[133] I use the Krugman second order condition here. Since I have substituted in the Krugman solution for umin, it follows that the Krugman second order condition must hold.
[134] The same technique shows that *b* exceeds unity in the Hyper-Incentive Contract that gives all the gains to trade to the debtor (the Pareto improved point at the bottom of the lens in Diagram 1).
[135] In contrast, the Optimal Taxation literature makes a point of proving that the marginal rate cannot exceed 100 per cent, even in a very general setup (Myles 1995).

It is worth noting that this problem mirrors the issue of how to make viable income transfers to motivate Pareto improving trade reforms. This issue is acknowledged in the literature, but no immediate solution is apparent (Turunen-Red and Woodland 1991). In this model, much depends upon the specific notion of effort and transfer, which has been left abstract in the preceding argument.

One natural interpretation is to think of the transfer as export income and the effort level as some proposed microeconomic reform. In this framework, a higher value of b could translate into the debtor being paid an export price higher than that prevailing in world markets, in the event that it clears its per-period debt repayments.

For example, suppose that Indonesia became a candidate for a Hyper-Incentive Contract, and that the effort level was the progress in corporate debt workouts brokered by the Jakarta Initiative Task Force (JITF) in a promising export industry, such as toys (Radalet 1999). Such a contract would outline an optimal amount of debt to be cleared (a/b) by toy exports (y). If exports exceeded this amount, the Indonesian authorities (or a fund hypothecated for the purpose of poverty reduction) would receive a payment from the IMF (assumed to be the largest creditor in this scenario). The total export premium received by Indonesia would be based on equation (*8*) (i.e. $-a+by$). This total would be the sum of the excess of exports over the debt to be cleared ($y-a/b$) plus the premium paid by the IMF $(b-1)(y-a/b)$.

It is important to note that the contract would not specify the effort level (say the number of JITF agreements) in its terms. It would be left up to the debtor to see the link, though the IMF could choose an export industry where the reforms that the debtor would undertake would be good overall policy. Nevertheless, although the contract would not specify the effort level, the creditor would have to have some idea of how costly effort was, in order to design an optimal contract.

On an operational level, such a scheme raises five issues.

First, there is the question about how the exports are to be recorded and defined. Statistics on imports are more reliable than exports, but this reflects the historic importance of import duties; there is no *in principle* problem with accurately recording exports. However, there would have to be scrutiny of the local agency reporting, as there would clearly be incentives to over-report. On the definition of exports, there would have to be a decision on how to treat re-exports.

Second, there is the issue of how the adjustment regime would distort the economy, and whether it would be in conflict with the long term liberalization agenda.

Third, there are the distributional implications of the adjustment regime. For example, if an export price premium is paid, and the toy exporting sector is intensive in the use of unskilled labour, there will be an improvement in distribution (from the

Stolper-Samuelson theorem). Other, less favorable, outcomes are possible (Stewart 1995).

Fourth, there is the question of the observability of effort. If reform effort were perfectly observable, my analysis, together with Krugman's, would be bypassed. In reality, effort is imperfect observed, but the extent of the problem varies widely across countries. For Indonesia, its recent bad experiences with the IMF may make a less intrusive approach, such as a Hyper-incentive contract, attractive.

Finally, there is the issue of timing, as the model in this paper has been constrained to only two periods. At the very least, the payments by the creditor would have to be based on an average for a number of periods. Otherwise, there would be an incentive for Indonesia to export many toys in one period (earning the premium) and export nothing in the other periods (passing the loss onto the creditor).

7 Conclusion

I began this paper by asserting that orthodox economics has a role to play in the debt forgiveness debate; case-by-case debt relief needs firm micro-foundations. I have found that the workhorse model of debt forgiveness (Krugman 1988), while providing a rationale for case-by-case debt write-downs, is not a fully optimal solution. Put simply, to talk in terms of a standard debt-overhang contract implicitly assumes the incentive parameter is unity - without justification. When the incentive parameter b is chosen

optimally, three things happen. First, the problem of moral hazard due to hidden effort is solved. Second, the first-period default option is recognized, taking the class of debt forgiveness models instigated by Krugman closer to their brethren in the sovereign debt literature. Third, a new way of making case-by-case contracts comes into being; *b* will vary, depending upon debtor characteristics.

