What Would Have Happened in Indonesia if Different Economic Policies Had Been Implemented When the Crisis Started?

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Abstract

Many models of the Indonesian economy cannot generate the large collapses in output and exchange rate experienced in 1997–98. The model in this paper was able to replicate the actual events by adding several new links. One new link is between the depreciation of the exchange rate and the deterioration of the balance sheets of firms, which are in turn linked to decline in investment. Another new link is between decline in output and decline in business confidence, leading to possible increased capital outflow and exchange rate collapse. The IMF's high interest rate policy did not succeed in strengthening the rupiah because it inflicted such severe damage on the net worth of Indonesian firms that it caused capital flight to accelerate, turning what was originally just a financial crisis into a major recession.

Two alternative counterfactual policy packages are examined: (1) a lower interest rate policy and (2) a lower interest rate policy combined with a partial write-down of the external debt. The model indicates that the country's macroeconomic conditions would have fared better if the prolonged high interest rate policy had been avoided. The results suggest that early actions should have been undertaken to address the mounting private foreign debts. The delayed handling of private debts had prevented other policies from working effectively. The two counterfactual policies also would have resulted in a more favorable outcome for income distribution and poverty incidence. The model revealed a close correlation between worsening (improving) income distribution and increasing (declining) interest rates.

1. Introduction

Indonesia is the only Asian crisis country where there has not been sufficient growth so far to justify belief in a sus-

tained recovery. GDP had collapsed by more than 13 percent in 1998, and its growth rate was only 0.2 percent in 1999 and 4.8 percent in 2000. Some observers have attributed this dismal state of affairs to alleged inept handling by the government of the economic situation and its alleged lack of consistency in implementing the economic reform program. Other observers are of the opinion, however, that the deteriorating sociopolitical situation has greatly diminished the efficacy of most economic policies. This second group of observers attributes this situation to the damage and severe repercussions of the policies implemented in the early stage of the crisis and believes that some elements of irreversibility are at work.

My main argument in this paper is that the policy responses in the early phase of the crisis were inappropriate and had, most probably, blockaded economic recovery or, at least, reduced the efficacy of subsequent measures. An alternative set of policies would have yielded better outcomes: in particular, policies of ensuring (partial) debt resolution and keeping the interest rate from rising and staying at high levels. I make my case by simulating these counterfactual policies in a model specifically constructed for this purpose. This model is an economy-wide type, determines prices endogenously, and has a financial block at its core. A tighter integration of the financial and real sectors distinguishes this model from those I have previously developed (Azis 2000a, 2000b).

The paper is organized as follows. Section 2 discusses two fundamental elements that aggravated the crisis: the corporate sector's high leverage (the international illiquidity problem) and the (very) high interest rate policy. Section 3 outlines the relevant parts of the model. The model's structure is given in the appendix.[1] Section 4 reports the results of the benchmark simulation. Section 5 presents the outcomes from the counterfactual simulations. Section 6 presents some concluding remarks.

2. International illiquidity and interest rate policy

2.1 Corporate leverage overlooked

Broadly speaking, before the crisis Indonesia had three decades of strong economic growth and low inflation (usually at a one-digit inflation rate). One of the important factors behind the low inflation was the prudent management of the government budget. Indeed, practically all countries in Southeast Asia had budget surpluses before the crisis. Indonesia's export performance was also strong, although the ex-

1 A complete list of equations is available upon request.

port growth rate started declining in 1996.[2] Despite the slower export growth, Indonesia's foreign reserves in May 1997 were still equivalent to 5.5 months of imports.

In addition to the often-quoted reasons for the slower growth in exports (for example, China's yuan devaluation, Japan's yen depreciation, and increased competition from other emerging markets), some observers have claimed that the rupiah was overvalued. However, given Indonesia's relatively low inflation, such a proposition is disputable. Based on a structural model of real exchange rates, and taking the Balassa-Samuelson hypothesis into account, Chinn (1998) found that the rupiah overvaluation was small, less than 5 percent.[3] When the consumer price index (CPI) is used, Indonesia's real exchange rate actually depreciated, rather than appreciated, before 1997. J.P. Morgan's measure of the real effective exchange rates indicated a 5.4 percent depreciation of the rupiah in 1996 (figure 1).

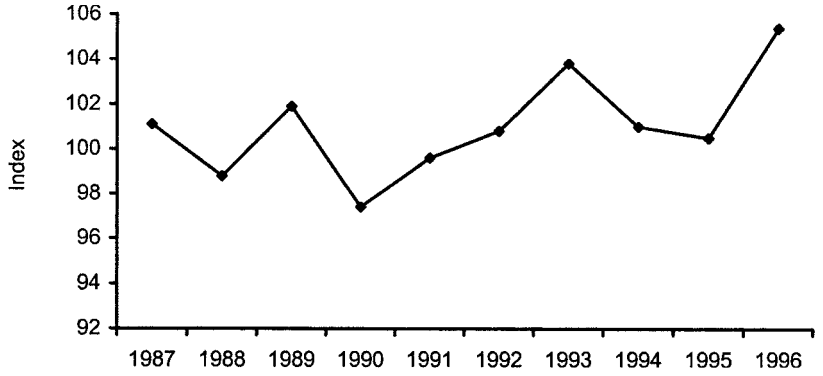
A lending boom is also frequently identified as a good predictor of currency crises in the making (Sachs, Tornell, and Velasco 1996). If lending increases rapidly, banks will not be able to screen out high-risk loans as easily, and their portfolios will deteriorate, setting the stage for a possible systemic collapse of the banking system. Although there may have been a strong growth of credit prior to the crisis, data on bank credits reveal only a weak sign of a lending boom. Bank credits grew an average 18 percent per annum during 1992–96, which is much lower than the 116 percent per annum in Mexico prior to its 1994–95 crisis.[4] The claim that poor macroeco-

2 The current account deficit increased from 3.6 to 3.9 percent during 1995–96. The data also suggest that a main cause of the widening current account deficit was increased imports, particularly in the capital and intermediate goods category.

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

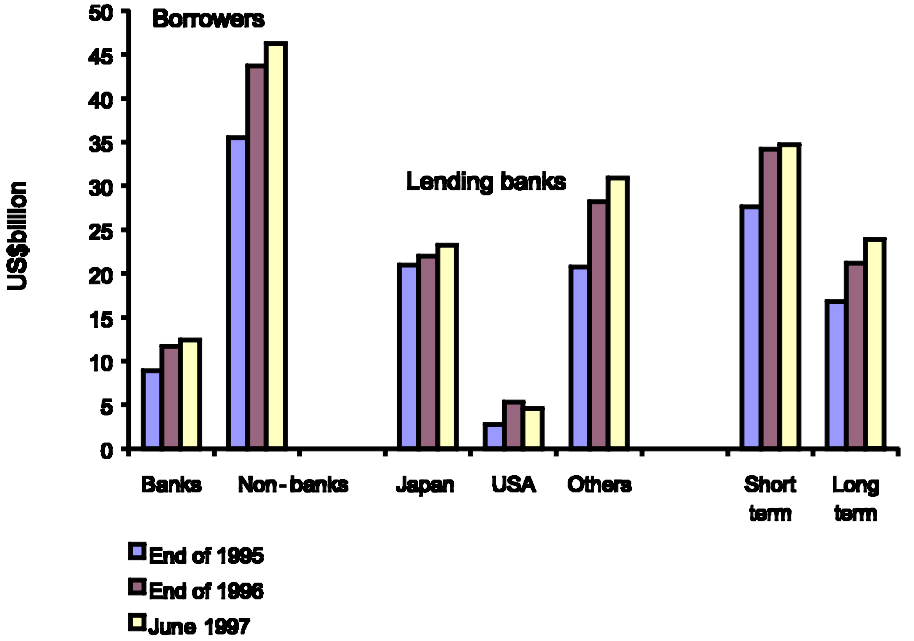
4 Data are from the International Financial Statistics (IFS) of the International Monetary Fund. According to the central bank data, credit outstanding of commercial banks grew by over 24 percent per annum between 1992 and 1997. Even this figure is still far lower than the rate in Mexico. It is important to note that data on bank credits do not include promissory notes of the multifinance companies. Under a quasi-fixed exchange rate system (such as that in Indonesia during the time), one should include such notes in the overall financial system's liabilities. However, the extent of multifinance companies in Indonesia was not as large as in Thailand.

