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ADB INSTITUTE WORKING PAPER 23

Modeling Crisis Evolution and Counterfactual Policy Simulations:

A Country Case Study

Iwan J. Azis

August 2001

A number of studies have already shown that the effectiveness of raising interest rates to avoid a currency crisis becomes very limited during the crisis. While most of these studies do not really explain the precise mechanisms, the model in this study does.

Using the case of one country – Indonesia – it is shown through a financial sector general equilibrium model that a high interest rate policy can be ineffective because the interest rates and the exchange rate channels of transmission of the policy can go in opposite directions. The mechanisms depend crucially on two important elements: economic and political risk factors, and the balance sheet position of the corporate and banking sector.

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Modeling Crisis Evolution and Counterfactual Policy Simulations: A Country Case Study

Iwan J. Azis

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He has published on subjects such as ASEAN economies, spatial development, impacts of economic reform, conflicts resolution, exchange rate and capital flows, reform sequencing, and financial crisis. He has authored or co-authored several books, and is currently working on another book on "Modeling Policy Analysis." He received his BA from the University of Indonesia and his MSc and PhD from Cornell University. During 1984-1993 he served as Chairman, Department of Economics, University of Indonesia, and Director of the World Bank-funded Inter-University Center.

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PREFACE

The ADB Institute aims to explore the most appropriate development paradigms for Asia composed of well-balanced combinations of the roles of markets, institutions, and governments in the post-crisis period.

Under this broad research project on development paradigms, the ADB Institute Working Paper Series will contribute to disseminating works-in-progress as a building block of the project and will invite comments and questions.

I trust that this series will provoke constructive discussions among policymakers as well as researchers about where Asian economies should go from the last crisis and current recovery.

Masaru Yoshitomi
Dean
ADB Institute

ABSTRACT

It is important to understand the causes and mechanisms of the East Asian crisis in order to analyze the policy responses. Articles and books have been written extensively, but in-depth research in this area is still in its infancy. While analysts continue to work on this topic, any new development that may arise should be evaluated with empirical evidence. Understanding the anatomy of the crisis requires a careful analysis that spells out the details of events (or sequence of events) and the corresponding implications on economic indicators in *each* country.

This study is using the case of one country, i.e., Indonesia. It describes how that country's economic policies evolved and why some of them may have planted the seeds for the subsequent crisis. The paper also discusses the dynamics and sequence of events that took place during the episode. The mechanisms of the process are explained using a comprehensive financial sector general equilibrium model, in order to help one better understand how various variables and indicators interacted during the crisis. In the benchmark run, the values of all exogenous variables (including policy variables) and exogenous events that precipitated the crisis are set equal to their actual (observed) values, and the model is used to derive the resulting values of the endogenous variables. The results of the simulation closely replicate the changes and trends that actually occurred.

To facilitate the discussions on the effectiveness (or ineffectiveness) of the actual policy response to the crisis, an alternative set of policies is explored. In particular, the author experimented with policies of (partial) debt resolution and of keeping the interest rate from surging continually. The simulations reveal that the country's macroeconomic conditions would have fared better if a prolonged high-interest rate policy had been avoided. To the extent that counterfactual policies are feasible, most macroeconomic variables would have been better when such a counterfactual policy is combined with partial debt resolution. This conclusion suggests that the initial actions to address the problems of mounting private foreign debts should have been undertaken as quickly as possible. A developing country with limited foreign reserves like Indonesia should seriously consider policies that put limits on its foreign currency debt. The likelihood of facing currency crises associated with not only currency collapse but also large recessions is higher when the foreign currency debt is large. Since the main channel toward recession is deteriorating balance sheets in the corporate and banking sector, irrespective of the country's exchange rate regime, a currency crisis may still occur under such circumstances.

With respect to the high interest rate policy, a number of studies (including at ADB Institute: Ohno et al. (1999: ADBI Working Paper No.6)) have shown that the effectiveness of raising interest rates to avoid a currency crisis becomes very limited during the crisis. Empirical tests using Indonesian data tend to confirm such a conclusion. While most of these studies do not really explicate the mechanisms, the model in this study does. It is shown that a tight monetary policy can be

ineffective because the interest rates and the exchange rate channels of transmission of the policy can go in opposite directions.

In fact, some multi-country studies reveal that higher interest rates are associated with real appreciation only in countries that do not suffer from a banking crisis. This condition contrasts almost completely with the Indonesian case, where almost the entire financial sector went into deep trouble following the 1997 shock. Yet, a fairly persistent high interest rate policy was cogently enforced. Clearly, there were serious inconsistencies and flaws in the policy analysis and the policy design.

The counterfactual policies explored in this study produce a more favorable trajectory of recovery for Indonesia compared to that under the actual case. These policies are far more essential than the drastic fundamental changes in micro-economic and institutional structure that the IMF prescribed during the early stage of the crisis. Miscalculated policy responses may have blockaded the efficacy of current and future policies.

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Modeling Crisis Evolution and Counterfactual Policy Simulations: A Country Case Study

Iwan J. Azis

1. Introduction

An extensive literature has been written on the causes and implications of the East Asian crisis.

While there are differences in characteristics and policies among the crisis-hit economies, all of them plunged into crisis within the space of a few months. As far as the causes of the crisis are concerned, it seems likely that there was a similar pattern of broad indicators in these countries. The issue of reversed expectations of future profitability of investments was pointed out by Krugman (1999a), McKibbin & Stoeckel (1999) and Corden (1999). But such a change in expectations, which led investors to pull their money out, was clearly not triggered by deteriorating macroeconomic fundamentals, except in Thailand (Azis, 1999). Another line of argument, along the Bernanke and Gertler (1989) line of reasoning, focuses on the deteriorating balance sheets of the corporate and banking sectors as the primary source of the currency crises (Krugman, 1999b, Aghion, Bacchetta and Banerjee, 2000, Azis, 2001). External factors also cannot be dismissed. As argued by Mundell (2000), "The appreciation of the dollar against the yen between 1995 and 1998, following hard on the heels of the devaluation of the renmimbi, is to blame for the so-called Asian crisis."

Efforts to understand the causes and mechanisms of the East Asian crisis are important in order to analyze possible policy responses. While research in this area may still be in its infancy, any new development that may arise should be evaluated with empirical evidence. Furthermore, understanding the anatomy of the crisis in the region requires a careful analysis that spells out the details of events (or sequence of events) and the corresponding implications on economic indicators in *each* country. True it is that we may gain insights from a cross-country analysis about common factors in the crisis economies, but such an undertaking also carries the serious risk of over-generalization and of yielding erroneous conclusions. Methodologically speaking, a cross-country analysis may also suffer from measurement errors and biases (Srinivasan, 1994).

This study attempts to take on the task outlined above. Specifically, the crisis evolution in East Asia is analyzed by using the case of one country, i.e., Indonesia. Section 2 summarizes the country's post-crisis policy environment. It describes how economic policies evolved and why some of them may have planted the seeds for the subsequent crisis. The sequence of events of the crisis episode is discussed in Section 3. To better understand the mechanisms of the process leading to the crisis, a fairly comprehensive model integrating the financial and the real sector is used. The specifications and mechanisms of the model are described in Section 4 and 5, respectively. The resulting benchmark scenario of model simulation is shown in Section

6. In the subsequent section (Section 7), I use the model to run counterfactual experiments. The two alternative policy scenarios to be experimented with are: (i) keeping the interest rates from rising after a high interest rate policy fails to restore confidence and strengthen the exchange rate, and (ii) a combination of this and partial debt resolution.

2. The Backdrop

When the price of oil dropped in 1983, resulted in a swelling of Indonesia's current account deficit, the government was forced to devalue the currency and subsequently liberalize the trade sector. A new era of monetary policy also began that year, in which all credit ceilings were eliminated, resulting in increased flexibility in pricing (interest rates) and quantity (credit). At that juncture, however, no provision was made on the ease of entry condition. The dominance of the state-owned banks, an important sign of the country's financial repression, remained overwhelming.

Realizing the need for competition, in October 1988 the government promulgated another major policy change aimed at increasing bank competition. This policy allowed the entry of new private banks, including foreign bank branches, outside Jakarta. This policy route was deemed necessary given the high degree of financial repression at that time. In combination with the effects of the June 1983 reform, the 1988 package brought increased competition in the financial system. The number of banks more than doubled, from 111 in 1988 to 240 in 1994.

Despite the swelling number, however, only a few commercial banks continued to control a large share of an oligopolistic market structure, and their shareholders were large industrial groups (conglomerates). Indeed, the structure of the banking and non-banking financial institutions corresponds very closely to the pattern of distribution of economic power. As expected, these industrial groups, either in an indirect or direct way, are the largest borrowers of the banks. Hence, the country's industrial organization structure—characterized by a high degree of concentration—determines the nature of the financial structure, not vice versa.[1]

Another notable flaw of the system was the absence of proper exit mechanisms, although a number of smaller banks actually suffered from severe liquidity problems in 1989. Only through liquidity injections by the Central Bank could these banks stay in operation. The predominant State banks (seven of them) had a poor track record of recouping the huge volume of loans they had extended to the large and influential conglomerates. While their market share had dropped from 70 to 40 percent following the deregulation, many of them needed and indeed received a large amount of injection money for re-capitalization. In some cases, they also needed emergency support, as was the case with BAPINDO in 1994 following the bank's recorded loss of $340 million due to fraud and collusion.[2]

Some private banks suffered from a similar predicament. *Bank Summa*, which allocated three-quarter of its loans to affiliated businesses (most of which invested in the

[1] To some extent this is similar to the situation in Korea, where a few large industrial groups, *chaebols*, dominate the industrial as well as the financial sector.

[2] BAPINDO, a state-owned development bank, lent substantial amounts of money to Golden Key company, the owner of which fled the country without repaying these debts.

real estate sector), eventually collapsed in 1990, although the process of its liquidation was far from easy. The regulatory and supervisory framework was theoretically already in place, but its enforcement remained weak, particularly regarding the legal lending limit, which Bank Summa had clearly breached. This, together with many other similar cases, demonstrated the country's fragile banking system following the 1988 deregulation.

However, the country's economic growth was robust during that time, and so there was no really strong incentive to alter the system. As long as growth continues delivering benefits to everyone, a weak banking system is considered annoying but not fatal. Hence, the urge for strengthening the banking sector was constricted. It is with such a background that, most analysts claim, the 1988 bank deregulation created the 'embryo' of the country's financial vulnerability that eventually led to the crisis in 1997.

Lending booms have also been frequently noted as one indicator of a weak banking system. They are good predictors of currency crises in the making (Sachs, Tornell, and Velasco, 1996). If lending increases rapidly, banks are not able to screen out higher risk loans as easily, and their portfolio can potentially deteriorate. When banks are weak, the government may be less likely to be willing to endure a period of overvaluation and recession due to increased bankruptcies. Contrary to what most observers believe, however, Indonesian data on bank credits show only weak signs of a lending boom. The recorded growth during 1992-1996 was only 18 percent, and the outstanding credits of commercial banks grew by 24 percent per annum between 1992-1997. These figures are clearly far lower than those in Mexico prior to the 1994 crisis (116 percent).[3]

With regard to exchange rate policy, the Indonesian government maintained a predictable nominal depreciation, i.e., roughly 5 percent annually. It is true that occasionally the currency was allowed to appreciate due to massive capital inflows. However, as soon as concerns over the slowdown of non-oil exports growth rose, the trend was immediately halted by accelerating the rupiah's depreciation. The country's sizeable external debts appeared to be the main reason why the exchange rate policy was primarily guided by the considerations of external competitiveness.

However, the task of maintaining exchange rates was far from easy, especially when the influx of capital flows continued. The Central Bank (Bank Indonesia, hereafter BI) had to intervene by purchasing foreign exchange. This caused domestic liquidity to increase, making the monetary targets impossible to achieve. Hence, a sterilization program had to be subsequently implemented.[4] Given the relatively huge amount of capital inflows, enormous volumes of foreign exchange had to be bought to defend the

[3] It is important to note, however, that data on bank credits do not include promissory notes of the multifinance companies. Under a quasi-fixed exchange rate system, one should include them in the overall financial system's liabilities. But it is also the fact that the extent of multifinance companies in Indonesia was not as large as in Thailand.

[4] A case in point was the experience during the first two-weeks in June 1996. In that period alone, three interventions, involving some US$800 million, had to be conducted by BI. If not sterilized, that would mean an inducement of fresh rupiah supply in the market. Yet, the growth of money supply was already way beyond the 17-20 percent target, i.e., 30.8 percent in May and 29.8 percent in June. As a result, there was high liquidity in the economy. An injection in liquidity also came from US$1.2 billion worth of initial public offerings (IPOs) and rights issues in the stock market at the time.

exchange rate.[5] In the Indonesian case, the expansionary effects of NFA were usually sterilized by an open market operation, that is, the selling of Central Bank certificates known as Sertifikat Bank Indonesia (SBI). Such operations were almost a 'menu of the day' whenever short-term capital inflows increased. However, the BI's own profitability can be severely decapitated. As an illustration, in 1992/93 when short-term capital continued to flow in, BI purchased more than US$14 billion in foreign exchange to defend the exchange rate. To sterilize potential money growth, an open market operation was conducted, involving some US$ 11 billion of SBI sales. This contributed to the swelling of the BI's foreign reserves. With LIBOR stabilized at 3.2 percent, the SBI interest rate at 12.5 percent, and the nominal exchange rate depreciated by 5.3 percent (it would have appreciated had the monetary authority not sterilized the capital inflows), this meant a 4 percent negative spread, or US$ .4 to US$ .5 billion loss on the BI's portfolio.

