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Simulating economy-wide models to capture the transition from financial crisis to social crisis

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Abstract. The transition from Asian financial crisis into employment and income loss is analyzed in details by using a *structural path analysis* (SPA) and a price endogenous model of *computable general equilibrium* (CGE) type. Indonesia is taken as a case study. It is revealed that the damage in the real sector has ripple effects on the services sector, reducing the demand for workers of the professional rural and urban category, the growing middle class of the country. In turn, the overall income of most high urban household declines. The depressed manufacturing and construction sector gravely injures the companies' financial position. For some sectors, the indirect transmission of the effects is not insignificant. The large drop of employment in rural professionals suggests that the rural non-farm activities are likely to receive a recession contagion from the urban-based economy. This also implies that there is no alternative outlet in the rural areas for the urban middle class who lost their jobs. Very likely, some of them will end up working in the informal sector. The CGE simulation also suggests that the real wages have declined, especially in the urban areas. The per-capita consumption of all urban workers drops, the largest decline of which is for the urban medium type. In general, therefore, the relative position of the urban sector deteriorates more than that in the rural area. Hence, the country has to be prepared to face a massive increase in urban poverty, a fertile ground for internal conflicts and social discontent.

1. Introduction

The social repercussions of the Asian financial crisis are serious. Yet, most analyses concentrate on the macro and micro economic issues, lacking the

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details of the social dimension of the problem. The combined force of declining real wages and unemployment, due to significant contraction in the economy, raised poverty dramatically (Azis 1998a, Gupta et al. 1998, Gurushri 1998). In turn, this has become a fertile ground for social and political instability, threatening the effectiveness of structural reform undertaken by governments throughout the region.

The danger of social repercussions may go far beyond unemployment and poverty, e.g., imperiled social fabrics, rising ethnic tensions, widespread distrust and disharmony among different groups of society. Violence and crime rates have gone up, family and community mechanisms to manage household risks, which have been a positive part of "Asian values," is also threatened. In same cases, the danger of regional sub-national separatism is also serious.

This paper concentrates on only selected social issues, that is, the impact of the crisis on employment and income loss, by using specific models that are relevant for such a purpose. First, the transition of original shocks into employment and income loss is analyzed in details by using *structural path analysis* (SPA). Subsequently, since the crisis has widespread impacts influencing not only prices and other macroeconomic variables, but also microeconomic and inter-sectoral linkages, a price endogenous model of *computable general equilibrium* (CGE) type is conducted to unravel the distribution of a full-scale impact among different households. Indonesia is used as an example. From simulating the two models, the nature and the depth of the impacts of financial crisis can be measured quantitatively. In the Indonesian case, the resulting social impacts suggest why social unrest of the nature being observed in the country is to be expected.

2. The models

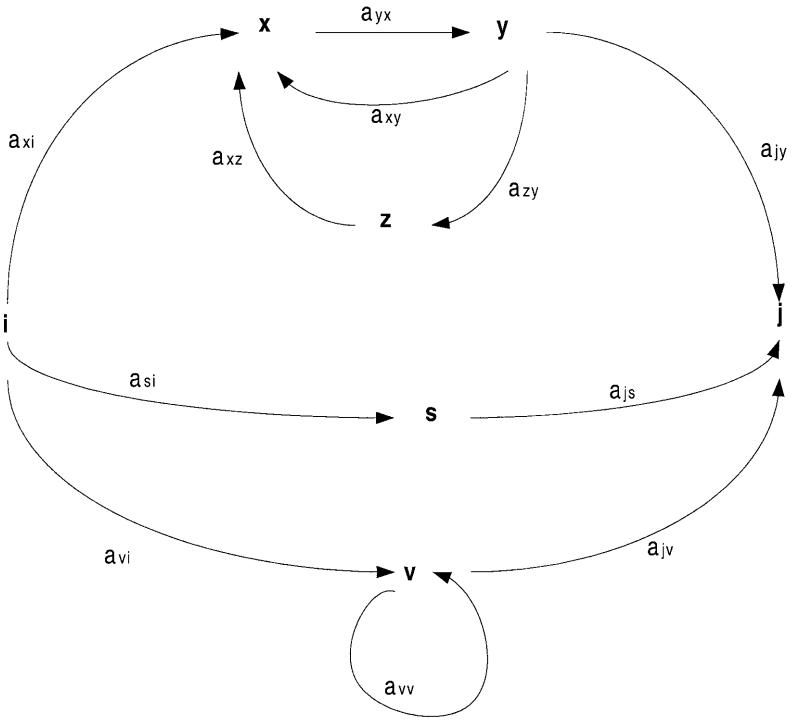
SPA is based on a decomposition of social accounting matrix (SAM). It was first developed by Defourny & Thorbecke (1984). Three types of 'influence' can be identified, from which we will be able to explore how a particular shock is transmitted: (1) Direct Influence, DI; (2) Total Influence, TI; and (3) Global Influence, GI. Graph 1 shows how these influences work.