Figure 1. Indonesia's real effective exchange rates (1996 = 100)



Source: *J.P. Morgan.*

Figure 2. Indonesia's private foreign debts



nomic fundamentals were the cause of the country's vulnerability is simply misguided.[5]

Of course, there were other parts of the economy prior to the crisis that were potential trouble spots, for example, a weak banking system,[6] the absence of exit policies after the 1988 bank deregulation, and slow diversification of non-oil exports. However, they were too small to explain the magnitude of the subsequent crisis. One could also easily find other countries with worse structural flaws that did not fall into a crisis. Because a major outcome of the shock has been a near collapse of the country's financial systems, some analysts (e.g., Chang and Velasco 1998) have argued that the explanation of the crisis was financial in nature. Although reversed expectations of future profitability of investments have been identified as the cause of the crisis by Corden (1999), Krugman (1999), McKibbin and Stoeckel (1999), and Woo, Sachs, and Schwab (2000), what is equally or more relevant is what really caused such changes in expectation.

Others and I have claimed that the change was not triggered by macroeconomic fundamentals, except perhaps in Thailand (Azis 1999). Regarding the financial explanation of the crisis, the maturity mismatch of private foreign debts holds the key to the story.[7] 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 (figure 2), in which the Japanese banks had the largest exposures. More seriously, the proportion of short-term debt (STD) was considerably larger than that of long-term borrowings. At the onset of the crisis, STD was already 170 percent of the foreign reserves (Radelet and Sachs 1998). This is obviously a strong case of *international illiquidity*.[8]

5 Even after the crisis burst, the IMF wrote: "The floating of the rupiah, in combination with Indonesia's strong fundamentals, supported by prudent fiscal and monetary policies, will allow its economy to continue its impressive economic performance of the last several years" (*IMF News Brief* no. 97/18, 14 August 1997).

6 There were undeniable moral hazards created by official favoritism. A few selected private sectors with high leverage and well-connected groups were given special (nontransparent) credit facilities. This spelled trouble for the state banks, since the probability of default for such loans was very high. (Ironically, privatization *increased* rather than decreased the public sector's burden.) The combination of corruption, cronyism, and nepotism resulted in misdirected credits, many of which went into the projects with the best connections rather than those with the best economic or financial prospects.

7 The IMF has recently acknowledged that the ratio of short-term external debt to reserves is a basic indicator of reserve adequacy: "the ratio of short-term external debt to reserves is the single best crisis indicator" (Fischer 2001).

8 Although the economic crises of most Latin American countries were often characterized by inappropriate government policies (hence weak macroeconomic "fundamentals"), by sum-

Banks' foreign borrowing was also on an upward trend, albeit a relatively small one.[9] But given the quasi-fixed exchange rate system, the asset/liability position of the financial system should also include domestic currency deposits as additional obligations in international currency. Depositors could withdraw rupiah from a bank to convert them into dollars at the announced parity. Hence, unless there were sufficient foreign reserves to honor such demands, a financial system could suffer from an international illiquidity problem because of 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), although it was still smaller than the ratio in Mexico prior to the 1994–95 crisis (9.1).

These facts suggest that it is more important to examine the problem of high asset/liability ratios in foreign currency—hence the problem of short-term foreign debts.[10] This issue did not take center stage in the early policies supported by the IMF. The initial rescue program did not propose debt relief or standstills for existing debt and priority payment for new loans. There were clearly no discussions about "bailing in" the foreign creditors, unlike in Korea. This issue alone has generated criticism and makes a compelling argument for the need to redesign the IMF rescue programs (Sachs and Woo 2000). Would the socioeconomic outcome have been more favorable had a (partial) debt resolution been given a higher priority? This will be one of the policy scenarios conducted in the counterfactual exercise in section 5.

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mer 1997 the Asian crisis countries were inferior in terms of this indicator of international illiquidity (e.g., in mid-1997 the STD/foreign exchange ratios were 170 percent, 206 percent, and 145 percent for Indonesia, Korea, and Thailand, respectively, compared to 120 percent for Mexico and less than 100 percent for Brazil, Peru, Columbia, and Chile).

9 The increase in private foreign debts was a regional phenomenon. Thanks to a widespread optimism about East Asia's future growth and the celebrated label "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 to ASEAN, coming mostly from the United States, Europe, and Japan (the first wave occurred during the second half of the 1980s, when Japanese investment in the region surged following the *Yendaka* phenomenon). The high domestic interest rate did not dampen their enthusiasm, largely because foreign loans were obtained easily at a relatively low rate and stable pegged exchange rates were perceived as a guarantee for earning stability. The fast-growing number of banks and multifinance 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 authority (e.g., legal lending limits and capital adequacy ratios), weak enforcement derailed the development of a healthy financial sector.

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

2.2 A critical evaluation of the high interest rate policy

One of the theoretical pillars for a high interest rate policy to combat depreciating exchange rates is the interest-parity hypothesis. However, the veracity of this hypothesis in the short run is questionable (Meredith and Chinn 1998), and several studies have concluded that the hypothesis breaks down during economic crisis, implying that a tight money policy is not helpful in strengthening the exchange rate (Ohno, Shirono, and Sisli 1999; Furman and Stiglitz 1998; Goldfajn and Baig 1998).[11] My own estimations show that the Indonesian data reject the interest-parity hypothesis. The propensity of the coefficients to be closer to zero rather than to unity implies that the use of interest rate policy does not help strengthen the exchange rate.

The conventional wisdom found in open-economy macroeconomic textbooks is that raising interest rates will reduce, if not reverse, capital outflow and thence strengthen the country's currency. Jeffrey Sachs (1999) and Charles Kindleberger (1996) have, on the other hand, claimed independently that this conventional wisdom holds only during normal times, and that the relationship is actually the reverse during a financial panic. To paraphrase Jeffrey Sachs, raising the interest rate to a very high level during a financial panic is akin to shouting fire in a crowded theater, because economic agents will recognize that the high interest rate will bankrupt many firms and hence will flee into foreign assets, causing the exchange rate to depreciate further. The evidence on the Kindleberger-Sachs thesis is mixed. The following quotations are typical of the conclusions of the authors who have examined and rejected the Kindleberger-Sachs thesis: "we have not found evidence supporting the revisionist view that high interest rates result in rising corporate bankruptcies, capital outflows, and hence, depreciating exchange rates" (Dekle, Hsiao, and Wang 2000, 16); "There is also no evidence that high interest rates led to weaker exchange rates" (Goldfajn and Baig 1998, 28); and "there is little evidence that higher real interest rates contributed to a widening premium and hence, *ceteris paribus*, to a weakening of the exchange rate" (Basurto and Ghosh 2000, 24).