With a determination to reduce speculative movements, and at the same time hoping to encourage foreign exchange trading among market participants (the country's foreign exchange market was fairly thin), BI used an exchange rate band (managed floating system) as an additional policy instrument.[6] The band was raised a number of times, with the latest being made in July 1997 (up by 12 percent) before the government decided to float the rupiah the following month. Some observers contend that this caused the real appreciation of the currency, and subsequently the crash of the rupiah. I disagree.

After enjoying strong growth during the late 1980s and early 1990s, Indonesia's export growth began to dwindle in 1996, causing the current account deficit to widen (reaching 3.9 percent of GDP). In addition to the often-quoted reasons, e.g., PRC's yuan devaluation, the dollar's depreciation, and increased competition from other emerging markets, there was also suspicion that the slower growth of exports was due to currency overvaluation. But with Indonesia's relatively low inflation, this proposition is disputable. Based on a structural model of real exchange rate, and taking account the Balassa-Samuelson hypothesis, Chinn (1998) found that the size of the rupiah's overvaluation was relatively small, i.e., less than 5%.[7] In a simpler measure using the CPI, I found that Indonesia's RER depreciated, rather than appreciated, before 1997. JP Morgan's measure of REER also points to 5.4% depreciation of the rupiah in 1996 (Figure 1). Hence, real appreciation was not really the problem.

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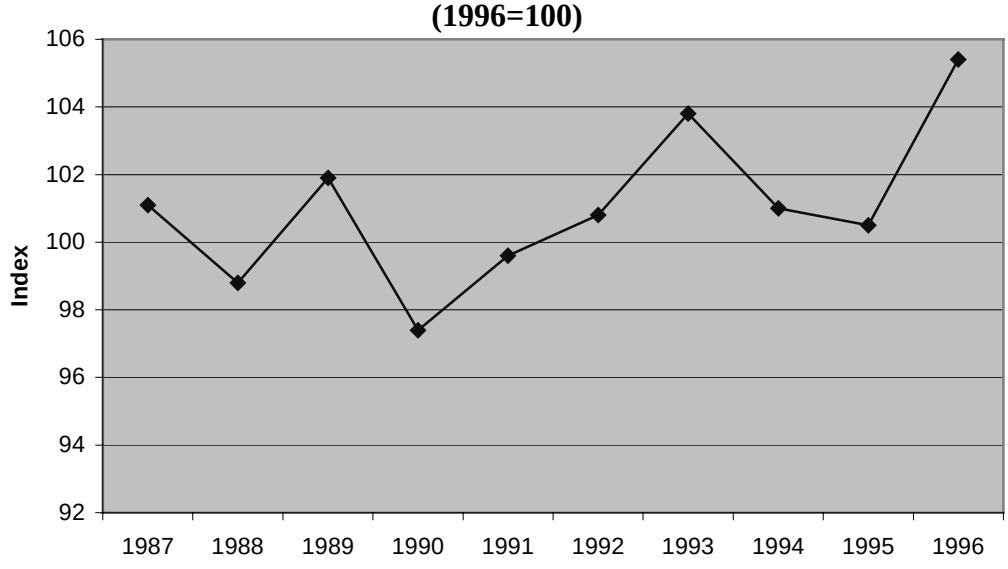
[5] An interesting NBER study by Chinn & Michael Dooley (1995) indicates that, of 10 Asia-Pacific countries under study, only Indonesia and Malaysia showed an inverse relation between capital flows and bank lending. The authors then contend, "Indonesia and Malaysia engaged in large scale sterilization of capital inflows. That is, in response to capital inflows some of the reduction of bank credit was manifested in a reduction in bank lending to private sector."

[6] In terms of BI's flexibility to set the interest rate, when the market exchange rate was in the middle of the band, short and medium term interest rates could be adjusted to reach around one to two percentage points above or below world interest rate.

[7] Using the PPP-based approach, the Singapore dollar was found to be overvalued by 13 percent, on par with the Thai baht and Malaysian ringgit. When a modified model incorporating monetary and real sectors was used, the Singapore dollar was overvalued by 45 percent, whereas in Thailand and Malaysia the size of the currency overvaluation was much smaller, i.e., 3.7 and 0.4, respectively. This is obviously inconsistent with the actual fall of the respective currencies after July 1997.

Figure 1. Indonesia's Real Effective Exchange Rates (1996=100)



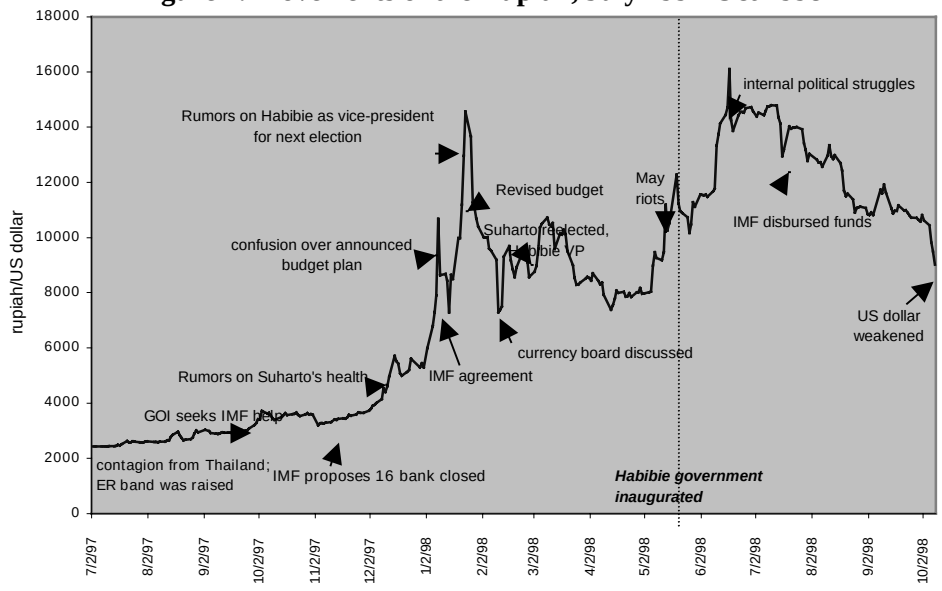
Source: JP Morgan

3. How the Crisis Evolved

The effects of the Thai baht's devaluation on July 2, 1997 rapidly spread to the neighboring countries. The change in expectations of future profitability of investments caused investors to pull their money out of the region. The remaining investors became jittery, and before long they too followed suit. As a result, domestic currencies came under pressure. This was precisely the case in Indonesia.

After making exhaustive efforts to defend the rupiah, the monetary authority decided to float the currency in August 1997. As happens when one casts a stone into the water, the rupiah failed to float. The currency depreciated fast; and in August alone lost 10 percent of its value. Although market confidence remained firm, as indicated by continued gross capital inflows, this amount was not able to offset the pressure on exchange rate due to rising demand for dollars in conjunction with the maturity of short term foreign debts (capital outflows). Demand for imports remained strong, but expectations of devaluation were also high, aggravating the dollar rush. Figure 2 shows the weakening of the rupiah since the abandonment of the fixed rate system.

Figure 2. Movements of the Rupiah, July 1997-Oct 1998



As the currency depreciated, the rupiah-denominated value of the interest and amortization of foreign debts surged, causing a serious balance sheet problem in both the corporate and banking sectors (the country's total private debts reached over $60 billion by mid-1997). The distress in the corporate sector led to an increase in non-performing loans; panic spread, and a fast growing number of commercial banks went bankrupt. The resulting credit crunch caused further distress in the real sector, leading to increased unemployment, falling real income, and a drop in overall aggregate demand.

When the rupiah hit a low of 3,825 per US dollar on October 6 (an over 50 percent loss compared to the July rate), the government, realizing the dire consequences of the trend, turned to the IMF for assistance. An agreement was reached under which the government pledged to implement a sweeping reform that included the removal of monopolies, cartels and other crony-based business operations. In return, the IMF came up with a commitment of some $23 billion in financial support. The amount quickly increased to $43 billion, as more countries and international organizations pledged additional commitments.

The underlying objective of the IMF prescription was to restore market confidence. This was done in two modes: restricting aggregate demand by raising interest rates and curtailing the budget; and improving the real sector's efficiency by removing monopolies and cronyism. It was agreed in late October that 16 banks would be liquidated. Most of these banks were owned by President Suharto's friends and family. As soon as the news became public, a widespread panic began. With no deposit insurance system in place, the bank closure backfired. During the subsequent weeks, rumors about the closing of other banks spread, exacerbating the market panic. Many depositors shifted their deposits to state and foreign banks. By January 1998, the state

banks had already regained their domination in terms of deposit share. Foreign banks also benefited from a large deposit increase (Figure 3).[8]

The panic and fears over the fluctuating value of the rupiah also resulted in an increasing share of foreign currency denominated deposits. The asset substitution from rupiah to foreign currencies occurred on a large scale, as indicated in Figure 4. This suggests that many domestic private banks suffered from a major reduction in funds, while state banks and foreign banks found themselves with excess liquidity.[9]

When the central bank started to act as the 'lender of last resort' by injecting liquidity funds known as Bantuan Likuiditas Bank Indonesia or BLBI to a number of private banks (by the end of the year the amount had reached 7 percent of GDP), most of these funds were used by the recipient banks to buy foreign currency. With expectations of further devaluation, the demand for dollars rose, causing many banks to seek rupiah liquidity to change in the forex market. Consequently, interbank rates skyrocketed. It was in such a situation that the injections of BLBI were made. At the end of the day, this liquidity support pushed the rupiah value to further south.

In retrospect, the policy response in the financial sector, which ranged from bank closures to liquidity injections, failed to meet the intended purpose, i.e., restoring market confidence. Bank runs and panic worsened the already distressed banking sector, and the impact on the exchange rate was devastating. The Fund's request for drastic and fundamental changes in the country's microeconomic and institutional structure created perceptions that the situation was much worse than originally thought. It therefore eroded market confidence further. In the words of ex-IMF staff member Morris Goldstein: "…both the scope and the depth of the Fund's conditions were excessive…They clearly strayed outside their area of expertise…If a nation is so plagued with problems that it needs to make 140 changes before it can borrow, then maybe the Fund should not lend." (*New York Times*, October 21, 2000). Indeed, the IMF had been acting a little like a heart surgeon who, in the middle of an operation, decided to do some work on the lungs and kidneys, too.

[8] With the expectation that state banks would not go bust, but would be bailed out by the government, most people decided to switch from private national banks to state banks. Some also put their money in foreign banks.

[9] The market segmentation is evident from the following gap: among small and medium sized banks, the average interbank rates for overnight funds increased from 35 to 57 percent in November 1997, while the rates among the prime banks decreased from 30 to 18 percent (Enoch, Baldwin, Frecaut and Kovanen, 2001).

Figure 3. Share of Commercial Banks' Time Deposits

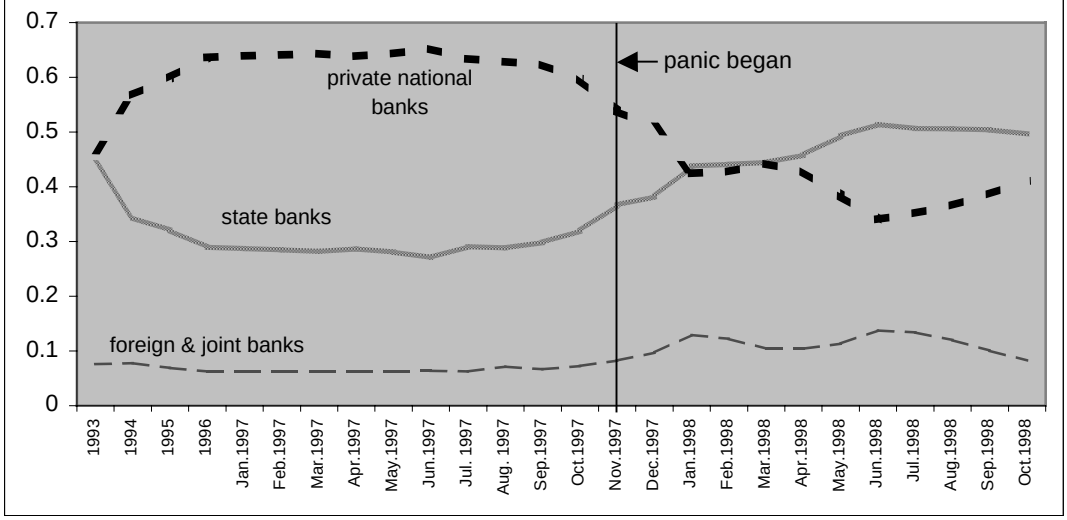
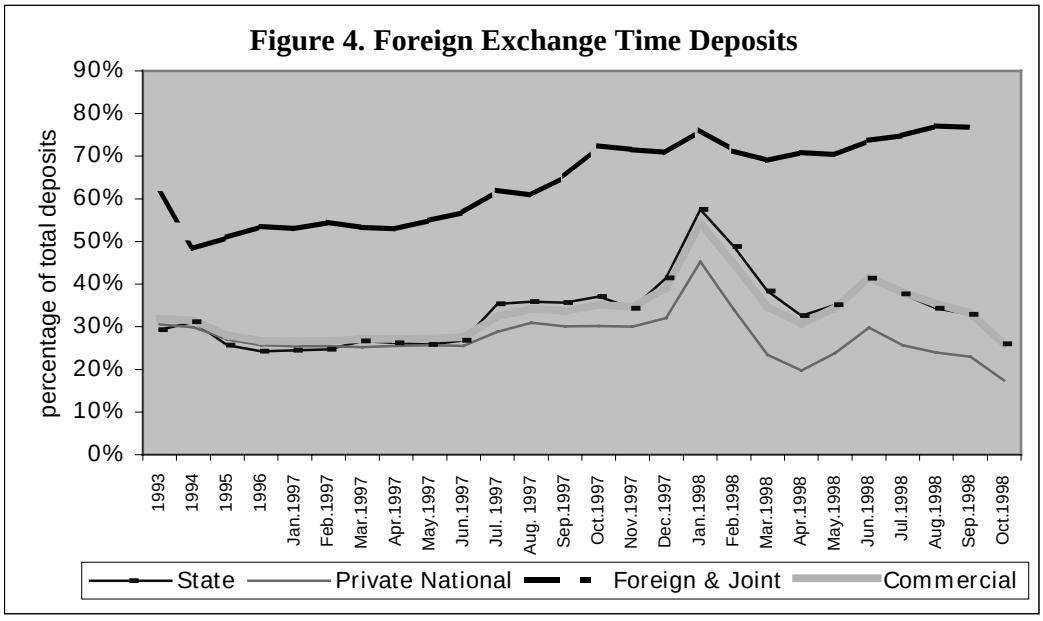