A direct influence is measured along the arc connecting two poles, say i and j (also known as an *elementary path*). It basically measures the change in income or production of j induced by a unitary change in i, assuming the production or income of other poles is constant:

$$DI_{(i \to j)} = a_{ji}$$

Unlike direct influence, total influence captures a multitude of interactions among poles; see again Defourny & Thorbecke (1984). Hence, the direct influence $a_{xi}a_{yx}$ in Graph 1 is transmitted back from y to x, creating an effect of $(a_{xi}a_{xy})(a_{xy} + a_{zy}a_{xz})$, and is then transmitted back to y. Hence, a series of impulses are generated, yielding a new set of multipliers:

$$a_{xi}a_{yx}[1 - a_{yx}(a_{xy} + a_{zy}a_{xz})]^{-1}$$



Graph 1. Structural path analysis. (*Notes:* Taken from Defourny and Thorbecke (1984), p. 122)

This term is to be multiplied by a_{jy}, since the last arc connecting y and j has to be traversed in order to complete the path shown in Graph 1. The resulting total influence is therefore:

$$TI_{(i \to j)} = a_{xi} a_{yx} a_{jy} [1 - a_{yx}(a_{xy} + a_{zy} a_{xz})]^{-1}$$

A global influence is a rather different concept. It measures the total effects on production or income of pole j as a result of an injection of one unit of output or income in pole i. Hence, it is basically equivalent to a standard SAM multiplier.

Consider a simple SAM setting:

$$y = F(x, y)$$

where y and x are vectors of endogenous and exogenous variables, respectively. It can be readily seen that the resulting multiplier is:

$$dy = [I - Dy.\ F(x, y)]^{-1} Dx.\ F(x, y)\, dx$$

$$= [I - Dyy]^{-1} Dyx.\ dx$$

$$dy = M^{SAM} \Delta x$$

In effect, a global influence cumulates *all induced and feedback effects* resulting from the existence of circuits shown in Graph 1.

Given the above decomposition, one can identify explicitly how an influence is diffused from a certain shock through a specific path. Various channels through which each influence is transmitted, and the extent to which the path is amplified by the circuits adjacent to it can now be measured. In the context of economic crisis, the relevant question would be how production contraction due to the crisis affects various types of labors and different income groups (households).

However, two major assumptions are kept along the way in the above analysis: prices are fixed (exogenous), and there is an across-the-board underutilized capacity in the economy (Dervis et al. 1982, Sadoulet and de Janvry 1995, Azis 1998b). To the extent that changing prices (e.g., exchange rate) are the triggering factor in the crisis episode, and the fact that domestic prices have generally risen, relaxing the assumption of fixed prices becomes indispensable.

Different institutions may be affected differently by – and respond differently to – general price increases. For example, the rising price of specific commodities that may reflect the pass-through of exchange rate changes (collapse) on food items and fuel will have a differentiated impact on households, depending on the share and composition of those items in the consumption basket (Gupta et al. 1998).