On the side in favor of the Kindleberger-Sachs hypothesis is the study by Furman and Stiglitz (1998), who found that in 13 crisis episodes in 9 emerging markets the temporarily high interest rates were associated with exchange rate depreciation, not appreciation. Goldfajn and Gupta (1999) concluded that higher interest rates were associated with real appreciation *only in countries that also suffered from a banking crisis*. In the case of Indonesia, the record is clear: the country's financial sector went

11 Gould and Kamin (1999) show that the exchange rates in the region are not affected by changes in the interest rate; rather, they are influenced by credit spread and stock prices.

immediately into a crisis following the interest rate shock, causing many banks to collapse or to be on the verge of collapse.

It is likely that no strong conclusions about the link between interest rates and exchange rates are justified. There could well be an asymmetrical relationship; the finding that higher interest rates may not weaken the exchange rate does not prove the opposite, that raising the interest rates would definitely strengthen the exchange rate. If so, the finding that high interest rates do not cause exchange rate depreciation cannot provide the empirical foundation for an interest rate defense of the exchange rate. Furthermore, it is highly doubtful that raising the interest rate would calm the market psychology and effectively strengthen the exchange rate. The undeniable fact is that the adverse effects of high interest rates on corporate and bank balance sheets are serious, as revealed in a study based on the balance sheets of Indonesian companies listed on the Jakarta Stock Exchange.[12] Hence, it is important to revisit the issue of an interest rate defense of the exchange rate, a task that I undertake in section 5.

3. Model mechanisms: From financial shocks to household welfare to poverty

The structure of the model presented in this paper is described in the appendix. There are a number of initial shocks one can use to illustrate the mechanisms of the model. Let me take the case in which the shock is sudden capital outflow (caused by either a contagion or simply a loss of confidence, as was the case in summer 1997). This effect is modeled by a decrease in the amount of equity held by foreign investors. The decline in foreign equity is captured in the model by a decrease in the variable *EQROW*. In turn, this leads to capital outflows, represented in the model by an increase in the variable *PFCAPOUT* (capital outflows). The increase in *PFCAPOUT* leads to a depreciation in the exchange rate.

To stabilize the exchange rate, the interest rate is raised, potentially reducing investment and output. The decline in investment reduces the capital stock and thus production. The exchange rate depreciation also indirectly affects investment by worsening firms' balance sheets. As the rupiah falls vis-à-vis the U.S. dollar, the rupiah value of firms' debts that are denominated in foreign currencies increases, making firms less creditworthy. This decrease in creditworthiness hinders firms' ability to raise funds and further reduces investment (the Bernanke-Gertler effect; Bernanke and Gertler 1989). This effect is modeled by including the real exchange rate as a

12 See Azis et al. (forthcoming).

variable in the equation for domestic investment *DOMPINV* (Krugman 1999; equation A.5 in the appendix).

The high interest rates and deteriorating economy reduce the net worth of the banking sector.[13] In the model, a decrease in the wealth of the banking sector, *WEALBANK*, will decrease the supply of bank loans. This reduction in the supply of loanable funds further reduces the ability of firms to invest and deepens the recession. The deepening recession, combined with the higher interest rates and depreciating exchange rate, will further reduce the confidence of foreign investors, leading to another round of declines in equity holding by the rest of the world, increased outflows of capital, and further currency depreciation.

It is clear, therefore, that there is a downward spiral in the model: a deteriorating confidence leads to capital outflows, and capital outflows depreciate the exchange rate; a depreciating exchange rate reduces investment and at the same time deteriorates the balance sheets of the highly leveraged corporate and banking sector. Reduced investment produces a deepening recession, and a deepening recession leads to a further decline in confidence. This downward spiral will be aggravated if most of the debts remain short term, are denominated in foreign currencies, and are not successfully rescheduled. Short-term maturities of debt magnify the effect of the depreciation on firms' balance sheets and hence exacerbate the depreciation and the decline in investment. The vicious recessionary cycle is depicted in figure 3.

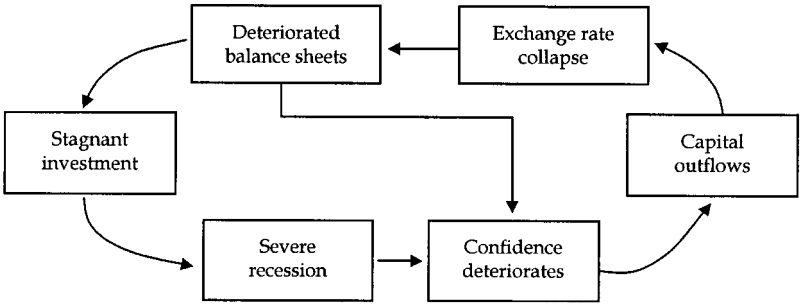
Four subsequent repercussions could be expected: (1) a standard push on net exports (*E-M*) via more competitive export prices (*PE*); (2) an increase in the value of foreign savings (in domestic currency) that will affect household incomes (*YHH*); (3) increased domestic value of foreign investment (*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. At some point, the negative impact of (4) may dominate the combined positive effects of (1), (2), and (3). In that case, total supply (*Q*) drops and so does aggregate demand.

Inflation (*PINDEX*) is determined through the interaction between aggregate demand and supply.[14] Theoretically, an upward pressure on prices can be countered

13 During the crisis there were also bank runs. Contrary to Fama's (1980) claims, a bank run can have real effects due to asymmetric information.

14 One could add several cost-push sources of inflation, for example, a drop in food production due to unfavorable weather conditions or a rise in import prices due to the exchange rate depreciation.

Figure 3. Circular causality, multiple equilibria, and policy choices



through a tight monetary policy (*MS2*). But the brakes might not be effective if the monetary authority injects funds, simultaneously, into several commercial banks to prevent a possible collapse in the financial system (for example, following a major bank run).

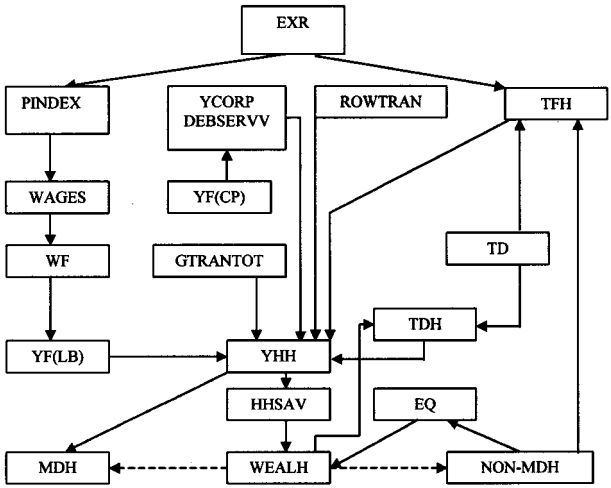
Figure 4 shows the five components of household incomes (*YHH*): (1) labor income (*YF*(*LB*)), (2) transfers from the rest of the world (*ROWTRAN*), inter-household transfers, and government transfers (*GTRANTOT*); (3) household income from after-tax corporate dividends (*YCORP*); (4) interest income from time deposits (*TDH*); and (5) interest income from foreign currency–denominated time deposits (*TFH*). There are two transmission mechanisms by which household welfare may be affected. The most direct one is through a decline in labor income related to layoffs. The second mechanism is through an increase in prices, especially those of basic commodities, leading to a rise in the poverty line. Since prices are endogenously determined, a monetary poverty line is derived *endogenously* on the basis of a basket of commodities that reflect basic needs. This basket is invariant and applies to all households.