Figure 4. Foreign Exchange Time Deposits



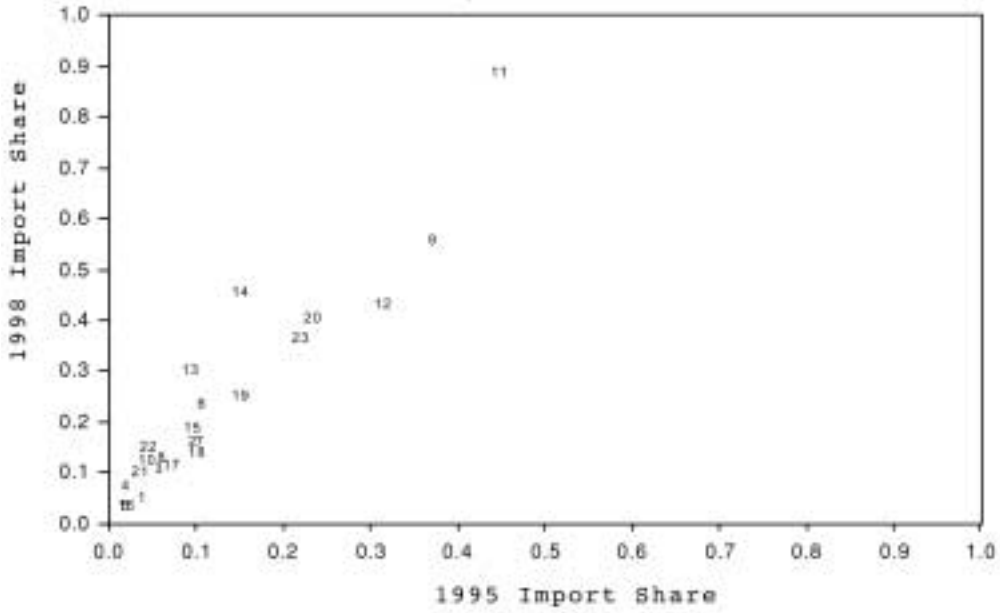
Non-economic factors reinforced the diverging movement of the currency. Uncorroborated political rumors sharpened the fluctuations of the rupiah and the stock market index, especially in the early stage of the crisis.[10] Many hoped that the March 1998 presidential election would mark the beginning of the rupiah's stabilization.

The IMF's early prescription of curtailing the budget to achieve a surplus implied that many spending items, including subsidies, had to be cut. Expectations grew that the

[10] When Suharto cancelled his trip to the ASEAN Summit in Kuala Lumpur and to his wife's resting place in late 1997, the rupiah trembled. In the same month, when rumors spread that Suharto had suffered a stroke (and some even said that he had died), the stock market index plunged, and the rupiah fell to 5,200.00 to the dollar. This rate was considered highly inconsistent with the economic fundamentals even during the time.

prices of rice, utilities, and fuel would increase substantially should the government adhere to the IMF scheme. In the first week of January 1998, Suharto made the surprise announcement that the projected growth of revenue and expenditure for the new government budget would be higher than originally thought. This created public suspicion that the government was simply refusing to acknowledge the real depth of the crisis. The rupiah was quickly dragged down to the 10,000 level.[11] Following rumors that the controversial minister Habibie might take the vice presidential post along with the perception that the IMF package so far had failed to restore market confidence, the rupiah subsequently hit its lowest level, 17,000 per US dollar.[12]

Figure 5. Import Share in Total Intermediate Input, Various Sectors, 1995 vs. 1998



Note: 1 = food crops, 2 = nonfood crops, 3 = livestock, 4 = forestry, 5 = fishery, 6 = oil, LNG, and coal mining, 7 = other mining, 8 = food processing, 9 = textile, 10 = wood processing, 11 = paper, 12 = chemicals, 13 = electricity and water supply, 14 = construction, 15 = trade and storage, 16 = restaurants, 17 = hotels, 18 = land transportation, 19 = air transportation, 20 = finance and insurance, 21 = real estate, 22 = public administration, 23 = social services.

The quickly depreciating rupiah caused the price of imported inputs and capital goods to soar. Two possible outcomes became possible: (1) producers could spend more for imported inputs because of rising import prices, or otherwise would be forced to reduce production; (2) producers could substitute imports with domestic products, avoiding a production cut. A careful look at the input-output tables (1995, 1998 and

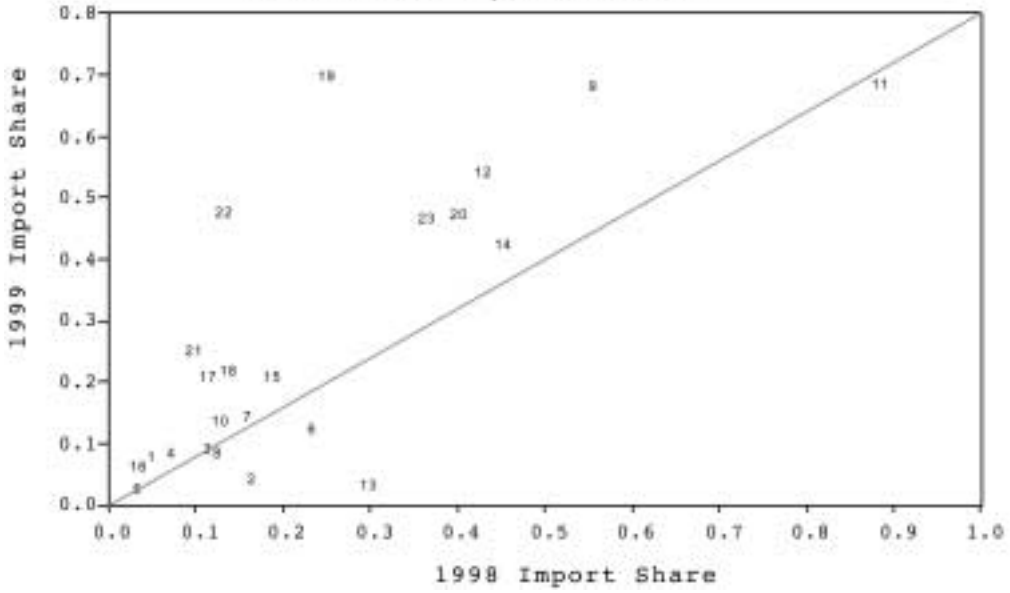
[11] Under strong pressure, however, the government subsequently announced the delay of 15 big infrastructure projects. With President Clinton promising continuing support to Indonesia, Suharto and the IMF's Michael Camdessus signed a historical agreement on January 15, 1998.

[12] Only after the central bank intervened and a revision of the government budget was made the following day, the rupiah rose to 12,000 per US dollar. Realizing how strenuous it was to prop up the rupiah's value, the government finally announced a temporary freeze on debt servicing in late January.

1999) and the production data suggests that the former was clearly the case for Indonesia. Figure 5 plots the Input-Output sectoral share of imports in 1995 versus the corresponding share in 1998. It can be seen that all pairs fall above the 45-degree line, indicating that the import share of total input costs rose between 1995 and 1998 for all sectors. Thus, a depreciating currency and low elasticity of substitution caused firms' expenditure on intermediate inputs to be increasingly devoted to imported materials.[13]

When the sectoral share of imports in 1999 is plotted against the corresponding share in 1998 (in Figure 6), only 5 sectors—i.e., nonfood crops (2), oil, LNG and coal (6), food processing (8), paper (11) and electricity/water supply (13)—fall below the 45-degree line. The other 18 sectors are above the line. Obviously, the elasticity of substitution in most sectors remains low, suggesting that when import prices rise, production tends to decline.[14]

Figure 6. Import Share in Total Intermediate Input, Various Sectors, 1998 vs. 1999



[13] For example, 13 out of 23 sectors experienced at least a 100 percent increase in their import costs: forestry, other mining, food processing, wood processing, paper, electricity, construction, trade & storage, hotel, air transportation, banking, real estate, and public administration.

[14] While the correlation coefficient between input coefficients of imported commodities declined, it remained relatively high for the 1998-1999 comparison, i.e., 0.92 for the 1995-1998 comparison, and 0.74 for the 1998-1999 pair.

Rising prices, and especially those of essential products, provided fertile ground for further social unrest. Vendors and traders, especially those of ethnic-Chinese descent, were accused of trying to extract a fat profit out of the chaotic situation.[15] In early February 1998, a proposal for implementing a currency board system (CBS) was brought to Suharto's attention.[16] Critized by most economists—but backed by a few members of the business sector (allegedly those who had huge amounts of foreign debts)—the CBS concept never really got off the ground. Confusion reigned over the government's position on the system.[17]

On March 7, when Suharto was reappointed to his seventh term with Habibie as his vice-president and daughter Tutut as a minister of social affairs, the rupiah slipped and the Jakarta stock index fell further. Many people who had previously anticipated that the March election would mark the beginning of the rupiah's stabilization, were proven wrong. Political uncertainties continued to plague the nation, hampering its recovery process.

In mid-May 1998, the government found itself forced to adhere to the IMF proposal to remove gasoline subsidies. While the original suggestion was to do it in stages, for unknown reasons Suharto impulsively decided to remove the entire fuel and energy subsidies all at once.[18] In retrospect, this may well have been the trigger that led to his downfall. As expected, the abrupt and significant price increase caused huge public protests. The government backed down, deciding to postpone the fuel price increase. But the situation worsened, and the student protest gained momentum. On May 13, a peaceful march turned into a terrifying event, later known as the "May riots," causing much capital to flee.[19] Some estimate that the amount of capital outflows reached as much as $28 billion, of which $8 billion was domestically owned.[20] The rupiah skidded to 17,500 per dollar on May 19, its lowest level ever. Suharto's

[15] It is interesting to observe that riots occurred only in places where the distribution network for essential goods was disrupted.

[16] Steve Hanke of the University of Maryland proposed the idea. CBS requires an independent board that handles foreign exchange transactions at a pre-announced rate. Hanke believed that such a board would solve the confidence problem, and thus release pressures on the rupiah and interest rates. But most economists were against the idea, partly because the country's foreign reserves needed to back up every single rupiah spent was quite small. Furthermore, under CBS, the central bank could no longer extend credits to commercial banks (it could, instead, use only reserve requirements as a policy instrument).

[17] Confusion reached its peak when the rupiah strengthened to reach 8,750 per US dollar on February 19. Two days later, probably under the conviction that widespread anticipation for the currency board had caused the strengthening of the rupiah, Suharto instructed the finance ministry and the central bank to make necessary preparations for the inception of CBS.

[18] Some believe that at the time Suharto wanted to "test the water."

[19] It was reported that during the riots that there were systematic incidents of molestation and sexual assaults against ethnic-Chinese. Although history has documented periodic resentments toward ethnic-Chinese during difficult times, such a record of sexual assaults was essentially unprecedented. This phenomenon led to the spreading of wild rumors that a certain powerful figure backed by a strong institution was behind the acts. The number of people who died during the riots was reported to have reached more than 1,000. As for the rape victims, the number is more debatable and difficult to trace. The government and some non-governmental organizations (NGOs) conducted a series of investigations, but a consensus on the exact number of victims has never been reached.

[20] During 1998, the capital account remained in deficit (by roughly $3.7 billion) due to capital outflows, despite official capital inflows of US$7.5 billion. FDI also recorded a minus figure of US$1.3 billion, indicating a deterioration in market confidence and investment climate in general.

resignation and Habibie's succession to the presidency failed to restore confidence. Only after the IMF disbursed some of the promised funds did the rupiah slowly begin to regain strength, reaching 13,000 per dollar in mid-July 1998.

In retrospect, the policy response at the early stage of the crisis (e.g., bank closures) caused panic, while the austerity program failed to restore market confidence. The high interest rate policy worsened the already weak condition of the banking system, and the tight budget sparked social unrest. Government's flip-flopping with the program did not help the situation either, and toying with the idea of fixing the exchange rate through a currency board system simply prolonged the uncertainty.

One thing, however, is certain: much of the country's financial sector and many of its large corporate businesses either collapsed or came close to collapse. From this perspective, the explanation of the crisis surely must be financial in nature (Chang & Velasco, 1998).