Equally important is to remove the assumption that any increased demand will be met by an immediate supply response (capacity assumption). Maintaining the multi-sectoral nature of the analysis, however, is compelled by the economy-wide repercussions of the crisis. It is on this basis that in this study a price-endogenous multi-sectoral model of CGE type is selected. Since the nature of the crisis is financial-oriented, the model explicitly links the financial and the real sectors of the economy; thus, comprising not only components of a standard CGE but also detailed financial sector.[1] The complete list of equations is shown in the appendix.

The model contains complex relations among variables and economic agents, whereby various substitutions are included. It entails a time frame required for all markets to reach a new equilibrium after a particular shock is made in the system. However, the time span is not long enough for major dynamic effects to take place. The rationale for using a price endogenous model to analyze the transition from financial crisis to social crisis is evident from the characteristics of the multipliers, as discussed below.

The inclusion of prices in the list of endogenous variables changes the whole system. We therefore yield a more complex multiplier. Given

$$y = \Psi(x, y, z),$$

where y (quantity) and z (price) are both endogenous and x a vector of exog-

[1] Applications of a CGE model to look at the impacts of alternative policy shocks and reform on macroeconomic variables and income distribution in Indonesia can be found in Azis (1997) and Thorbecke et al. (1992), and an application on the distributional impact of foreign investment is analyzed in Azis (1998f).

enous variables. A Jacobian multiplier can be derived:

$$dy = [I - (Dyy + Dyz(I - Dzz)^{-1}Dzy)]^{-1}$$

$$\times [Dyx + Dyz(I - Dzz)^{-1}Dzx]\, dx.\ \Psi(x, y)]^{-1} Dx.\ \Psi(x, y)\, dx.$$

$$= My^{CGE} \Delta x$$

$$dz = Mz^{CGE} \Delta x$$

This Jacobian multiplier captures the equilibrium dependence of the endogenous variables upon one another as well as upon exogenous shocks. Compared to the SAM multiplier, three new components appear: *Dyz*, *Dzz* and *Dzy*. It is easy to see that if these three components are set to zero, the above Jacobian multiplier collapses to a SAM multiplier.

These three components have important interpretations. *Dyz* and *Dzy*, the off-diagonal elements in Graph 2, represent linkages that work through variations in prices. In other words, should there be excess demand in the system, prices will adjust until that excess vanishes. Ignoring this mechanism fails to take account of price adjustment. *Dzz* reflects the interaction among prices in the system. An exchange rate depreciation induces an upward pressure on prices of imported goods; whereas many export sectors will be favorably affected. Hence, *Dzz* should not be ignored in the calculation of multipliers.

	y	*z*	*x*
y	*Dyy*	*Dyz*	*Dyx*
z	*Dzy*	*Dzz*	*Dzx*

Graph 2. Componenets of SAM and Jacobian multipliers

It is not difficult to see that, while all elements in a SAM multiplier matrix have positive signs, it is not so in a Jacobian multiplier matrix. For example, a contraction in food processing industry will reduce the demand for some agricultural products (i.e., a positive multiplier). On the other hand, increased demand for agricultural products may generate detrimental effects on food processing and other light industries, because it drives up prices in this forward industry's input market (the multiplier will have a negative sign).

Hence, a Jacobian (CGE) multiplier matrix consists of a mixtures of pluses and minuses, different from the all-positive elements in a SAM multiplier. Needless to say, this very point is among the most important requirement in analyzing the full impacts of financial crisis.