Following the lead of Tobin (1969), Brunner and Meltzer (1972), Bernanke and Blinder (1988), Bourguignon, Branson, and de Melo (1989), and Thorbecke (1991), the model allocates household wealth among liquid assets (narrow money), domestic time deposits, foreign time deposits, and equity, according to the risk preference of the households. The portfolio of the production sector consists of foreign loans, domestic bank loans, demand deposits, and money.

4. Validating the model: A benchmark simulation

In the benchmark run, I set the values of all exogenous variables (including policy variables) equal to their actual values to generate the values of the endogenous vari-

Figure 4. Potential negative impacts of exchange rate depreciation on income distribution



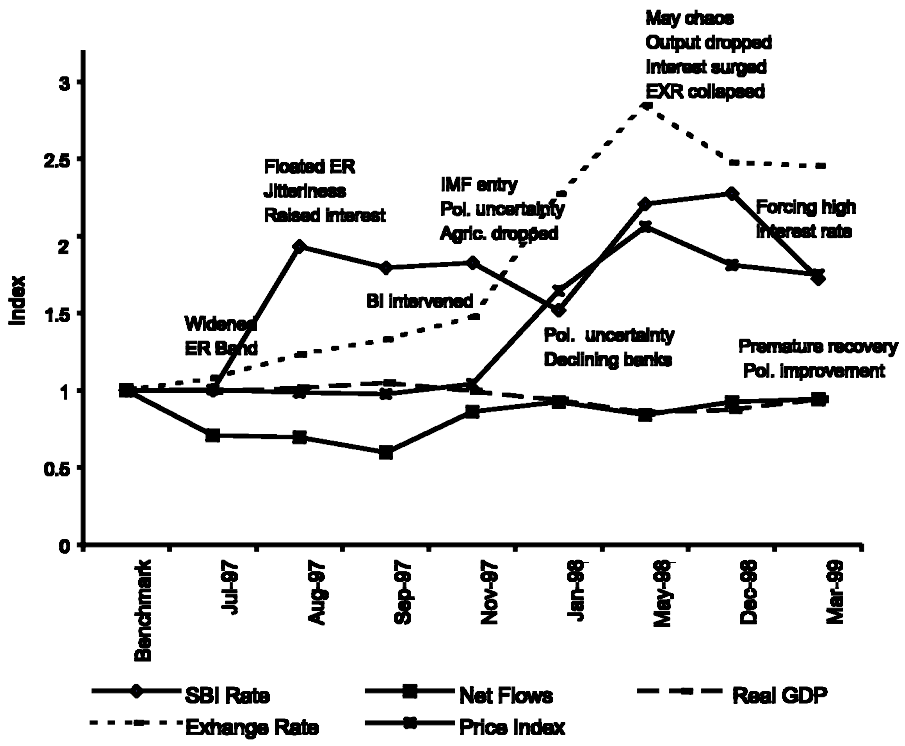
EXR	Exchange rate
EQ	Equity
HHSAV	Household savings
NON-MDH	Household wealth outside narrow money demand
TD	Total time deposits
WAGES	Labor wages
WEALH	Household wealth
WF	Average factor price across sectors
YF(CP)	Factor incomes for capital
YF(LB)	Factor incomes for labor

ables. The latter are, in turn, compared with the actual values, allowing us to check on the extent to which the model replicates the situation that actually occurred (a backward validation).

Eight sequential events, starting in July 1997 and ending in March 1999, are used to shock the model (they are referred to as "stages" in the description that follows). These stages are shown in figure 5. By adjusting the relevant exogenous variables in line with the changes in the events described below, a set of sequential simulations (from stage 1 to stage 8) is conducted. Each event (stage) is superimposed on the values of the endogenous variables generated in the preceding stage. With the exception of the interest rate (Sertifikat Bank Indonesia, or SBI, rate), all variables shown in figure 5 are generated *endogenously* within the model.

As pressure in the foreign exchange rate emerged following the Thai baht's depreciation in July 1997, the Indonesian government widened the exchange rate band to

Figure 5. Trends of selected variables during the crisis



12 percent (stage 1: July 1997). At the same time, driven by the jitteriness among foreign investors, capital began to leave the country. These outflows, reflected in the model through *EQROW* and *PFCAPOUT*, continued in the following month (August), despite the fact that the interest rate on the central bank's certificate (SBI) was raised. Unable to defend the exchange rate further, the government finally decided to float the rupiah (stage 2: August 1997). In the model simulation, these two events are captured sequentially.

In stage 3 (September 1997), the central bank intervened in the foreign exchange market by selling some of its foreign reserves. The interest rate on SBI was reduced slightly, however. Outflows of foreign assets (*EQROW*) continued, causing net flows to decline. The government invited the IMF's assistance (stage 4: October/November 1997); and the IMF offered the standard prescriptions, that is, raising the interest rate (from its already high level), closing 16 banks, tightening the government budget, and imposing extensive structural reforms in areas unrelated to financial matters. Since there was no deposit insurance system in Indonesia, the bank closures caused bank runs and financial panic.

When capital outflows and the rupiah's depreciation persisted (partly because nothing was done to deal with the explosive growth of the rupiah value of the foreign debts of the corporations), the economic situation quickly worsened. Panic buying of foodstuffs started on 8 January 1998, and the rupiah began a steep fall (stage 5: January 1998).[15] Riots erupted in a number of regional towns throughout the country following the major price increases, creating great uncertainty over the durability of the Suharto regime and about the post-Suharto leadership. This panic situation is nicely captured in figure 6 by the jump in January 1998 of the risk premium on the dollar bonds issued by Indonesia.

Some observers (McKibbin and Stoeckel 1999) have adjusted the risk premium exogenously at a rate sufficient to generate the actual degree of exchange rate collapse. I adopt a similar approach, except that the standard risk premium in the uncovered interest-parity equation includes—and in some cases is even dominated by—the political risks, labeled *POLRISK*, in equation (A.3) in the appendix. For the benchmark simulation, the value of this parameter is adjusted in stage 5 (January 1998).