In this context, I do believe that the mismatch between private foreign debt maturity (largely short term) and the country's capacity to repay (measured by the size of foreign reserves) holds the key to the story (Azis, 1999).[21] Yet, it is interesting to note that most analyses of Indonesia's macroeconomic development up to mid-1997 failed to touch upon this issue. The following data, which is now well-known, only became widely quoted after the crisis burst.

Indonesia's private foreign borrowing increased dramatically during the 1990s. By mid-1997, the amount reached more than US$50 billion, most of which fell under the category of corporate (non-bank) borrowing, with Japanese banks having the largest exposures (Figure 7). More seriously, the proportion of short-term debts (STD) was considerably larger than the long-term borrowings. At the onset of the crisis, STD already made up 170 percent of the foreign reserves.[22] This is obviously a strong case of *international illiquidity*.[23]

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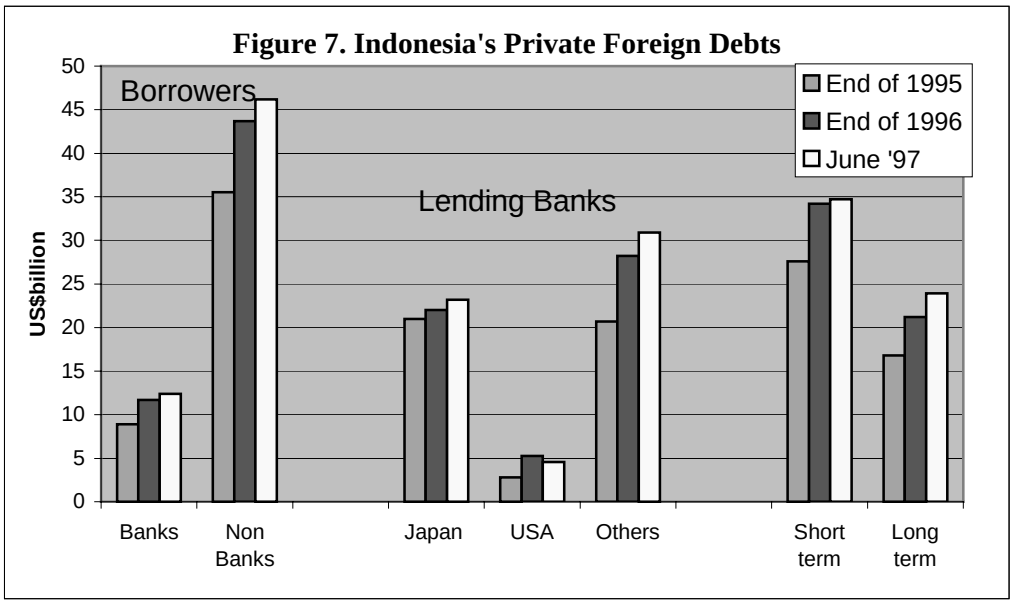
[21] In the aftermath of the Asian crisis, the ratio of short-term external debt to reserves has become the IMF's basic indicator of reserve adequacy. In Stanley Fischer's words: "…the ratio of short-term external debt to reserves is the single best crisis indicator." (see Stanley Fischer, *"Asia and the IMF,"* June, 2001)

[22] While the crisis episodes of Latin American countries were often characterized by inappropriate government policies (i.e.weak macroeconomic "fundamentals"), the Asian crisis countries were inferior in terms of international illiquidity (e.g., in mid-1997, the STD/forex ratios were recorded at 170%, 206%, and 145% in Indonesia, Korea and Thailand, respectively, compared to 120% in Mexico and less-than 100% in Brazil, Peru, Columbia and Chile).

[23] The increasing trend of private foreign debts was actually a regional phenomenon. Thanks to widespread optimism about East Asia's future growth and the celebrated label of the "East Asian Miracle," many private investors—local and foreign alike—were poised to expand their activities throughout the region. This was the second wave of foreign capital flows into ASEAN, coming mostly from the U.S, Europe and Japan (the first wave occurred during the second half of 1980s, when Japanese FDI in the region surged, following the *endaka* phenomenon). The relatively high domestic interest rates failed to dampen investment growth, since foreign loans could be obtained easily at a relatively low rate. Furthermore, stable pegged exchange rates were perceived as a guarantee for earning stability. The label "miracle" swayed lenders and the international financial community, leading them to lend recklessly. The fast-growing number of banks and multi-finance corporations, following the 1988 deregulation, also produced considerable effects. Many big companies set up new banks primarily to serve their own often-risky projects. Despite regulatory measures formally imposed by the monetary authorities (e.g., legal lending limits, capital adequacy ratios), weak enforcement and compliance discouraged the development of a healthy financial sector.



Banks' foreign borrowings were also in an upward trend, albeit relatively small. But given the quasi-fixed exchange rate system and the full convertibility of the capital account, domestic currency deposits should have also been included in the asset/liability position of the financial system, as additional obligations in international currency. A depositor could withdraw rupiah from a bank to convert it into dollars at the announced parity. In this situation, unless there are sufficient foreign reserves to honor such a demand, a financial system can still suffer from an international illiquidity problem if it holds excessive domestic liabilities. Indonesia's ratio of M2 to foreign reserves before the onset of the crisis was indeed the highest among the Asian crisis countries (6.3). Yet, it was still smaller than Mexico's prior to the 1994/95 crisis (9.1).

The above suggests that in a liberalized capital account system like in Indonesia, bank deposits, currency mismatches, and short-term foreign debts are important indicators to watch.[24] Yet, the issue of short-term private foreign debts did not seem to take center stage in the early policy designs supported by the IMF. The early rescue program dealt with neither debt relief nor moratoriums on existing debts. There were no discussions about "bailing in" foreign creditors. This issue alone has sparked criticism and become a compelling argument for the need to re-design IMF rescue programs (Sachs and Woo, 2000).

An interesting question to ask is therefore: in addition to avoiding a higher interest rate policy, would the resulting outcomes have been more favorable had a (partial) debt resolution also been given priority? This will be one of the policy scenarios conducted in the counterfactual exercise in Section 7. To run counterfactual scenarios, a fairly comprehensive model has been constructed. Prior to conducting the counterfactual experiments, the model wil be used to generate trends in some macroeconomic variables based on the actual sequence of events during the crisis. Let me first describe in the next two sections the specifications and mechanisms of the model.

[24] In classifying the sources of Indonesia's vulnerabilities, Summers (2000) assigned a value of "1" (meaning "very serious") for short-term foreign indebtedness, along with the problem of general governance and banking weaknesses.

4. The Model

The model used is economy-wide, with endogenous prices in nature. It has a fairly detailed financial sector, designed to capture the mechanisms of the financial shock. In total, there are 893 equations in the model. The following section discusses only the key components of the financial block of the model, and the mechanisms (channels) of influence through which a financial shock such as the one that occurred in the summer 1997, including political instability, affects the system (a complete list of equations is available upon request at **info@adbi.org).** Some of the parameters and coefficients are calibrated, while others are estimated econometrically.

4.1. Financial Sector

In the first stage, gross private capital inflows (PFCAPIN) are specified as a function of interest rate differentials and country risks (labeled *RISK*), the latter being influenced by the debt service ratio (debt service to exports):

$$PFCAPIN = \sigma_0 + degree \times \sigma_1 (RLOAN - RFLOAN - RISK) \quad (1)$$

$$RISK = \alpha_0 + \alpha_1 \times \frac{\sum_{inl} DEBSERV_{inl}}{\sum_p E \times pwe_p} \quad (2)$$

where *RLOAN* and *RFLOAN* are domestic and foreign interest rates, respectively, *PFCAPIN* and *DEBSERV* are the gross private capital flows and the debt service, respectively; *degree* indicates the intensity of capital openness, with its size calibrated from the Social Accounting Matrix (SAM*), pwe* is the world price of exports, and ***E*** is export volume. The subscripts *inl* and *p* are for borrowing institutions and the production sector, respectively. The risk factor, determined by the country's debt-service ratio (equation 2), affects the gross capital inflows as specified in equation 1. Hence, even when the interest rate *RLOAN* increases, capital inflows may not increase if the *RISK* factor also moves upward (equation 1).

In standard general equilibrium models, the interest rates act as an equilibrating factor in securing the saving-investment balance. However, during crisis, the interest rates should be treated as policy variables (exogenous) as they were influenced by IMF conditionality requirements and manipulated by the monetary authorities; hence they were exogenously determined. There are three interest rates in the model, i.e., the deposit rate (labeled *RT*), loan rate (*RLOAN*), and the central bank certificate or SBI rate (*RSBI).* All three have usually moved in the same direction, with only a few exceptional cases, e.g., when banks need to adjust the interest rate differential (the gap between *RT* and *RLOAN*). Of the three, *RSBI* is the one that the monetary authority can directly control; hence, this rate is treated exogenously in the model. When *RSBI* is raised, banks' portfolios are shifted towards more SBI, as indicated by an increased proportion of SBI in banks' funds *(bb1*).

$$bbl = browl \times \left(\frac{1 + RSBI}{1 + RLOAN} \right)^{brow2} \quad (3)$$

Subsequently, this reduces the amount of loanable funds *BANKF*, causing the interest rate *RLOAN* to increase. The specification of *BANKF* is derived from the commercial bank's balance sheet:

$$BANKF = (1 - bbl)\{WEALBANK + dcur \times CURRENCY + \sum_{ihh}(TDH_{ihh} + EXR \times TFH_{ihh}) + \sum_{p}(TDI_{p} + EXR \times TFI_{p}) + TDGOV + EXR\ (1 - rrbank)(0BORROW_{combank} + BORROW_{combank}) - BANKRES + CBTRAN\} \quad (4)$$

where *brow1*, *brow2* and *dcur* are constant, *WEALBANK*, *CURRENCY*, *BANKRES*, *CBTRAN*, *BORROW* and *EXR* are the bank's wealth, the amount of currency, bank's reserves, central bank's transfers to commercial banks (e.g., BLBI discussed earlier), bank's foreign borrowing (*0BORROW* indicates its value at the initial condition), and the nominal exchange rate, respectively. TDH, TFH and *TDI*, *TFI* are household time deposits in domestic and foreign currency, and institutional time deposits in domestic and foreign currency, respectively. The subscript *ihh* refers to household category.

While the interest rates are set as policy variables, in practically all crisis countries with the exception of Malaysia, the exchange rate has been allowed to float since August 1997. In this sense, the exchange rate plays an important role in the determination of the saving-investment balance.

The phenomenon of capital outflows, particularly as undertaken by foreign investors, was widespread during the early part of the crisis. This is modeled through a shrinking equity asset *EQROW* in the foreign sector's balance sheet. In turn, this can spark outflows of other types of assets, and will eventually raise the total outflows, *PFCAPOUT* (expressed in US$).

Next, the exchange rate determination and the role of non-economic factors need to be specified. Since a standard testable uncovered interest parity (UIP) model requires a rational expectation assumption, the corresponding risk premiums (lumped together with expectational errors, ξ) would have a rather loose economic interpretation. The usual assumption that ξ is orthogonal to the interest rate differential (and hence the slope parameter close to unity) is nothing more than a statistical conjecture.[25] Hence, alternative interpretations can be suggested, providing scope for introducing other risk factors. The selection of risk factors depends on the prevailing country's situation. When political factors play a major role, for example, a proxy for political instability, labeled *POLRISK*, may enter the equation. A simple example of this can be seen in equation 5:

$$RLOAN = RFLOAN + \left(\frac{EXPEXR}{EXR} - 1\right) + POLRISK \quad (5)$$

[25] It is not surprising that a clear consensus has not been reached by most empirical tests using UIP models (see for example, Froot, 1989, MacDonald & Taylor, 1992, and Meredith & Chin, 1998). On the other hand, many studies reject the proposition that exchange rate movements are best characterized as a random walk, (Meese & Rogoff , 1983).

The expected exchange rate is modeled through:

$$EXPEXR = EXR0 \times \left(\frac{PFCAPOUT}{PFCAPOUT0} \right)^{\delta 1} \times \left(\frac{RISK}{RISK0} \right)^{\delta 2} \times \left(\frac{M2CBFR}{M2CBFR0} \right)^{\delta 3} \quad (6)$$

where *M2CBFR* is the ratio of broad money M2 to the central bank's foreign reserves, and where all variables ending with "0" indicate values at the initial (pre-crisis) period. As the expected exchange rate (*EXPEXR*) increases, the following alternatives must occur, individually or simultaneously, in order to be consistent with the uncovered interest parity (UIP) equation 5: (i) the interest rate *RLOAN* must increase, and (ii) the actual exchange rate *EXR* depreciate. The same alternatives apply to the case where the political instability, *POLRISK*, worsens. The worsening exchange rate expectation (*EXPEXR*) can be set off by increased capital outflows, risk factors, and the ratio of M2 to foreign reserves, as specified in equation 6.

The money supply is modeled through a money multiplier and high powered money (reserve money), the size of which is determined by the difference between the central bank's loans *CBLNTOT* plus transfers *CBTRAN* plus foreign reserves *CBFR* (equivalent to NDA plus NFA) and the central bank's wealth *WEALCB* plus non-interest bearing government deposits *DDGOV* and the central bank's certificate *SBI*. Hence,

$$MS2 = multRM \quad (7)$$

where

$$RM = (CBLNTOT + CBTRAN + EXR \times CBFR) - (WEALCB + DDGOV + SBI) \quad (8)$$

The money multiplier, *mult*, fluctuates rather sharply during a crisis, because household behavior varies considerably. Therefore, money multipliers are allowed to vary freely, influenced among other factors by government policy such as reserve requirements (see Harberger, 2000 for a discussion of flexible multipliers during the Asian crisis).