Upon reflection, the number of free parameters in debt forgiveness contracts seems to reflect a political-economy version of the Tinbergen rule. For many years, the primary goal of debt relief was maximizing creditors' recovery of loans. Krugman's model was caste in these terms - if there was to be forgiveness, it was to be based on getting the most for the creditor. One objective (creditor utility) required only one instrument (debt write downs). While this was not strictly correct (as I have argued in this paper), it did reflect the political economy of the day.

Now, however, times have changed. Partly due to the influence of J2K, there is more popular support for the notion that debtors should be given a non-trivial standard of living. Two objectives, creditor utility and a minimum acceptable debtor expected utility, require (at least) two instruments. It is the suggestion of this paper that providing *Hyper*-incentives in a twin-instrument loan contract could help meet these two important objectives.

Appendix

Does the Participation Constraint Bind? [136]

The creditor maximizes his utility subject to the incentive compatibility and the participation constraints. I start with the simplified expression for creditor utility, with optimal *e* substituted in, (i.e. incentive compatibility is already satisfied).

$$E(Uc) = -1 + \frac{\sqrt{3}b\sigma - a}{2\sqrt{3}\lambda\sigma - b} - \frac{\sqrt{3}\sigma\lambda^2}{b}\left(\frac{\sqrt{3}b\sigma - a}{2\sqrt{3}\lambda\sigma - b}\right)^2 \qquad (A1)$$

I want to choose *a* and *b* to maximize this subject to the following constraints:

$$2\sqrt{3}\lambda\sigma - b > 0 \qquad (A2)$$

$$\sqrt{3}b\sigma - a > 0 \qquad (A3)$$

$$b > 0 \qquad (A4)$$

$$\frac{\lambda}{2b}\frac{(\sqrt{3}b\sigma - a)^2}{(2\sqrt{3}\lambda\sigma - b)} \geq \text{u min} \qquad (A5)$$

Equation (*A2*) is the second order condition. Equation (*A3*) then follows automatically since optimal *e* is positive. Equation (*A4*) limits the solutions to those of economic interest. Equation (*A5*) is the participation constraint, with optimal *e* substituted in, and simplified.

The solution given in the text assumes that (*A5*) holds with equality - that is, that (*A5*) 'binds'. To verify this, I maximize (*A1*), subject to (*A2*), (*A3*) and (*A4*) (but not by (*A5*)). The unconstrained optimum is not within the region specified by (*A5*). Therefore, in a constrained optimum, (*A5*) must bind.

I make the following transformation to simplify the analysis:[137]

$$y = 2\sqrt{3}\lambda\sigma - b \qquad \Rightarrow \qquad b = 2\sqrt{3}\lambda\sigma - y$$
$$x = \sqrt{3}b\sigma - a$$

I therefore want to maximize:

$$E(Uc) = -1 + \frac{x}{y} - \frac{\sqrt{3}\sigma\lambda^2}{(2\sqrt{3}\lambda\sigma - y)}\frac{x^2}{y^2} \qquad (A6)$$

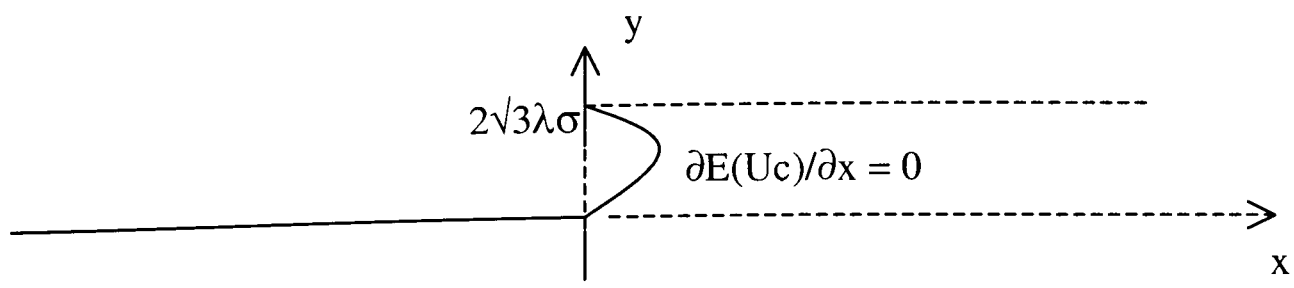
where $x \in R^+$, $y \in (0, 2\sqrt{3}\lambda\sigma)$