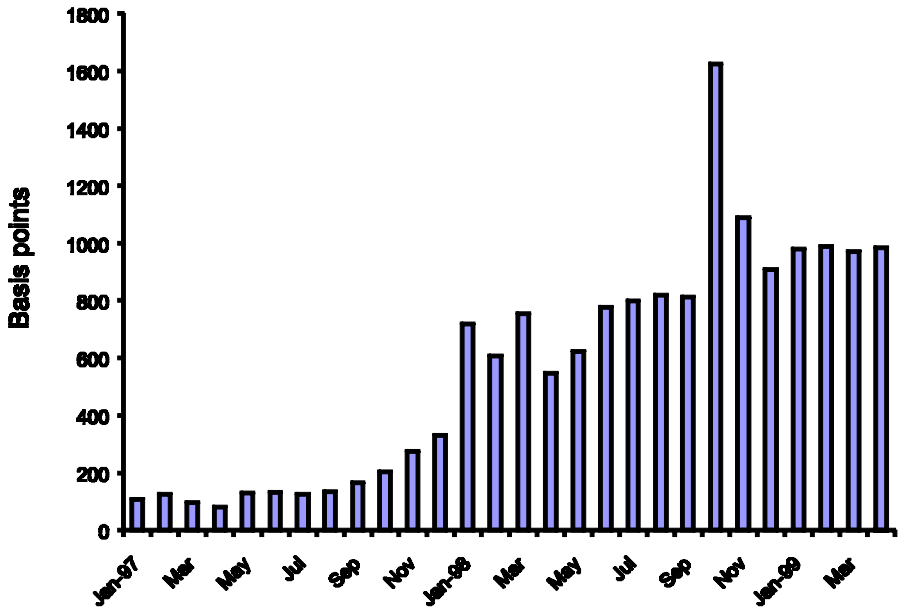
The economy continued its collapse, and the resulting deep recession damaged investors' confidence further, causing even more capital to leave the country (increased *EQROW*). Suharto's government was in serious trouble, and a major riot took place in Jakarta and other major cities in May 1998, involving looting and burning (stage 6: May 1998). The distribution channels for some basic goods were seriously affected because many food outlets were burned or damaged. Suharto resigned. As shown in figure 6, the country's risk premium began to creep up again, hence the value of *POLRISK* needs to be readjusted in stage 6.

Under Habibie's government, market confidence remained low, yet the political situation became somewhat better than in the preceding stages (and the *POLRISK* parameter is adjusted correspondingly).[16] This is detected by—and captured through—the unrelenting outflows of capital, despite the IMF and government's

15 The IMF appeared to be out of touch with these historical 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 caused prices of some basic goods, including rice, to soar. This was obviously incorrect. Hoarding and food riots occurred 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 an aggregate demand management, that is, a high interest rate.

16 Actually, between stage 6 (May 1998) and stage 7 (December 1998) there was a period of deteriorating sociopolitical conditions, particularly in October 1998, when there were student demonstrations 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

Figure 6. Risk premium



Source: *Data are from McKibbin and Stoeckel (1999).*

efforts to continue the strategy of monetary tightening (stage 7: December 1998). Meanwhile, the severe economic contraction following the May 1998 event had created an environment in which migration from urban to rural areas became more likely. As indicated in Azis, Azis, and Thorbecke (2001), data from the 1998 and 1999 Social Accounting Matrix show that there was considerable reverse migration. Hence, the migration equation is activated in this stage.[17]

By March 1999 (stage 8) the political scene had become somewhat calmer. Signs of recovery began to emerge, albeit largely because of improved weather conditions that boosted agricultural production.

September backfired: it abolished government subsidies on basic food commodities (including rice), sparking widespread protests and damaging the government's credibility. With respect to the risk premium, figure 6 shows that there is a spike around October 1998, before improving toward the end of the year. However, since stage 7 in the model simulation is roughly associated with only the December 1998 period, the October increase is not directly captured in the model.

17 At the same time, some adjustments are also made in the wage distortion parameter, *WFDIST,* to reflect a greater flexibility of intersectoral labor movements through labor price adjustment.

The generated trajectories of real GDP, net capital outflow, the exchange rate, and the price index shown in figure 5 are close to the actual movements. Notice 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 rate, the expected capital inflows did not occur; outflows actually rose and caused a collapse in the exchange rate. Real GDP dropped continuously, and inflation surged to over 70 percent. Figure 5 shows that by the end of the simulation period (stage 8) the GDP level was still lower than the pre-crisis (benchmark) level.

The benchmark simulation also replicates the shift in household portfolios from domestic to foreign assets quite well. The ratio of time deposits in foreign currency to time deposits in local currency increases dramatically from 19.2 in stage 6 to 20.2 in stage 8 (compared to the baseline).

Real wages in all categories stay below their baseline levels during the entire simulation period. Nonwage incomes are also affected negatively. The decline in total income (measured in real terms and in per capita terms) is larger in the urban areas. The two urban household groups, "urban high income" and "urban low income," are among the worst hit during the crisis. Another group that receives a severe blow is "rural low income." Since virtually all household categories suffer from declining real incomes, there is a major increase in poverty incidence.

The Indonesian labor market is remarkably flexible. The decline in wages and the movement of labor from urban to rural areas and from formal to informal sectors prevented a catastrophic situation from occurring. During the peak of the crisis the unemployment rate may have increased significantly, but toward the end of 1998 and in early 1999 the recorded unemployment rate showed only a slight increase from the pre-crisis level. The model simulation produces less than a 1 percentage point rise in unemployment, which is consistent with the official data.

Table 1 shows the resulting Foster-Greer-Thorbecke measures of poverty in the benchmark scenario (the "End of simulation period" column refers to stage 8 of the simulation). The Foster-Greer-Thorbecke measures of poverty are very general measures that include the proportion of the population living below the poverty line (head count index) as a special case. The formula for the Foster-Greer-Thorbecke measures also encompasses the poverty gap measure and the poverty severity measure, which are generated by altering the size of α (see Foster, Greer, and Thorbecke 1984; Decaluwe et al. 1999):

$$P_{\alpha}^{ihh} = \int_{0}^{z} \left(\frac{PL - YHH_{ihh}}{PL} \right)^{\alpha} f^{ihh}(YHH_{ihh}; p_{ihh}, q_{ihh}) dYHH_{ihh},$$

Table 1. Foster-Greer-Thorbecke measures of poverty under IMF policy regime

	Baseline			End of simulation period		
	$\alpha = 0$	$\alpha = 1$	$\alpha = 2$	$\alpha = 0$	$\alpha = 1$	$\alpha = 2$
Agricultural employees	17.83%	2.99%	0.78%	14.17%	2.27%	0.57%
Farmers owning land	20.96%	4.21%	1.32%	25.69%	5.41%	1.74%
Rural low income	11.36%	1.83%	0.48%	19.81%	3.62%	1.02%
Rural high income	8.85%	1.51%	0.42%	12.12%	2.19%	0.63%
All rural residents	16.12%	3.00%	0.88%	20.06%	3.92%	1.19%
Urban low income	15.88%	3.08%	0.91%	25.20%	5.61%	1.83%
Urban high income	8.03%	1.49%	0.44%	11.56%	2.32%	0.71%
All urban residents	12.22%	2.34%	0.69%	18.63%	4.03%	1.29%
Total	14.85%	2.78%	0.82%	19.65%	3.95%	1.22%

Source: *Measures are calculated from endogenous sector-specific poverty lines generated by the model: $\alpha = 0$, head count, proportion living below poverty line; $\alpha = 1$, poverty gap; $\alpha = 2$, poverty severity.*

where PL is the poverty line, distinguished between rural and urban, and α is the poverty aversion parameter. Based on the above formula, one can calculate (1) the head count index by setting $\alpha = 0$ (or P_0), (2) the poverty depth by setting $\alpha = 1$ (or P_1), and (3) the poverty severity by setting $\alpha = 2$ (or P_2). Because prices are determined endogenously in my model, the poverty line for the rural sector and the poverty line for the urban sector are generated endogenously in order to calculate the Foster-Greer-Thorbecke measures in the benchmark case and in the subsequent counterfactual simulations.