The saving-investment closure departs drastically from neo-classical specifications. Private domestic investment in a sector *p*, i.e., $DOMPINV_p$ is determined through an independent function. It has been observed empirically that over an extensive period of time, Indonesia's sectoral domestic investment was correlated with value added (output accelerator), interest rates and inflation rate (see Throbecke, 1992). In the current model, I have modified the specification by replacing the inflation rate with nominal exchange rate (equation 9) for reasons to be discussed below. Foreign investment FORINV, which is part of net private capital inflows, $f_1(1-f_2)\ PFCAP$, along with $DOMPINV_p$ and exogenous government investment $GOVINV_p$, constitute total investment *TOTINVEST*,

$$DOMPINV_p = \lambda_p VA_p^{\lambda 1 p} (1 + RLOAN)^{\lambda 2 p} (EXR)^{\lambda 3 p} \quad (9)$$

$$TOTINVEST = \sum_p (DOMPINV_p + GOVINV_p) + (f_1(1 - f_2)PFCAP) \times EXR \quad (10)$$

where VA_p is the value-added of sector *p*.

The above specification of *DOMPINV* reflects the financing behavior (i.e., bank-dependent) of agents, and the emerging constraints on the corporate balance sheet following the exchange rate collapse (Bernanke and Gertler, 1989, Krugman, 1999, Aghion, Bacchetta and Banerjee, 2001) This fits fairly well with the prevailing crisis conditions in some East Asian countries.

Hence, it is assumed that interest rates and the production capacity (accelerator), combined with the (depreciating) exchange rate, affect the size of domestic investment. When the exchange rate is favorable, few firms are constrained by their balance sheets. In such cases, the direct effect of *EXR* on aggregate demand is minor. On the other hand, if the exchange rate collapses (as it did in Indonesia), firms with foreign-currency debt—and hence deteriorating balance sheets—are unable to invest. This only worsens the recession. In the interim, exports may rise, but the effects of a bankrupt corporate sector and the absence of new investment, including in the exporting sector, may be large enough to outweigh the direct effects of greater export competitiveness. In this case, the depreciating exchange rate can be contractionary.

This clearly implies that exchange rate movements can also affect aggregate demand. As suggested by Aghion et al. (2000), under such circumstances, the normally upward-sloping curve of output determination given the *EXR* may have a backward-bending segment, creating multiple stable equilibria, i.e., allowing the system to produce a bad equilibrium with collapsed *EXR* and a bankrupt corporate sector.

The estimated equations for Indonesia (based on equation 9) are shown in Table 1. I must note, however, that the regression equations for the crisis period (1997:2-1999:4), calculated with either OLS or TSLS techniques with different AR(i) to account for serial correlations, are used as the reference models. Hence, precisely the same methods of calculation are applied for the non-crisis period (1983:3-1997:1), irrespective of the quality of the econometric results.[26] This approach is adopted to maintain consistency in making the comparison between the two periods. The main purpose is to show the directional changes of the effects of exchange rate on domestic investment (λ_3) from the non-crisis to the crisis period.

Taking into account the above notes, in general the results conform to the hypothesis stated earlier. During the non-crisis period (1983:3 – 1997:1), only 4 out of 16 sectors registered negative exchange rate elasticity, while the coefficient in one of them, i.e., the food processing industry ("FoodProc"), was insignificant. On the contrary, during the crisis period, 15 out of 16 sectors had negative elasticity, and only one, i.e., "Textile," did not register a significant coefficient.

Clearly, while the depreciation of the rupiah during the non-crisis period generally had a positive effect, the collapsed exchange rate in the crisis episode produced a fairly pronounced negative effect on domestic investment. Looking at all sectors (the last row), the coefficient of the exchange rate turned out to be not only negative but also more significant.

[26] As a consequence, this causes some equations in the non-crisis period to produce unexpected signs (e.g., positive coefficients for the interest rates, λ_2) and non-significant coefficients.

Table 1. Summary of Estimated Parameters for Domestic Investment

Equation: $DOMPINVp = \lambda p + \lambda 1 Log(VA_p) + \lambda 2 Log(RLR1) + \lambda 3 Log(EXR) + AR(i)$

where $DOMPINV_p$=domestic private investment in sector p; VA_p= Value added of sector p;

RLR1=(1+RLOAN), where RLOAN is the loan interest rate, and EXR = nominal exchange rate.

Sector p		Crisis			Non Crisis	AR(i)
			1997: 2 - 1999: 3		1983:3 - 1997:1	
		$Log(PV_p)$	Log(RLR1)	Log(EXR)	Log(EXR)	
Food	TSLS	1.688	-0.61	-0.733	0.069	AR(1)
		(4.53)	(-1.40)	(-2.22)	(1.44)	
Non Food	TSLS	2.138	-0.83	-0.546	0.85	AR(1)
		(1.02)	(-1.81)	(-2.56)	(1.15)	
Mining	TSLS	0.852	1.317	-0.866	1.205	AR(1)
		(3.15)	(3.16)	(-3.56)	(0.72)	AR(2)
FoodProc	TSLS	0.091	-0.467	-0.436	-0.418	AR(1)
		(1.10)	(-2.29)	(-3.82)	(-0.52)	
Textile	OLS	0.016	-0.62	-0.112	1.784	AR(1)
		(0.02)	(-2.63)	(-0.41)	(1.78)	
Construct	OLS	-8.47	2.299	-3.239	-1.734	AR(1)
		(-3.37)	(3.88)	(-2.84)	(-1.29)	
Paper	OLS	1.017	-0.558	-0.113	0.528	AR(1)
		(10.53)	(-2.97)	(-1.14)	(1.78)	
Chemical	TSLS	0.405	0.503	0.238	0.96	AR(1)
		(10.47)	(4.39)	(4.54)	(2.54)	AR(2)
Utility	OLS	1.281	-0.824	-0.546	0.252	AR(1)
		(8.04)	(-5.25)	(-5.18)	(0.15)	
Trade	OLS	1.019	-0.629	-0.394	0.532	AR(1)
		(8.59)	(-2.85)	(-2.85)	(0.86)	
ResHotel	OLS	1.448	-0.644	-0.792	-1	
		(7.13)	(-2.15)	(-3.72)	(-1.59)	
Transport	OLS	1.423	-0.486	-0.245	-0.116	AR(1)
		(14.36)	(-2.72)	(-2.63)	(-0.14)	AR(2)
Bank	OLS	1.702	-1.204	-1.309	0.351	AR(1)
		(5.82)	(-3.78)	(-3.80)	(0.19)	
RealEst	OLS	1.101	-0.354	-0.472	0.426	AR(1)
		(8.56)	(-1.02)	(-2.64)	(0.73)	AR(2)
PubAd	TSLS	0.852	-0.746	-0.353	0.255	AR(1) AR(2)
		(2.30)	(-1.93)	(-1.09)	(0.34)	AR(3) AR(4)
SocSvc	OLS	1.176	-0.858	-0.561	0.012	AR(1)
		(7.60)	(-3.17)	(-3.73)	(0.02)	AR(2)
TOTAL	TSLS	0.936	-0.153	-0.207	0.974	AR(1)
		(21.476)	(-1.334)	(-3.557)	(2.927)	AR(2)

4.2. Output and Factor Markets

The specification of the real sector is fairly standard for this class of CGE-type models; the production structure is modeled as a set of nested CES function (for further details and a list of equations for output and factor markets, see Azis 2000a). In the first stage, the production function (expressed as value-added) is determined, with primary inputs being the right-hand side variables in the equation. Like many other East Asian economies, Indonesia's structure of production and trade is such that a considerable proportion of intermediate inputs continue to be imported. Therefore, the composite intermediate inputs are of necessity modeled as a CES function of domestic and imported inputs (when needed, one can alter the elasticity of substitutions of some of

these inputs). In the second stage, domestic output is specified as a CES function of value-added and composite intermediate inputs.

On the supply side, exports are assumed to be differentiated from domestically sold products in each sector. Domestic output is allocated between exports and domestic sales using a constant elasticity of transformation (CET). This suggests that substituting exports with domestic goods is not costless; a lower elasticity implies greater cost (more obstacles). Furthermore, the domestic market price is different from the export price (determined by the world price and the exchange rate). Thus, in the revenue maximization process, the producers' behavior is captured through equations that express the ratio of exports to domestic sales as a function of relative prices.

Following Armington (1969), aggregate demand is specified as a CES composite of imports and domestically produced products. Minimizing the cost of acquiring composite goods gives the first-order condition where the ratio of imports to domestic sales is determined by their price ratio. The demand for imports is assumed to be infinitely elastic with fixed world prices (the small country assumption). Along with the exchange rate, import taxes, and trade and transport margins, together with the world price, are assumed to determine the domestic price of imports.

Once the whole system is specified, the sequential dynamics of the model are subsequently expressed through the following motion equations for an aggregate capital stock *K*:

$$K_t = K_{t-1}(1-\Delta) + \Psi \delta K_t \qquad (11)$$

where Δ is the depreciation rate, δK is the change in capital stock, and ψ is the scaling factor.

5. Model Mechanisms

There are a number of initial shocks one can choose to describe the mechanisms of the model. Let me take the case where the shock takes the form of sudden capital outflows (caused by either a change in expectation of profitability, a contagion, or simply a loss of confidence, as was the case in the summer of 1997). This effect is modeled by decreasing the amount of equity held by foreign investors. The decline in foreign equity is captured in the model by a decrease in variable *EQROW*. This, in turn, leads to capital outflows, represented in the model by an increase in variable *PFCAPOUT* (capital outflows), leading in turn to a depreciating exchange rate.

To stabilize the exchange rate, the interest rate *RSBI* is raised, followed by rising interest rates for loans (*RLOAN*) and deposits (*RT*), potentially reducing investment and output. The decline in investment reduces the capital stock and consequently production. The exchange rate shock thus not only directly affects investment by producing higher interest rates but also indirectly affects it by worsening firms' balance sheets. As the exchange rate falls, the rupiah value (in the case of Indonesia) of firms' foreign currency liabilities increases, making firms less creditworthy. The decrease in creditworthiness hinders the ability of firms to raise funds and further reduces investment. This effect is modeled by including the real exchange rate as a variable in

the equation for domestic investment *DOMPINV* (Krugman, 1999, again, see equation 9 and Table 1).

The high interest rates and deteriorating economy reduce the net worth of the banking sector.[27] In the model, a decrease in the banking sector's net worth, *WEALBANK*, reduces the supply of bank loans. This reduction in the supply of loanable funds further reduces the ability of firms to invest, and this deepens the recession. The deepening recession, combined with the higher interest rates and depreciating exchange rate, further reduce the confidence of foreign investors, leading to another round of declines in equity holding by the rest of the world, continued outflows of capital, and further depreciation.

It is clear, therefore, that a downward spiral can take place in the model: deteriorating confidence leads to capital outflows, and capital outflows depreciate the exchange rate. A depreciating exchange rate, along with high interest rate policy, reduces investment, and at the same time deteriorates the balance sheet of the highly-leveraged corporate and banking sectors. Lower investment produces a deepening recession, and a deepening recession leads to a further decline in confidence.

This downward spiral can be aggravated if most of the debts remain mainly short-term, denominated in foreign currencies, and are not successfully rescheduled. The short-term maturity of the debt can magnify the effect of the depreciation on firms' balance sheets and hence exacerbate the depreciation. At any rate, a vicious recessionary cycle can replace the virtuous growth cycle, as depicted in Figure 8.

Figure 8. Circular Causality, Multiple Equilibria, and Policy Choices

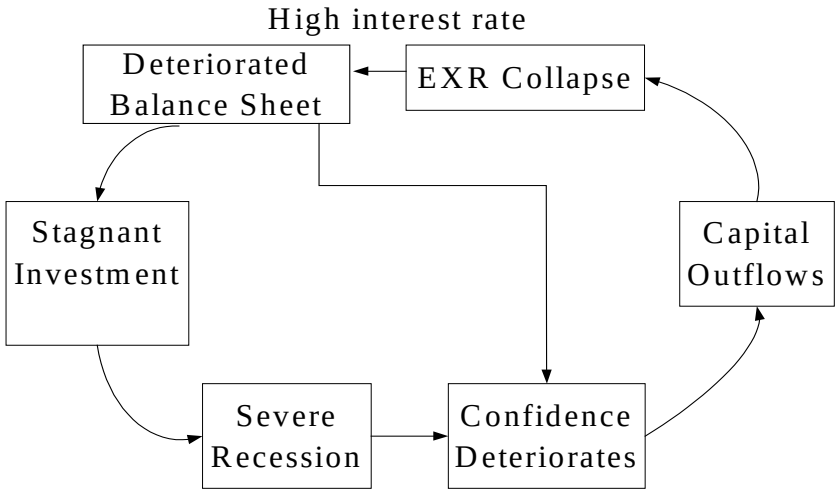


Figure 9 displays the detailed mechanisms of the model that relate to the above-mentioned circular causality (the shaded areas contain the relevant variables discussed in the text). As market confidence collapses, the amount of foreign equity *EQROW* declines, leading to rising capital outflows (*PFCAPOUT*). The most direct channel of

[27] During the crisis, the situation was combined with bank runs. Contrary to Fama's (1980) claims, a bank run can actually have real effects due to the presence of asymmetric information.