I differentiate *E(Uc)* with respect to *x* to obtain the maximum values of *x* for given *y*.

$$\frac{\partial E(Uc)}{\partial x} = \frac{1}{y} - \frac{2\sqrt{3}\lambda^2\sigma x}{(2\sqrt{3}\lambda\sigma - y)y^2} = 0$$

$$\Rightarrow x = \frac{y(2\sqrt{3}\lambda\sigma - y)}{2\sqrt{3}\lambda^2\sigma} \qquad (A7)$$

This ridge is the maximum of the function in the *x* direction (i.e. for given *y's*), viewed from above in the following diagram. The dashed lines show the boundaries.



[136] Meg Meyer first alerted me to the importance of this question. Jens Rittscher and Andrew Dancer provided important insights for this appendix.
[137] The parameter *y* is not to be confused with output in the body of the paper.

I now differentiate *E(Uc)* with respect to *y*, substituting in (*A7*). This gives the change in *E(Uc)* in the *y* direction along the ridge. Straightforward algebra reveals:

$$\frac{\partial E(Uc)}{\partial y} = -\frac{1}{4\sqrt{3}\lambda^2\sigma} < 0 \qquad \text{(using } \frac{\partial E(Uc)}{\partial x} = 0\text{)}$$

This implies that the function is always *increasing* as *y* approaches zero along the ridge, and that there appears to be no interior maximum.

Now (*A6*) implies that *E(Uc)* takes on the following values close to the boundaries.

$$\lim_{y\downarrow 0, x>0} E(Uc) = -\infty$$

$$\lim_{x\downarrow 0, y>0} E(Uc) = -1$$

$$\lim_{y\uparrow 2\sqrt{3}\sigma\lambda} E(Uc) = -\infty$$

$$\lim_{x\downarrow 0, y\downarrow 0} E(Uc) = \textit{undefined}$$

But *E(Uc)* >-1 can be solved for sufficiently small *x* (from *A6*), thus ruling out the first three boundary values as maxima. I therefore have that the function achieves a maximum approaching, the undefined boundary *(0,0)* along the *∂E(Uc)/∂x = 0* ridge. I conclude that (absent (*A5*)) the maximizing values of *x* and *y* both approach zero.

It now remains to be proven that the participation constraint prevents the attainment of the unconstrained optimum. For a given small *y* equal to *ε*, (A7) dictates the unrestricted maximizing value of *x*.

$$x = \frac{\varepsilon(2\sqrt{3}\lambda\sigma - \varepsilon)}{2\sqrt{3}\lambda^2\sigma}$$

For the participation (*A5*) constraint

$$\frac{\lambda}{2(2\sqrt{3}\lambda\sigma - y)}\frac{x^2}{y} \geq \text{u min} \qquad \Rightarrow \qquad x \geq \sqrt{\frac{2y(\text{umin})(2\sqrt{3}\lambda\sigma - y)}{\lambda}}$$

to bind, the unrestricted maximizing value of x must be less than or equal to the value dictated by the participation constraint. This will be the case if:

$$\frac{\varepsilon(2\sqrt{3}\lambda\sigma - \varepsilon)}{2\sqrt{3}\lambda^2\sigma} \qquad \leq \qquad \sqrt{\frac{2\varepsilon(\text{umin})(2\sqrt{3}\lambda\sigma - \varepsilon)}{\lambda}}$$

implying

$$\varepsilon(2\sqrt{3}\lambda\sigma - \varepsilon) \leq 24\lambda^3\sigma^2(\text{umin})$$

The last condition will be true for sufficiently small ε. If ε is not small enough for this to be true, then the participation constraint is not stopping the creditor reducing ε further, which is optimal. The creditor continues to make ε smaller until the inequality is true.

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