Table 1. Gross domestic product at 1993 price: Indonesia

	Rp. Billion				Percentage		
	1995	1996	1997	1998	Gr 95–96	Gr 96–97	Gr 97–98
Agriculture	61885.2	63827.8	64289.5	64566.8	3.14	0.72	0.43
Mining	35502.2	37739.4	38385.9	37103.9	6.30	1.71	−3.34
Manufacturing	91637.1	102259.7	108828.6	91517.7	11.59	6.42	−15.91
Electricity, G & W	4291.9	4875.8	5498.6	5678.8	13.60	12.77	3.28
Construction	29197.8	32923.7	35040.6	21902.9	12.76	6.43	−37.49
Trade	64230.8	69475.8	73503.8	59330.9	8.17	5.80	−19.28
Transport	27328.6	29701.4	32169.4	28361.4	8.68	8.31	−11.84
Financial	34313	36384.2	38730.4	31664.5	6.04	6.45	−18.24
Services	35405.8	36610.2	37649.4	35573.8	3.40	2.84	−5.51
GDP	**383792.4**	**413798**	**434096.2**	**375700.7**	**7.82**	**4.91**	**−13.45**

Source: Central Bureau of Statistics

3. Simulation results based on 'Structural Path Analysis'

The production contraction of various economic sectors due to the severe economic crisis influences the demand for factors. It is along this path of influence the severe unemployment is created. In turn, the demand for a certain type of labor affects the income and welfare of different households groups. The primary question to be raised is: which category of socio-economic group is hardest hit by the crisis, and, more importantly, through what path does the transmission of influence take place?[2]

In the Indonesian case, the most severe contraction (greater than minus 18%) applies to the following sectors (see Table 1): banking and other financial institutions (denoted by BankF in Table 2), construction including wood industry (ConW), and trade and other services (Trade). The real estate sector (RealEs), not shown separately in Table 1, is another hardest hit activity.

SPA follows closely the mechanism assumed in a SAM framework. In the following analysis, the 1993 SAM of Indonesia is used as the primary data. First is the influence of one production sector to another production sector (intersectoral influence), followed by the influence of production to different factors, and subsequently the influence of factors to different socio-economic groups (Azis 1998c).

3.1. Production to production: ripple effects of the real sector on services

Let us first begin with the banking sector. As depicted in Table 2, in case 1 a significant part (30.2%) of the global influence of the banking sector upon construction sector is exercised *directly* through the demand for construction

[2] Thorbecke (1998) analyzes the first part of the question, i.e., who is mostly affected, through a multiplier analysis. The second part was explored in Azis (1998d).

activities which includes demand for wood and wood products. Hence, a depressed banking sector can easily dampen the growth of construction sector. Alternatively stated, efforts to regain the strength of the devastated banking sector would simultaneously help improve the construction sector.

In the structural path analysis, the size of path multipliers increases as the length of a path increases. The transmission from the banking sector to the construction sector can take different paths, some are longer than others and some are shorter. For example, the last two paths in case 1 (under the column "elementary paths") indicate a longer path, passing two more poles before the influence arrives at the construction sector. Consequently, the path multipliers for both paths are larger (1.6 and 1.5).

The elementary path that gives the highest path multiplier suggests the presence of an amplifying action of powerful circuits. Since 1.6 is the highest path multiplier among 4 alternative elementary paths in case 1, one can imply, albeit not strictly speaking, that it takes relatively longer for the improved banking sector to impact upon the construction sector if the transmission has to travel through such a path.

At the outset, it looks as if the path with highest total influence (TI) will have the lowest path multiplier. The first path in case 1 is a clear example. However, such a pattern is by no means a rule. The following case (construction sector) indicates a slightly different pattern.

The largest global influence of the construction sector is on the electricity, gas and water sector. But 73% of such an influence is exercised *indirectly* through the demand for services sector, as shown in case 4. This reveals the damaging effects of the construction sector during the financial crisis on the entire services sector. Even when we take a longer path, in which the effect of the declined construction sector is first transmitted through the paper industry before hitting the services sector, the proportion of the global influence is still larger than the case of a direct path (4.7% versus 0.8%).