The deterioration in poverty conditions is more severe in the urban than in the rural areas. The head count poverty measure for farmers owning land increases from 21 to 26 percent. For rural nonfarm households, it increases from 11 to 20 percent (for low-income rural) and from 9 to 12 percent (for high-income rural). However, the poverty incidence within the category of agricultural workers drops from 18 to 14 percent. This last result, although surprising, is caused by most agricultural workers being employed in the plantation export sector, which benefited from the currency depreciation. In contrast, in the two categories of urban households, the head count poverty incidence increases, with the most dramatic increase, from 16 to 25 percent, among the urban low-income group. Similar trends are observed for the poverty gap and the poverty severity indicators. Overall, urban poverty rises from 12 percent in 1996 to 19 percent in 1999, and rural poverty increases from 16 percent to 20 percent.

5. Counterfactual policy simulations

Since the actual policy response was heavily influenced by the IMF, I label the benchmark simulation "benchmark (IMF)." In figures 7–12 the two sets of counterfactual policy packages are (1) the interest rate is kept from rising (labeled

"less tight") and (2) the same interest policy as (1) and combined with the restructuring of some foreign debt (labeled "less tight & debt"). There are three interest rates in the model: deposit rate, loan rate, and the central bank certificate rate (SBI rate). All three have usually moved in the same direction, with a few exceptions. Of the three, only the SBI rate can be directly controlled by the monetary authority; hence, this rate is treated exogenously in the model (i.e., it is set lower than the actual rate).

After the first interest rate increase in mid-1997 failed to halt the decline in the exchange rate, the government lowered the actual SBI rate slightly in early 1998 (stage 5). The SBI rate was raised subsequently, presumably on the recommendation of the IMF (see the actual trend of the SBI rate in figure 5). Since the IMF entry was heavily involved in Indonesian macroeconomic policies only from November 1997, which is roughly equivalent to stage 4, the starting point of the relevant adjustments to the exogenous variables is in stage 4. In the counterfactual experiment, it is assumed that the SBI interest rate in stage 5 is six basis points lower than in the benchmark case and that the SBI rate is kept constant at this level.[18] The scenario of partial debt resolution is simulated by lowering the amount of debt service in stage 4 and stage 5 by approximately 10 percent. This is done by lowering the value of the variable *DEBSERV* in stages 4 and 5, which will cause *RISK* to decline, and consequently *PFCAPIN* (capital inflows) to increase (see equations A.1 and A.2 in the appendix). In stages 4 to 7, the influence of the political risks variable (*POLRISK*) under the two counterfactual scenarios is set lower than in the benchmark simulation because the political and socioeconomic repercussions of more "reasonable" interest rates should be less severe.[19]

5.1 Macroeconomic outcomes

Although a higher interest rate reduces output directly, the corresponding exchange rate depreciations reduce output further. The chain of events leading to the currency depreciation is as follows. The drop in domestic investment (*DOMPI*) causes GDP to decline and the *RISK* factor to rise. The higher *RISK* lowers private capital inflows

18 When the interest rate is set lower, the decline in the banking sector should also be lower (e.g., fewer bankruptcies). The size of the resulting depressed construction sector, construction being the most bank-sensitive activity, would also be affected. In the two counterfactuals, I accommodate such changes in the relevant stages where downward adjustments have been imposed under the benchmark simulation.

19 When interest rates surge, the probability of an increased number 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, the political environment and uncertainty will be further jeopardized. Hence, under the two counterfactuals, the *POLRISK* exogenous variable should be lower than in the "benchmark (IMF)" scenario.

(*PFCAPIN*) and increases the expected amount of exchange rate depreciation (*EXPEXR*), the joint result of which is a severe depreciation of the rupiah. The exchange rate depreciation in turn further reduces investment through the Bernanke-Gertler-Krugman mechanism. Figure 7 reveals that the "less tight" interest rate policy would have raised real GDP by about 5.7 percent for the stage 4 to stage 8 period. In stage 8 alone, the gap could be as high as 9.6 percent. Meanwhile, the exchange rate under the "less tight" interest rate scenario would have been stronger by between 3.9 and 5.5 percent (figure 8). With identical *POLRISK* under the "less tight" and "less tight & debt" scenarios, the exchange rate would have been stronger in the latter.

In terms of net capital flows, figure 9 shows that "less tight" is always superior to the other two scenarios. The reason greater inflows are produced in the "less tight" regime compared with the "less tight & debt" scenario is that the debt rescheduling deters new inflows substantially in the short run. Figure 10 shows that up to stage 7 the "benchmark (IMF)" scenario produces the highest price index. The gap is largest in stage 6, with prices converging in the final stages.

Because of the vicious cycle mechanism summarized in figure 3, the "less tight & debt" strategy would have increased *RISK* least and hence would have caused the least amount of currency depreciation (see figure 11).

5.2 Social indicators

Perhaps the aspect of the Indonesian economy that has done most to prevent the sociopolitical situation from being worse than it has been in the last four years is the flexibility of the country's labor markets. As mentioned earlier, the National Surveys of Labor Force (*Sakernas*) show that the unemployment rate increased by only about 0.8 percentage points during the crisis. This low unemployment does not mean that the "benchmark (IMF)" scenario was not too bad, because the unemployment rate in the "less tight" experiment is less than 0.4 percentage points in stage 8, half of the increase generated under the benchmark scenario.

All scenarios produce an improvement in income distribution from stages 4 to 5 but a worsening in the subsequent stages (figure 12). In my model, income distribution is the ratio of the incomes of the three categories of high-income households to the incomes of the four categories of low-income households: the higher the ratio, the worse the income distribution. The relative income distribution under "benchmark (IMF)" is persistently the worst among the three scenarios. The difference in income distribution between the "less tight" and "less tight & debt" scenarios is small, with the latter very slightly better. It is interesting that under the "benchmark (IMF)" scenario there is a close correlation between a worsening (improving) trend in income