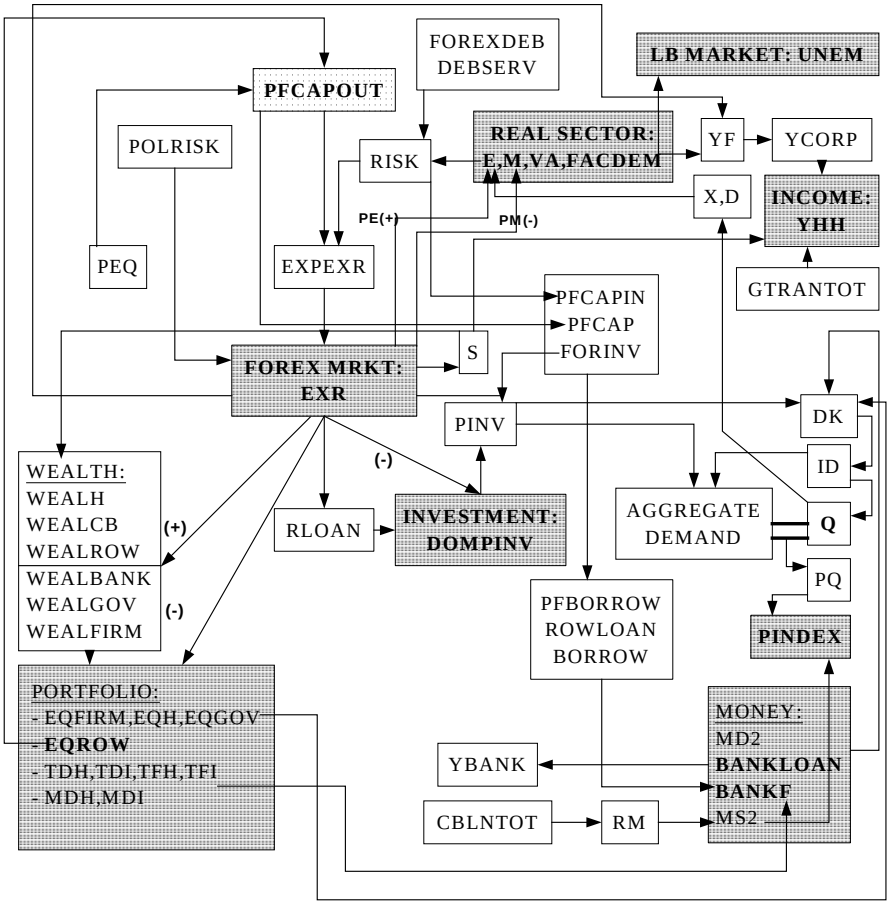
influence is through worsening expectations of a further currency depreciation reflected by a change in *EXPEXR*. With additional pressure from the *RISK* factor, the nominal exchange rate *EXR* tends to depreciate further.

Four subsequent repercussions can be expected: (1) a standard push on net-exports, *E-M*, via more competitive export prices, *PE*; (2) an increase in the value of foreign savings (in domestic currency) that will affect household incomes *YHH*; (3) increased domestic value of foreign investment (*FORINV*); and (4) declining domestic investment, *DOMPINV* via both increased interest rates (*RLOAN*) and the direct impact of worsening firm balance sheets due to the rising value of foreign liabilities (again, see equation 9). At some point, the negative impact of (4) can dominate and more than compensate for the positive combined effects of (1), (2) and (3). As a result, total supply (*Q*) drops, as does aggregate demand.

The resulting inflation (*PINDEX*) is determined through the interaction between aggregate demand and supply. One may also want to add several cost-push sources of inflation, e.g., a drop in food production due to unfavorable weather conditions. Another potential contributing factor to inflation may be less economic in nature, e.g., political instability and concomitant higher transaction costs. The inflation may also be further fueled by the rising import prices resulting from the exchange rate depreciation.

Theoretically, pressures on prices can be countered by a tight money policy (which affects *MS2*). But such brakes may not be effective when the monetary authority injects funds simultaneously into the banking sector (increased *CBLNTOT* in Figure 9). Such a decision may be taken in response to the fear of a collapse in the financial system, following a major bank run. This was precisely the case in Indonesia during the last quarter of 1997. Due to the Central Bank's reluctance to close more banks (as a result of the lessons learned from the panic caused by the closure of 16 banks in November 1997), liquidity support was injected. This support increased continually, i.e., from 24 trillion in October 1997 to 60 trillion rupiah in January 1998 (equivalent to 7 percent of GDP). Consequently, instead of lowering the price level through a tight money policy, the increased money supply due to liquidity support made the prospect of hyperinflation real.

Figure 9. Impacts of Capital Outflows on Financial and Real Sectors



6. Benchmark Simulation

The model is calibrated on the basis of the initial conditions prevailing at the onset of the crisis as reflected by the country's *social accounting matrix* (SAM). A number of parameters and coefficients in the model have been statistically estimated on the basis of quarterly data from mid-1997 to the end of 1999. Consistent with the issue at hand, a reclassification of the Indonesian SAM yields the following classification: 16 production sectors, 8 labor types, 8 household categories, 3 borrowing institutions, and 7 non-labor institutions. For the benchmark run, I set the values of all exogenous variables (including policy variables) and exogenous events that precipitated the crisis equal to their actual (observed) values and use the model to derive the resulting values of the endogenous variables. The latter are, in turn, compared with the actual values, allowing me to check on the extent to which the model replicates the changes that actually occurred (a backward validation).

Eight sequential events, starting from July 1997 and ending in March 1999, are used to shock the model (they are referred to as 'Stages' in the description which follows). These stages are shown in Figure 11. Each event (stage) is superimposed on the resulting values of the endogenous variables generated in the preceding stage.

As early pressure on the exchange rate emerged following the Thai's baht depreciation in July 1997, the Indonesian government responded by widening the exchange rate band to 12 percent (Stage 1: July 1997). At the same time, driven by the jitteriness of foreign investors, capital began to leave the country. These outflows, reflected in the model through exogenous *EQROW* and *PFCAPOUT*, continued in the following month (August), despite the fact that the interest rate on the Central Bank's certificate (Sertifikat Bank Indonesia or SBI) was raised. Unable to defend the exchange rate further, in the subsequent stage (Stage 2: August 1997) the government finally decided to float the rupiah. In the model simulation, these two events are captured sequentially.[28]

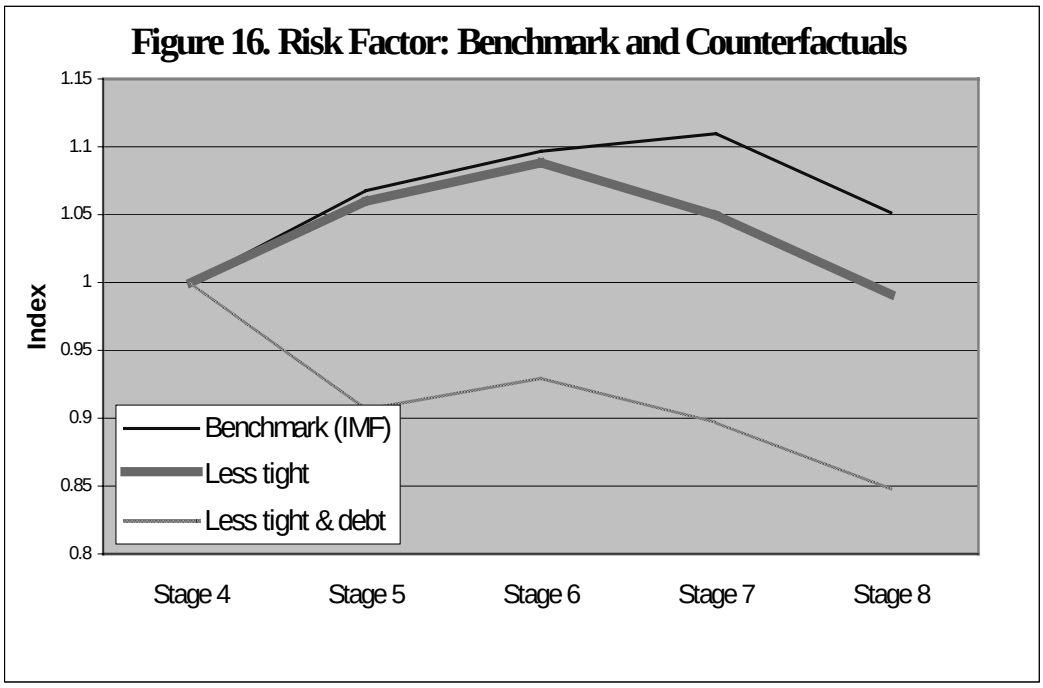
In Stage 3 (September 1997), the Central Bank tried to intervene in the forex market by releasing some of its foreign reserves, and the interest rate on SBI was slightly reduced. However, outflows of foreign assets (*EQROW*) continued, causing net flows to decline. This prompted the government to finally invite in the IMF (Stage 4: October/November 1997). With limited understanding of what caused the crisis at the time, the IMF offered standard prescriptions, i.e., keeping interest rates high (raising them even further from their already high level), closing 16 banks, tightening government outlays, and imposing extensive structural reforms in areas unrelated to financial matters. The closing of banks was done despite the fact that the country had virtually no deposit insurance system.[29] The resulting outcome was obvious: a bank run and financial panic.

When capital outflows and the rupiah's depreciation persisted (partly because of the failure to deal with mounting corporate debts), the economic environment quickly turned worse. The financial sector went into a downward spiral, and the entire economy fell into a deep recession. The stock market plunged, and the rupiah continued "to go south." Pandemonium set in when on January 8 and 9, 1998, people went on a buying spree to hoard foodstuffs, and the rupiah began to experience a severe fall.[30] In a standard interest parity model, the country's risk premium should have surged during the time. This is indeed the case, as can be seen from Figure 10 (note the sharp jump in January 1998).

[28] Meanwhile, during the same period, Indonesia also suffered from crop failures due to the fickle global weather (the El Nino phenomenon) and massive haze problems from forest fires. These factors, although unrelated to the financial crisis, affected the country's food production. Consequently, some adjustments in the food sector productivity parameter have been made.

[29] In the end, the government decided to protect small depositors, i.e., with Rp. 10 million deposits, roughly $3,000 at the prevailing exchange rate. These covered 90 percent of total depositors, but only 25 percent of total deposits.

[30] The IMF appeared out of touch with these chronological events. In a private conversation with IMF economists in Jakarta in March 2000, I was told that there was no food hoarding and rioting in January 1998 that could have caused the prices of some basic goods, including rice, to soar. This is obviously incorrect. There *was* hoarding and food rioting, not only in Jakarta but also in many other cities, causing the inflation rate to rise by 13 percent between December 1997 and January 1998. Since the IMF remained convinced that the resulting inflation was a demand phenomenon, the proposed solution continued to be aggregate demand management, i.e., high interest rates.



However, given the prevailing interest rates, the recorded jump in the risk premium underestimated the actual size of the exchange rate collapse. The primary reason is that the worsening socio-political conditions began to play a compelling role during the time, and this cannot be fully captured by a standard risk premium index. Indeed, this was a period of great uncertainty over post-Suharto leadership, and riots erupted in a number of regional towns throughout the country following the increase of prices of basic commodities.

The failure of the standard UIP models is quite well known. Ex-post deviations from UIP are often attributed to the existence of foreign exchange risk premiums and systematic forecasting errors. Some argue that the risk adverse behavior of agents explains the presence of a risk premium (e.g., Fama, 1984), while the systematic forecast errors may arise because of the existence of irrational traders (e.g., Froot and Thaler, 1990) or, as argued by Lewis (1995), simply due to the presence of expectational errors caused by infrequent shocks/uncertainties.[31] Some observers (McKibbin and Stoeckel, 1999) resolved the problem by adjusting the risk premium exogenously at a rate sufficient to generate the actual degree of exchange rate collapse. I adopt a similar approach, except that for the reasons stated above, the standard risk premium in the UIP equation includes—and in some cases is even dominated by—political risks, labeled *POLRISK***,** in equation 5. For the benchmark simulation, the value of this parameter is adjusted in Stage 5 (January 1998).

In the model specification, the collapsed exchange rate causes corporate balance sheets to deteriorate with large negative net-worths (related to unpaid foreign debts). Consequently, domestic investment is dampened, prolonging the recession (equation 9).

[31] In general, countries characterized by stable (unstable) monetary policy experience less (more) forward premium bias when the bias is substantially caused by forecast errors arising from changes in monetary regime.

The significance of the observed declines in output also makes it clear that the problems in the financial and corporate sectors have adverse impacts on productivity. Hence, beginning in Stage 5, downward adjustments in some of the sectoral productivity parameters are made. As demonstrated in Figure 9, the deep recession damaged investors' confidence further, causing even more capital to leave the country (increased *EQROW*). Furthermore, political factors (*POLRISK*) began to play a determining role once again. In May 1998, the Suharto government was in serious trouble, and major riots took place in Jakarta and other large cities, involving looting and burning. The distribution channels of some basic goods were seriously affected, as many food outlets were burnt and damaged. As shown in Figure 10, the country's risk premium began to creep up again; hence, the value of *POLRISK* needs to be re-adjusted in Stage 6.

Under the Habibie government, uncertainties continued, causing market confidence to remain low. Yet, the political situation became somewhat better than in the preceding stages (*POLRISK* is adjusted correspondingly).[32] This is detected by—and captured through—the unrelenting outflows of capital, despite efforts by the IMF and the government to continue adopting a strategy of monetary tightening. This episode is applied in Stage 7 (December 1998).