Such a finding may not be detected if we rely merely on the global influence (GI) or the SAM multiplier. While the latter cumulates all induced and feedback effects resulting from the existence of circuits, that can amplify in a complex way, the TI in structural path analysis does the same thing but only for a given elementary path. In other words, in TI the direct and indirect effects are measured for an individual elementary path and the circuits adjacent to that path only. From this standpoint, a more specific policy for a particular path can be analyzed in greater details.[3]

The impact of the financial crisis on the real estate sector is devastating. The bursting of the price bubble, and the inability of many corporate firms operating in that sector to pay their foreign debts (mostly short-term and unhedged) have damaged the entire real estate industry in the country.

The path for the real estate sector (case 7) is rather interesting because the largest total influence of production contraction is the one that passes through the demand for factors and income of institution (households) before impacting the production of construction sector. An important policy implication can be drawn: the construction sector can be indirectly boosted by improving the real estate sector through raising the demand for urban workers

[3] The relation between TI and GI is obvious: the sum of all TIs (for all possible paths) equals GI.

Table 2. Structural path analysis for Indonesia: Unraveling the impacts of contraction in the hardest hit sectors

Cases	Path origin (i)	Path destination (j)	Global influence GI($i \rightarrow j$)	Elementary paths ($i \rightarrow j$)	Direct influence DI($i \rightarrow j$)	Path multiplier (Mp)	Total influence TI($i \rightarrow j$)	TI($i \rightarrow j$)/ GI($i \rightarrow j$) (%)
1	BankF	ConW	0.16	BankF-54-ConW	0.035	1.389	0.048	30.2
				BankF-54-Food-ConW	0.006	1.479	0.008	5.3
				BankF-54-SelfHouse-HiUrNonF-ConW	0.004	1.571	0.006	3.8
				BankF-54-SelfHouse-LoUrNonF-ConW	0.004	1.491	0.005	3.3
2.a	BankF	SelfHouse	0.556	BankF-54-SelfHouse	0.496	1.121	0.556	100
2.b	BankF	CapDomPr	0.224	BankF-54-CapDomPr	0.104	1.121	0.117	51.9
				BankF-54-Food-43-CapDomPr	0.007	1.197	0.008	3.5
				BankF-54-ATrCom-53-CapDomPr	0.005	1.233	0.006	2.8
3	BankF	HiUrNonF	0.374	BankF-SelfHouse-HiUrNonF	0.079	1.296	0.103	27.5
				BankF-UrWgProf-HiUrNonF	0.038	1.312	0.05	13.3
				BankF-UrWgMan-HiUrNonF	0.011	1.314	0.014	3.7
4	ConW	ElecGW	0.292	ConW-45-ElecGW	0.002	1.406	0.002	0.8
				ConW-Serv-ElecGW	0.152	1.406	0.213	73
				ConW-45-Paper-Serv-ElecGW	0.008	1.683	0.014	4.7
5	ConW	CapDomPr	0.212	ConW-45-CapDomPr	0.108	1.248	0.135	63.8
				ConW-Serv-ElecGW-48-CapDomPr	0.014	1.406	0.02	9.3
				ConW-45-ATrCom-53-CapDomPr	0.002	1.378	0.003	1.2
6	ConW	Comp	0.279	ConW-45-CapUrOth-Comp	0.002	1.379	0.003	0.9
				ConW-45-CapDomPr-Comp	0.108	1.279	0.139	49.8
				ConW-Serv-ElecGW-48-CapDomPr-Comp	0.014	1.441	0.02	7.3
7	RealEs	ConW	0.135	RealEs-55-ConW	0.008	1.299	0.01	7.3
				RealEs-55-UrWgMed-HiUrbNonF-ConW	0.013	1.501	0.02	14.9
				RealEs-55-UrWgProf-HiUrNonF-ConW	0.008	1.486	0.012	8.9
8a	RealEs	UrWgMed	0.409	RealEs-55-UrWgMed	0.33	1.112	0.367	89.7
8b	RealEs	UrWgProf	0.2	RealEs-55-UrWgProf	0.184	1.051	0.193	96.7
8c	RealEs	CapDomPr	0.154	RealEs-55-CapDomPr	0.052	1.043	0.054	35
9	RealEs	HiUrbNonF	0.683	RealEs-55-UrWgMan-HiUrbNonF	0.017	1.238	0.021	3.1
				RealEs-55-UrWgMed-HiUrbNonF	0.273	1.235	0.337	49.4
				RealEs-55-UrWgProf-HiUrbNonF	0.166	1.221	0.203	29.7