Figure 7. Real GDP: Benchmark and counterfactuals

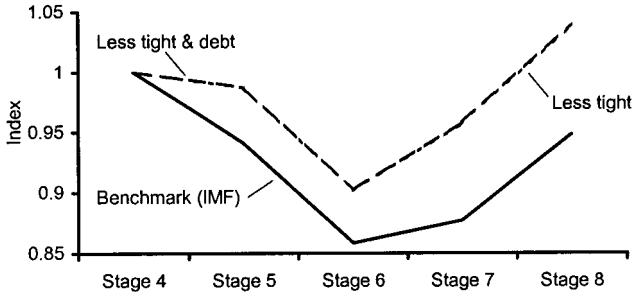


Figure 8. Exchange rates: Benchmark and counterfactuals

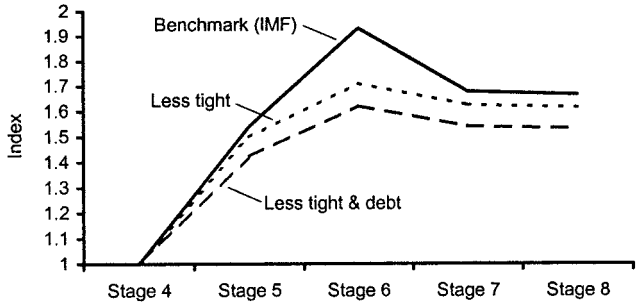


Figure 9. Net capital flows: Benchmark and counterfactuals

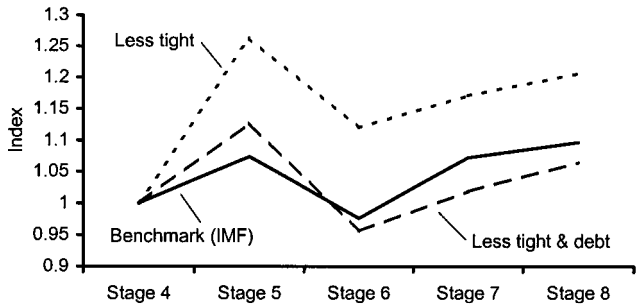


Figure 10. Prices: Benchmark and counterfactuals

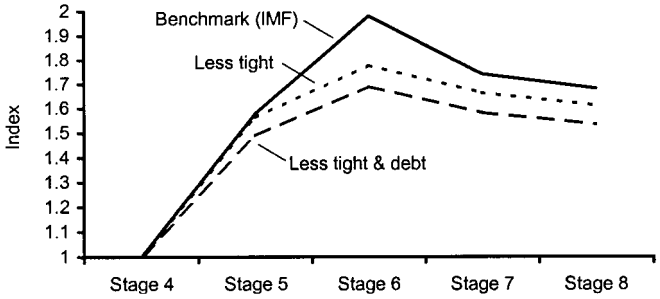


Figure 11. Risk factor: Benchmark and counterfactuals

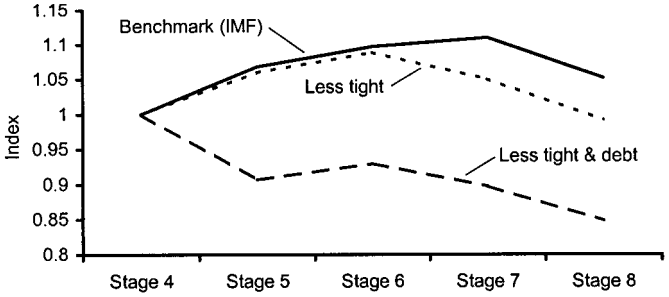


Figure 12. Income distribution: Benchmark and counterfactuals

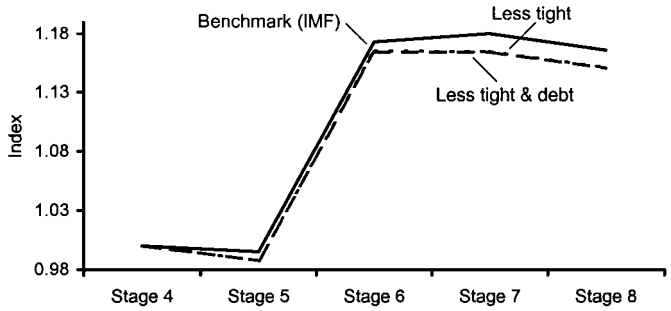


Table 2. Foster-Greer-Thorbecke measures of poverty under counterfactual policy regimes

	Policy regime of lower interest rate			Policy regime of lower interest rate and partial write-down of external debt		
	End of simulation period			End of simulation period		
	$\alpha = 0$	$\alpha = 1$	$\alpha = 2$	$\alpha = 0$	$\alpha = 1$	$\alpha = 2$
Agricultural employees	11.73%	1.78%	0.43%	11.50%	1.75%	0.43%
Farmers owning land	19.56%	3.89%	1.20%	19.75%	3.94%	1.22%
Rural low income	15.04%	2.57%	0.69%	14.98%	2.55%	0.69%
Rural high income	9.69%	1.68%	0.47%	9.71%	1.69%	0.47%
All rural residents	15.50%	2.86%	0.83%	15.54%	2.87%	0.84%
Urban low income	20.30%	4.25%	1.32%	20.17%	4.22%	1.31%
Urban high income	9.40%	1.79%	0.53%	9.33%	1.77%	0.53%
All urban residents	15.05%	3.07%	0.94%	14.95%	3.04%	0.93%
Total	15.37%	2.92%	0.86%	15.37%	2.92%	0.87%

Source: *Measures are calculated from endogenous sector-specific poverty lines generated by the model:* $\alpha = 0$*, head count, proportion living below poverty line;* $\alpha = 1$*, poverty gap;* $\alpha = 2$*, poverty severity.*

distribution and increasing (lowering) interest rate. The increase in interest income and the windfall from foreign asset holdings (e.g., time deposits in foreign currency), in an environment of very high interest rates and severe exchange rate collapse, surely have contributed to such a relation.

Table 2 reports the impact of the counterfactual policies on the Foster-Greer-Thorbecke poverty measures. For the head count variant of the measure, the proportion of rural residents below the poverty line in stage 8 is 15.50 percent under the "less tight" policy regime and 15.54 percent under the "less tight & debt" regime, compared to 20.06 percent under the "benchmark (IMF)" policy regime. The proportions of urban residents below the poverty line in stage 8 for the three policy regimes are 15.05 percent, 14.95 percent, and 18.63 percent, respectively. The national proportions are 15.37 percent, 15.37 percent, and 19.65 percent, respectively.

It is therefore evident from the above model simulations that not only the macroeconomic indicators but also the socioeconomic and poverty conditions would have been better if the prolonged high interest rate policy had been avoided.

6. Concluding remarks

I have used a model that replicated the observed outcomes to study the consequences of alternative economic policies in response to the East Asian crisis. Incorporating a detailed financial sector and a poverty module enables my economy-wide model to capture various channels and transmission mechanisms through which the financial shock and other noneconomic perturbations (e.g., political insta-

bility) affect the socioeconomic system. The two sets of counterfactual policies were (1) a less tight monetary policy and (2) a less tight monetary policy plus a partial writing down of the foreign debt. The experiments reveal that the policy scenario of not raising the interest rate would have created more favorable outcomes in terms of macroeconomic indicators as well as social indicators. With the exception of net capital flows, the results generated from the combination of a lower interest rate and partial debt resolution appear to be preferable.

One can experiment with several other counterfactuals using the model. Examples of other scenarios include implementing partial restrictions on capital flows and reallocating the huge amount of bank recapitalization funds for other sectors. Such reallocation may generate a more effective process of recovery.

There are some intriguing questions that future research should seek to explain. Why was the interest rate raised again after January 1998, despite the fact that the early interest rate surge clearly failed to revive the exchange rate and the economy? Why did the government not put a higher priority on debt write-down? Perhaps, having been wedged in by the IMF letter of intent, little attention could be directed toward programs other than those consistent with the letter. The IMF might have decided against a debt write-down because it considered the resolution of debt problems to be unattainable, particularly because most of the lenders were nonsyndicated banks and the number of borrowers (mostly of the corporate sector) was very large, with diverse quality and varying intentions to repay their debts.[20] It is, however, also possible that the IMF thought that a debt resolution might be "too easy" a way out or a quick fix for the Indonesian government and the private sector and that some of its conditions would not be met.

Appendix: Key blocks of the model

The key components of the financial block of the model and the channels through which a shock affects the socioeconomic system are presented below. Some of the parameters and coefficients in the model are calibrated, while others are estimated econometrically.