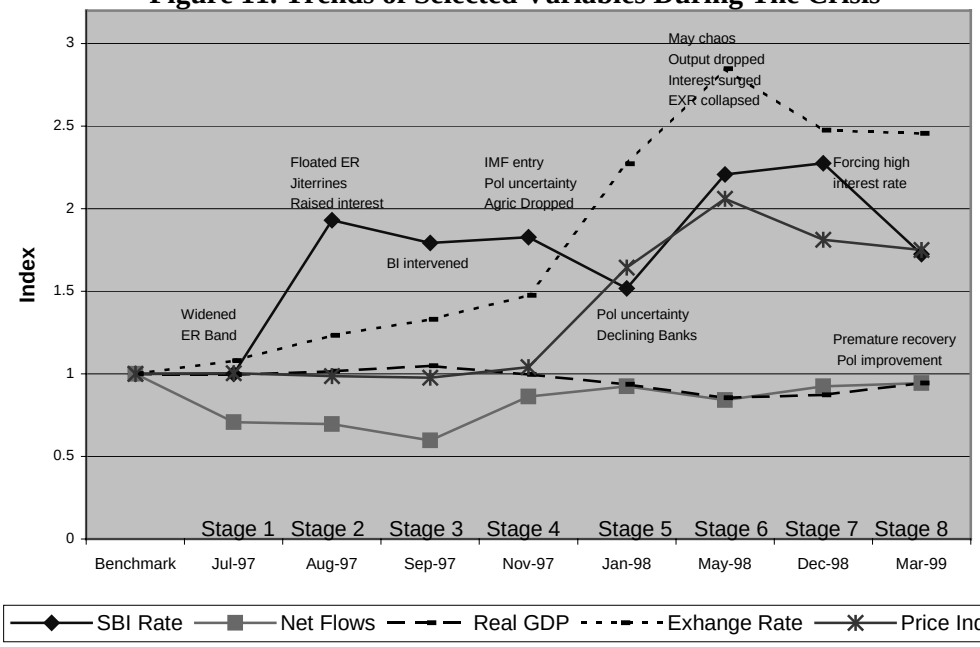
Only in Stage 8 (March 1999) did the situation begin to get better and the political situation improve somewhat. Signs of recovery emerged, supported further by improved weather conditions that helped the production of many agricultural activities to pick up.

By adjusting the relevant exogenous variables in line with the above changes and sequence of events, a set of sequential simulations (from Stage 1 to Stage 8) is conducted. Figure 11 displays the trend of major variables. Note that with the exception of the SBI interest rate (*RSBI*), all variables shown in the Figure are derived *endogenously* within the model.

Overall, the generated trajectories of these variables are close to the actual trends. Notice also that some dramatic changes occurred in Stages 5 and 6, when the political variable *POLRISK* began to show its forceful impact on the system (the January and May riots, and the downfall of Suharto). Despite the continued high interest rates, the expected capital inflows did not come in, while outflows continued to rise. This caused a decline in net capital flows, and a collapse in the exchange rate. Real GDP dropped continuously, and supply shock-related inflation surged, reaching over 70 percent. Note also from Figure 11 that by the end of the simulation period (Stage 8) the value of GDP was lower than the pre-crisis level.

[32] Actually, a period of deteriorating socio-political conditions occurred between Stage 6 (May 1998) and Stage 7 (December 1998), when there was a series of student demonstrations (in October 1998) demanding Habibie's resignation and an end to the direct involvement of the armed forces in Indonesian politics. Furthermore, the stern IMF program announced in September, which involved abolishing government subsidies on basic food commodities including rice backfired, sparking widespread protests and damaging the government's credibility. In terms of the risk premium, Figure 10 shows that there was a spike around October 1998, before it improved towards the end of the year. But since Stage 7 is only associated with the December 1998 period, the October incidents cannot be directly captured in the model.

Figure 11. Trends of Selected Variables During The Crisis



7. Counterfactual Policy Simulations

In this section, I concentrate on two alternative policies, the results of which will be compared with the benchmark simulation described above. Since the major actual policy response to the crisis was largely influenced by the IMF, I will label the benchmark simulation "Benchmark (IMF)."

The two sets of counterfactuals are: (1) a scenario of keeping the interest rates from continually rising, implying that the interest rates are lower than under the actual (benchmark) case; this alternative scenario is labeled "Less tight;" and (2) a scenario identical to number 1, but combined with the restructuring of some foreign debts (labeled "Less tight & less debt"). Obviously, these scenarios contrast with the actual or "Benchmark (IMF)" case.[33] As stated in Section 4, there are three interest rates in the model, i.e., the deposit rate, loan rate, and the central bank certificate rate (*RSBI*). All three have usually moved in the same direction, with only few exceptions. Of the three, *RSBI* is the one that the monetary authority can directly control; hence, this rate is treated exogenously in the model (set lower than in the benchmark, see Azis, 2001 and Azis et al, 2001).

Taking a lesson from the fact that the early interest rate increase (in mid-1997) failed to revive the economy and the exchange rate, the government attempted to lower the interest rates. Indeed, the actual interest rate on *RSBI* came down slightly in early

[33] Another potentially interesting counterfactual scenario would be one in which there is no panic (e.g., no bank closures). This could be done by altering the risk premium in the UIP equation (equation 5) after splitting the risk premium into two types: politically-related and non politically-related risks. Assuming that the non-politically inspired risk is caused partly by panic related to the bank run (the closure of 16 banks), one could adjust (lower) the exogenously determined non politically-related risk premium in order to test a case without panic.

1998 (Stage 5), but was subsequently raised again, presumably under recommendations by the IMF (see the actual trend of *RSBI*, labeled "SBI Rate" in Figure 11). In the counterfactual experiment, it is assumed that the decrease in the interest rates in Stage 5 is larger than in the benchmark, i.e., the assumed rate is lower by roughly 6 basis points, and there is no swing or upward movement of the rate since then (it is kept constant). The scenario of partial debt resolution is conducted by lowering the amount of debt service in Stage 4 and Stage 5 by approximately 10 percent. This implies that the repayment of matured debts is either reduced or postponed. Since most lending banks are non-consolidated, unlike in the case of the 1980s debt crisis in Latin America, and the qualifications/quality of borrowers (mostly in the corporate sector) are so diverse, there were difficulties in arranging a debt resolution plan. Hence, a scenario of only 10 percent debt rescheduling is reasonably justified.

Since the IMF made its entry in November 1997—roughly equivalent to Stage 4, the starting point of the relevant adjustments to the exogenous variables is in Stage 4. To conduct a proper comparison, the exogenous changes in each stage, with the exception of the interest rates and the level of foreign debt, are kept the same as in the benchmark simulation described in the preceding section.[34]

In Stages 4 to 7, the influence of the political risks variable (*POLRISK***)** under the two counterfactual scenarios is set smaller, i.e., 17 to 36 percent lower than in the benchmark simulation. This approach is adopted because the political and socio-economic repercussions of a more reasonable level of interest rates would have been less severe.[35]

The second counterfactual experiment, labeled "Less tight & less debt," involves a combination of lower interest rates with a partial resolution of foreign debts. This is done by lowering the value of the variable *DEBSERV* in Stages 4 and 5, which causes *RISK* to decline, and consequently *PFCAPIN* (capital inflows) to increase (see equations 1 and 2).

Let me now discuss the results of the counterfactual experiments. Since the different shocks for the experiments are applied starting at Stage 4 (the IMF entry in November 1997), Table 2 and the set of figures in the following discussions show only the trends from Stage 4 to Stage 8.

Under the two alternative scenarios, the impacts on output (real GDP) and prices are more favorable than in the "Benchmark (IMF)" scenario. While higher interest rates produce an output-curtailment effect, the corresponding depreciation of the exchange rate appears to be worse. The latter is formed through the following mechanism. As domestic investment (*DOMPINV*) drops, output is adversely affected; this includes both the domestic output *D* and the production for exports *E*. Consequently, GDP declines and the *RISK* factor increases (again, see equation 2). In turn, this reduces private

[34] When the interest rates are set lower, fewer bankruptcies would be expected. In turn, the resulting fall in construction activities, being the most bank-sensitive sector, would also be less severe. In the two counterfactuals, I accommodate such changes in the relevant stages by setting the (declining) productivity parameters for the sector slightly higher than in the benchmark scenario.

[35] When the interest rates surge, the probability of bankruptcies becomes higher. Furthermore, the unfavorable impact on output drags domestic investment further down, causing more severe repercussions on the economy. At some stage, with such a development the political environment can be jeopardized. Hence, under the two counterfactuals, the *POLRISK* exogenous variable should be set lower than in the "Benchmark (IMF)" scenario.

capital inflows, *PFCAPIN*. A higher *RISK* also pushes the expected exchange rate *EXPEXR* upward, resulting in a severe depreciation of the rupiah. Hence, despite the standard mechanism of the interest parity equation, the intended impact of high interest rates is offset by a rise in *EXPEXR* through the above channel, causing greater depreciation of the exchange rate.[36]

Table 2. Results of Benchmark and Counterfactual Simulations

	Stage 4 Nov-97	Stage 5 Jan-98	Stage 6 May-98	Stage 7 Dec-98	Stage 8 Mar-99
Net flows					
Benchmark (IMF)	1.0000	1.0737	0.9762	1.0723	1.0966
Less tight	1.0000	1.2621	1.1198	1.1707	1.2058
Less tight & less debt	1.0000	1.1270	0.9556	1.0185	1.0646
Real GDP					
Benchmark (IMF)	1.0000	0.9408	0.8582	0.8767	0.9481
Less tight	1.0000	0.9869	0.9016	0.9567	1.0380
Less tight & less debt	1.0000	0.9875	0.9022	0.9576	1.0393
Exchange Rate					
Benchmark (IMF)	1.0000	1.5401	1.9304	1.6775	1.6646
Less tight	1.0000	1.4995	1.7096	1.6248	1.6139
Less tight & less debt	1.0000	1.4231	1.6209	1.5411	1.5313
Price Index					
Benchmark (IMF)	1.0000	1.5796	1.9805	1.7410	1.6813
Less tight	1.0000	1.5627	1.7780	1.6627	1.6119
Less tight & less debt	1.0000	1.4890	1.6894	1.5817	1.5347
Risk					
Benchmark (IMF)	1.0000	1.0679	1.0967	1.1096	1.0514
Less tight	1.0000	1.0599	1.0884	1.0496	0.9915
Less tight & less debt	1.0000	0.9066	0.9294	0.8969	0.8478

Source: Model simulations

[36] A number of studies have shown that the effectiveness of raising interest rates in order to strengthen the exchange rate disappears during the crisis. Those using the case of Asian countries before and after the crisis also point to a similar conclusion (Ohno, et al, 1999, and Goldfajn & Baig, 1998). Gould and Kamin (1999) show that the exchange rates in the region are not affected by changes in interest rates, but rather are influenced by the credit spread and stock prices. The empirical test using Indonesian data shows that interest rate policy does not help strengthen the exchange rate during crisis. When "the news factor" is taken into account, it appears that only good news has a favorable effect on the rupiah (at a 5% level). The effect of bad news does not seem to be significant (Turongpun, 2001). This is consistent with the findings of Goldfajn & Baig (1998). The main limitation of these models, however, is that they do not really explicate the mechanisms that can explain why higher interest rates can cause a weaker exchange rate. From this perspective, the current model helps to unravel such mechanisms.

The above mechanism is repeated and reinforced by the presence of the Bernanke-Gertler-Krugman effects of the exchange rate on investment. As shown in Figure 12 and Table 2, choosing between a high and non-high interest rate policy can result in a difference of real GDP by as much as 5.7% for the entire Stage 4-Stage 8 period, but in Stage 8 alone the gap can be as high as 9.6%. Meanwhile, the exchange rate under the non-high interest rate scenario can be stronger by between 3.9 to 5.5% (Figure 13). By keeping *POLRISK* identical in the "Less tight" and "Less tight & less debt" scenarios, the exchange rate appears to be stronger in the latter.

In terms of net capital flows, there is a fluctuating trend, but "Less tight" is always superior to the other two (Figure 14 and Table 1). The reason why it produces greater inflows than in "Less tight & less debt" is that with debt rescheduling the new inflows appear to be smaller than with no debt rescheduling (any debt resolution tends to deter further inflows), although the outflows are larger in the latter.