10	Trade	ElecGW	0.267	Trade-49-Mine-Serv-ElecGW	0.037	1.792	0.066	24.6
				Trade-49-Forest-Serv-ElecGW	0.016	1.387	0.022	8.4
				Trade-49-AgOthFood-Serv-ElecGW	0.013	1.644	0.021	7.7
11a	Trade	CapDomPr	0.139	Trade-49-CapDomPr	0.019	1.108	0.021	15.3
11b	Trade	CapFor	0.068	Trade-49-Mine-42-CapFor	0.005	1.68	0.009	13.2
11c	Trade	CapUrOth	0.245	Trade-49-CapUrOth	0.132	1.185	0.157	64
11d	Trade	UrWgMed	0.161	Trade-49-UrWgMed	0.077	1.179	0.091	56.5
11e	Trade	UrNonWgMed	0.073	Trade-49-UrNonWgMed	0.019	1.143	0.022	30.2
12	Trade	HiUrNonF	0.377	Trade-49-CapUrOth-HiUrNonF	0.068	1.321	0.09	23.8
				Trade-49-UrWgMed-HiUrNonF	0.064	1.3	0.083	22.1
				Trade-49-UrNonWgMed-HiUrNonF	0.012	1.297	0.016	4.3

of a medium level (UrWgMed) that will raise wages and income of the urban households which includes businessmen and other professionals. Indeed, workers and household of this type have suffered most from the shattered real estate sector during the crisis (discussed later).

As the production of most industries suffers a blow from the crisis, the trade sector has consequently become another casualty. What is the impact of a depressed trade sector? Let us look at the path from this sector to the electricity, gas and water (carries a large 0.27 global influence).

Demonstrated in case 10, a large part (25%) of the global influence is activated *indirectly*, among others through the demand for services sector. The second largest (over 8%) is exercised through the demand for forest and, again, services sector. Hence, it is clear that in both cases the services sector appears to be one of the better "conductors" to transmit the effects of the trade activities on electricity, gas and water sector.

What the above suggests is that the damage in the real sector, including the construction activities, has ripple effects on the services sector. It is analyzed in the next two sections how such a path will eventually reduce the demand for labor and, in turn, the income of particular households.

3.2. Production to factors: reducing unemployment

The most immediate impact of a production decline in a particular sector is a reduced demand for various inputs required by the production of that sector.

Case 2a depicts the path from the banking sector to housing as a factor asset, and case 2b refers to the path from the banking to domestic private capital. Judging from the sheer size of the global influence (close to 0.6), it is clear that housing is one of the most adversely affected factors by the depressed banking sector. This is due to the fact that the financing of most housing in the country largely came from bank loans.

A more obvious case is the effect of the depressed banking sector on the demand for domestic private capital. More than half (52%) of the global influence in such a path is activated *directly*, and only 3.5% and 2.8% are exercised *indirectly* through the food industry and the transport-communication sector, respectively.

It is not surprising that most analysts, including those of the IMF, consider reforming the banking sector to be the most critical element in reviving all sectors of the economy. The expected result of an improved banking sector is an increase in demand for capital inputs. Under the standard SAM assumptions, this also means raising the availability of capital.

The hard hit construction sector also influences largely the demand for domestic private capital (64%), as shown in case 5 of Table 2. The indirect paths occur through the electricity, gas and water (9%) and the transport-communication sectors (over 1%). In fact, in the remaining sectors the structural path analysis reveals that the demand for domestic private capital constitutes a considerable part of the global influence, i.e., 35% for the real estate sector, and 15% for the trade sector.