A.1 Financial sector

In the first stage, gross private capital inflows 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):

20 In a seminar in March 1998, Stanley Fischer mentioned this point in responding to my question. Much later, in early 2001, Michael Camdesus repeated the same point to me.

$$PFCAPIN = \sigma_0 + degree \cdot \sigma_1 \cdot (RLOAN - RFLOAN - RISK), \quad \text{(A.1)}$$

$$RISK = \alpha_0 + \alpha_1 \cdot (\Sigma_{inl}\, DEBSERV_{inl} \,/\, \Sigma_p E_p \cdot pwe_p)\,, \quad \text{(A.2)}$$

where *RLOAN* and *RFLOAN* are the 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, the size of which is calibrated from the Social Accounting Matrix; *pwe* is the world price of exports; and *E* is export volume. In most theoretical models, the interest rate equilibrates saving and investment. However, during the crisis, the interest rate is treated as a policy variable (because it was influenced by IMF conditionality requirements and manipulated by the monetary authorities); hence it is exogenously determined. On the other hand, the exchange rates in practically all crisis countries, with the exception of Malaysia, were allowed to float. In this sense, the exchange rate played an important role in determining the saving-investment balance. The phenomenon of capital outflows, particularly withdrawals by foreign investors, is widespread during the early part of a financial crisis. This is modeled through a shrinking equity asset (*EQROW*) in the foreign sector's balance sheet, which will eventually contribute to the rising outflows (*PFCAPOUT*) (expressed in U.S. dollars).

Next, the exchange rate determination and the role of noneconomic factors need to be specified. Since the 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 (hence the slope parameter is close to unity) is nothing more than a statistical conjecture.[21] Hence, alternative interpretations can be suggested, providing a scope for introducing other risk factors. The selection of risk factors depends on the particular country's situation. When political factors play a major role, for example, a proxy for political instability, *POL*, may enter the equation. A simple example appears in equation (A.3):

$$RLOAN = RFLOAN + (EXPEXR/EXR - 1) + POLRISK, \quad \text{(A.3)}$$

$$EXPEXR = EXR0\,(PFCAPOUT/PFCAPOUT0)^{\delta 1}\,(RISK/RISK0)^{\delta 2}\,(M2CBFR/M2CBFR0)^{\delta 3}\,, \quad \text{(A.4)}$$

21 It is not surprising that a clear consensus could hardly be reached by most empirical tests using a UIP model (see Froot 1989, MacDonald and Taylor 1992, and Meredith and Chinn 1998). On the other hand, many studies also reject the proposition that exchange rate movements are best characterized as a random walk (Meese and Rogoff 1988).

where *M2CBFR* is the ratio of broad money M2 to the central bank's foreign reserves. As the expected future exchange rate (*EXPEXR*) depreciates (i.e., increases in value), the following alternatives must occur, individually or simultaneously, in order to be consistent with the above equation: (1) the interest rate (*RLOAN*) increases and (2) the actual exchange rate (*EXR*) depreciates. The same alternatives apply to the case in which the political instability (*POLRISK*) worsens. One of the most dynamic components in the financial block during the crisis was the portfolio allocations made by agents (as described in the text of the paper).

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 plus reserves (net domestic assets plus net foreign assets) and the central bank's wealth plus non-interest-bearing government deposits and the central bank's certificate (SBI). The money multiplier fluctuates rather sharply during the crisis, because household behavior varies considerably. Money multipliers are allowed to vary freely, because they are influenced 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 a neoclassical specification. Private sector domestic investment in sector p (i.e., $DOMPINV_p$), is determined through an independent function, as in equation (A.5). In Indonesia, it has been observed that over an extensive period domestic investment in a sector is highly correlated with value-added (output accelerator), the interest rate, and the inflation rate. Foreign investment (*FORINV*), which is part of net private capital inflows ($f_1(1-f_2)$ *PFCAP*), along with $DOMPINV_p$ and the exogenous government investment ($GOVINV_p$), constitutes total investment (*TOTINVEST*):

$$DOMPINV_p = \lambda_p \cdot VA_p^{\lambda 1p} \cdot (1 + RLOAN)^{\lambda 2p} \, (EXR/PINDEX)^{\lambda 3p}, \qquad \text{(A.5)}$$

$$TOTINVEST = \Sigma_p \, (DOMPINV_p + GOVINV_p) + [\, f_1(1 - f_2) \, PFCAP \,] \cdot EXR, \qquad \text{(A.6)}$$

where VA_p is the value-added of sector p, and *RLOAN* and *EXR* are the interest rate and nominal exchange rate, respectively. *PINDEX* is the price index. Note that from the econometric estimation using the pre- and post-crisis periods, it is found that the role of each explanatory variable in equation (A.5) changes; for example, the significance of *RLOAN* is taken over by *EXR*/*PINDEX* (with a negative sign), suggesting that the interest rate becomes less relevant in the investment function during the crisis and that the real exchange rate has indeed curbed the growth of private investment (via balance sheet effects).

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

Hence, the interest rate and the production capacity, combined with the (depreciating) exchange rate, is assumed to affect the size of domestic investment. When the real exchange rate ($RER = EXR/PINDEX$) is favorable, few firms would be balance-sheet constrained. In such a case, the direct effect of the real exchange rate on aggregate demand would be minor. On the other hand, if the exchange rate collapses (as it did in Indonesia), firms with foreign-currency debt, that is, deteriorating balance sheets, would be unable to invest. This would further accelerate the recession. In the interim, exports might rise, but the effects of a bankrupt corporate sector and the absence of new investment might be large enough to outweigh the direct effects of greater export competitiveness. In this case the worsening exchange rate would be contractionary. This clearly implies that exchange rate movements can also affect aggregate demand. As suggested by Aghion, Bacchetta, and Banerjee (1999), under such circumstances the normally upward-sloping curve of output determination, given the EXR, may have a backward-bending segment, creating multiple stable equilibria, that is, allowing the system to produce a bad equilibrium with collapsed EXR and a bankrupt corporate sector.

A.2 Output and factor markets

The specification of the real sector is standard for this class of computable general equilibrium models, in which the production structure is modeled as a set of nested constant elasticity of substitution (CES) functions. 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. Similar to that in many East Asian economies, Indonesia's structure of production and trade is such that many intermediate inputs are still imported. Therefore, the composite intermediate inputs are necessarily modeled as a CES function of domestic and imported inputs, such that in the model simulations 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. This suggests that substituting domestic goods for exports is not costless; a lower elasticity implies greater cost

(more obstacles). Furthermore, the domestic market price will be 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 a CES composite of imports and domestically produced products. Minimizing the cost of acquiring composite goods gives the first-order condition in which the ratio of imports to domestic sales is determined by their price ratio. The demand for imports is assumed infinitely elastic with fixed world prices (small-country assumption). Along with the exchange rate, import tax, and trade and transport margin, the world price is assumed to determine the domestic price of imports.

The labor market is specified by assuming that sectoral wage rates are endogenously derived as functions of value-added, labor productivity, and the inflation rate. In a crisis model, even when it is used for a short-term analysis, the composition of labor supply in Indonesia cannot be treated exogenously. When the urban sector is hardest hit by a shock, labor may migrate from urban to rural areas (a reverse migration). This flexibility is in large part due to most urban dwellers having close ties with their extended families in the rural areas.

The standard Harris-Todaro migration approach in which labor movements are determined by the growth of earning differentials does not fit the Indonesian data (Azis 1997). I have modeled migration behavior by making use of the changes in labor demand (*DFL*), to represent labor opportunity, as the explanatory variable:

$$MIG = LS0\ \{\tau[(DFL_y/DFL0_y)/(DFL_x/DFL0_x)]^{\tau 1} - 1\}. \qquad \text{(A.7)}$$

As shown in the above equation, the labor demand probability is measured by the growth ratio of labor demand in category y to labor demand in category x, where y is the expected migration destination category and x is the expected migration origin category.

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