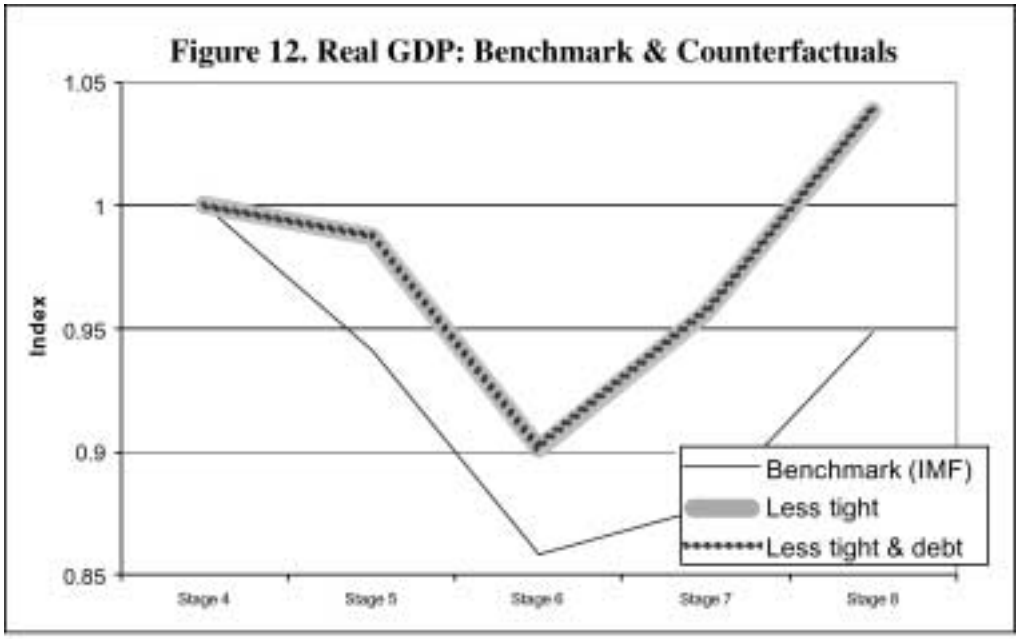


Figure 13. Exchange Rates: Benchmark & Counterfactuals

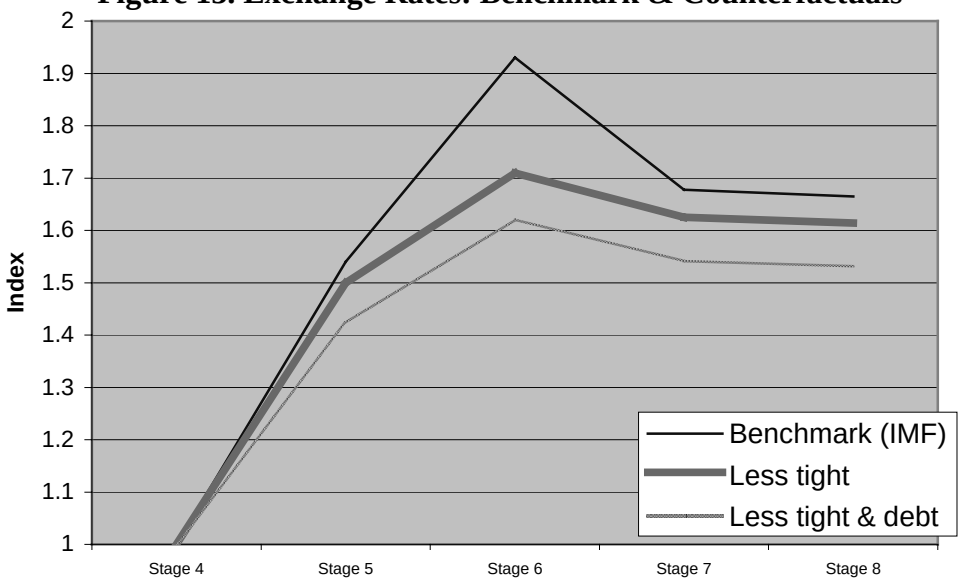
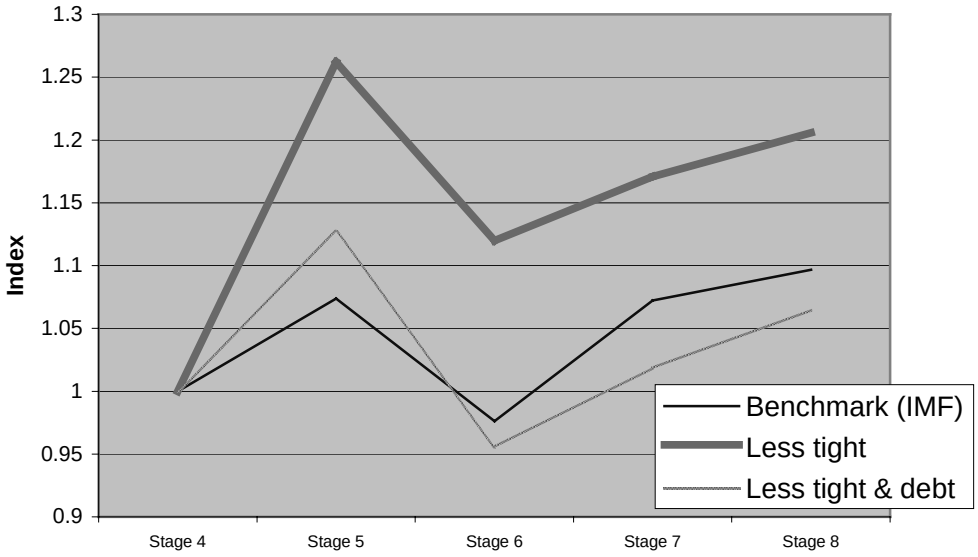
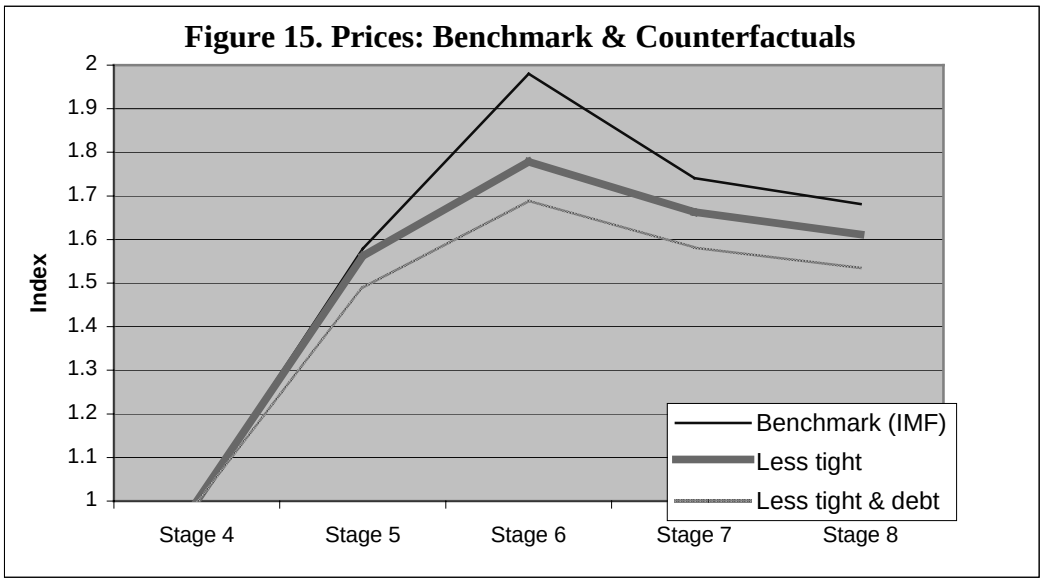


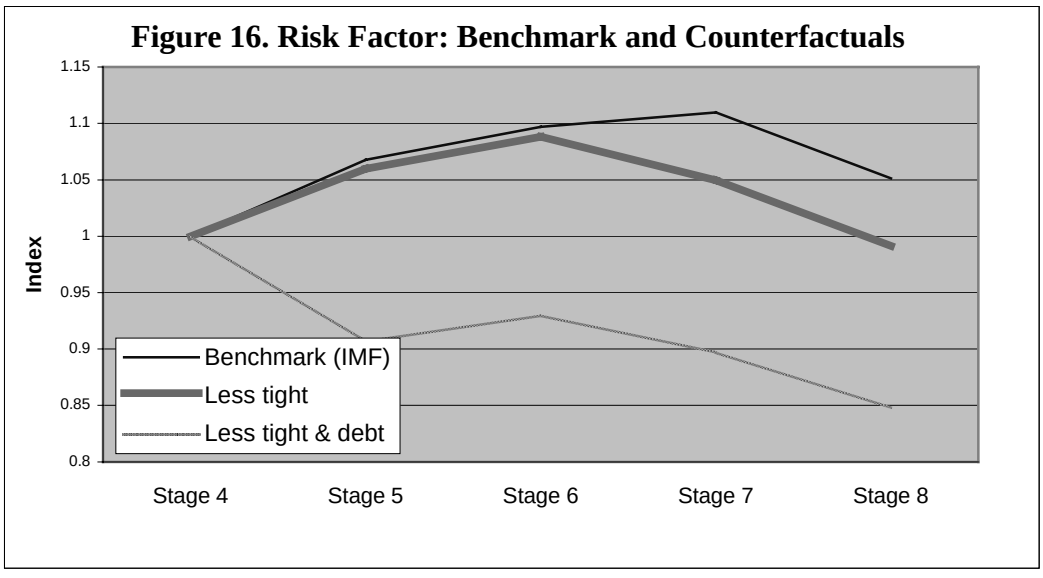
Figure 14. Net Capital Flows: Benchmark & Counterfactuals





The numerical effects of the scenarios on prices show that up to Stage 7 the "Benchmark (IMF)" produces the highest price index. The gap is largest in Stage 6, though prices tend to converge in the remaining stages. In fact, in Stage 8 the price level under the "Benchmark (IMF)" is slightly lower than under the "Less tight" scenario (Figure 15). However, for the entire period, the poverty line price level is still highest under the "Benchmark (IMF)" experiment.

With additional pressures from the *RISK* factor, the actual (nominal) exchange rate can actually go into a free fall. As stated earlier, the declines in domestic investment and GDP, which prevent the exchange rate-stimulated exports from expanding, are likely to increase the *RISK* factor. The higher *RISK* pushes up the expected exchange rate, causing the exchange rate to collapse. From the counterfactual experiments, it appears that lower interest rates and partial debt resolution would have generated a lower risk to the country, as shown in Figure 16 and Table 1.



It is therefore evident from the above model simulations that the macroeconomic indicators would have fared better if a prolonged high-interest rate policy could have been avoided. Furthermore, with the sole exception of net capital flows, the results generated from the combination of non-high interest rates and partial debt resolution appear to have been most preferable.

An intriguing policy question emerges: why was the interest rate raised again despite the fact that the early interest rate surge clearly failed to revive the exchange rate and the economy, and why did not the government put a higher priority on debt resolution? Given the pressure of the IMF letter of intent (LOI), practically no attention—or perhaps none at all—could be directed towards programs other than what had been written into the LOI. The IMF felt that resolving debt problems would be difficult, particularly because most lenders were non-syndicated banks, and the number of borrowers (mostly in the corporate sector) was very large, with a diversity of quality and of intention to repay the debts.[37] It is also possible that the IMF thought a debt resolution might become an easy way-out or a quick-fix for the Indonesian government and the private sector, who subsequently might not feel obliged to meet the IMF conditionalities.

8. Closing Remarks

I have elaborated the evolution of the crisis in Indonesia by first summarizing the policy environment and the economic condition before the crisis. I have also discussed the dynamics and sequence of events that took place during the episode. The mechanisms of the process are explained using a model. Such mechanisms help one to better understand how various variables and indicators interacted during the crisis.

Some of the parameters and coefficients in the model are statistically estimated based on quarterly data for the crisis period, and others are calibrated on the basis of the social accounting matrix (SAM) and the flow-of-funds data. In the benchmark run, the values of all exogenous variables (including policy variables) and exogenous events that precipitated the crisis are set equal to their actual (observed) values, and the model is used to derive the resulting values of the endogenous variables. The latter are, in turn, compared with the actual values of these variables subsequent to the crisis. In general, the results of the simulation closely replicate the changes and trends that actually occurred.

To facilitate discussions on the effectiveness (or ineffectiveness) of the actual policy response to the crisis, an alternative set of policies is explored. In particular, I have experimented with policies of (partial) debt resolution and of keeping the interest rate from surging continually. The simulations reveal that the country's macroeconomic conditions would have fared better if a prolonged high-interest rate policy had been avoided. More importantly, most macroeconomic variables seem to be best when generated from a combination of non-high interest rates and partial debt resolution. This conclusion suggests that initial actions to address the problems of mounting private foreign debts should have been undertaken as quickly as possible.

[37] In a seminar held on March 1998, Stanley Fischer (World Bank) mentioned this in response to my question about this issue. In Spring 2001, during his visit to Cornell University, Michael Camdesus (IMF) repeated the same point when I raised the same question.

One important policy lesson of the counterfactual simulations in this study is that a developing country with limited foreign reserves like Indonesia should have seriously considered policies that put limits on its foreign currency debt. The likelihood of facing currency crises associated with not only currency collapse but also large recessions is higher when the foreign currency debt is large. Since the main channel toward recession is deteriorating balance sheets in the corporate and banking sector, irrespective of the country's exchange rate regime, a currency crisis may still occur under such circumstances.

It is well known that the management of the Indonesian banking crisis was plagued with protracted delays in implementing necessary measures. But the delayed handling of private debts is even more serious. It has prevented other policies from working effectively.

With respect to the high interest rate policy, a number of studies have shown that the effectiveness of raising interest rates to avoid a currency crisis becomes very limited during the crisis. Empirical tests using Indonesian data tend to confirm that interest rate policy does not help to strengthen the exchange rate during such an episode. While most of these studies do not really explicate the mechanisms, the model in this study does. It shows that a tight monetary policy can be ineffective because the interest rates and the exchange rate channels of transmission of the policy can go in opposite directions.

Some multi-country studies reveal that higher interest rates are associated with real appreciation only in countries that do not suffer from a banking crisis. This condition contrasts almost completely to that of Indonesia, where almost the entire financial sector went into a crisis following the 1997 shock, causing many banks to collapse or to come near collapse. Yet, a fairly persistent high interest rate policy was cogently enforced. Clearly, there were serious inconsistencies and flaws in the policy analysis and design.

The counterfactual policies explored in this study would have produced a more favorable trajectory of recovery for Indonesia compared to the policies that were actually taken. They are far more essential than the drastic fundamental changes in micro-economic and institutional structure that the IMF prescribed during the early stage of the crisis. Miscalculated policy responses may have blockaded the efficacy of current and future policies.

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