To be more precise, in the real estate sector the demand for urban labor of medium type and of professional category is more important than that for capital; the global influence is: 0.41, 0.2 and 0.15 respectively. Meanwhile, in the case of trade sector the more important demand is for labor of medium

type and other capital in urban area (the global influence is, respectively, 0.161 and 0.245).

To sum up, the analysis in this section suggests that a contraction in sectoral production can create varying effects on labor demand, aggravating the already high unemployment, and on capital availability. But in some sectors, the transmission of the effects traveling through indirect channels is not insignificant. Policies to minimize the intermediate effects of the industry's contraction on the services sector may be worth exploring before the entire process eventually results in a further reduction of the demand for urban labor (i.e., to avoid more layoffs of workers).

3.3. Production to institutions: who suffers most?

The most devastating effect of the depressed economy during the crisis seems to be on the urban household of the high category (including businessmen, managers, and other professionals). In all five sectors but one (construction sector), the largest global influence is on such a household category.

In case 3, the declining banking sector will adversely affect the welfare of urban households largely through the housing sector (see also the earlier production to production analysis) and reduced demand for professional urban labors (28% and 13% respectively).

In cases 9 and 12, the transmission from the real estate sector and the trade sector to the urban household is largely reflected in the demand for urban labor, the largest being of the medium type. In case 12, however, the largest part of the global influence is activated through other capital in urban areas (24%).

What the above suggests is that, while indeed the high urban households are the hardest hit group, the impact is transmitted through different paths for different sectors. Identifying each node in the entire path, from which the intermediate impact on a particular node can be minimized, can sharpen the policy analysis. For example, policies should be directed toward softening the impact of a contraction in the banking sector on the demand for urban labor if the reduction in income of high urban households is to be minimized.

In case 6, the largest global influence is on a company's income. Hence, the weakened construction sector will adversely affect a company's income very seriously. Indeed, many of the country's corporate sectors are in severe financial trouble. Those who are already listed in the stock market suffer from plunging share prices. The most effective "conductor" for the construction sector to affect a company's income is domestic private capital.

To sum up, the contraction of banking, real estate, and trade sectors results in a severe blow to the income of most high urban households, while the depressed construction sector gravely injure companies' financial position throughout the country.

4. Simulation results based on price endogenous model

4.1. How the crisis evolved

To conduct a multi-period analysis using the price endogenous model, we need to trace the sequence of the events (how the crisis evolved) since July 1997. As discussed in Azis (1998e) and Azis (1998g), the crisis evolved in stages.

In the first stage, the devaluation of the Thai's baht on July 2 created serious jitteriness among global investors. Mutual fund managers and corporate treasurers from around the world, not only in Thailand but also in Jakarta, Manila, and Kuala Lumpur immediately began to sell local currencies, setting off a tumble in local currencies and the stock markets. A crawling-peg exchange rate system was still in place during that time, in which the latest announced band was 12%. Unable to fend off further pressures, on August 14 the government decided to float the rupiah.

In the subsequent stage, depreciation expectations created nervousness among local corporate sectors. These local companies scrambled to buy greenbacks to meet repayment of their enormous loans; many of which were un-hedged, short-term, and used to finance long-term projects or high-risk schemes including many in the real estate sector.[4]

In a later stage, political factors came into the picture. Major rioting that took place on May 13–15, 1998 brought devastating impacts on almost every aspect of life. The official estimated loss of US$250 million is likely underestimated. Around 5,000 buildings were damaged or burnt, close to 2,000 vehicles were torched, no less than 220 bank branches were destroyed, and about the same number of automatic teller machines were damaged. Many stores were closed for several days, so were businesses and banking operations.[5]

However, the most serious damage was the exit of money and capital especially owned by the Indonesian Chinese (ethnic Chinese control around 70 to 80% of the assets of Indonesia's top 300 companies). The exodus of expatriates and foreigners also bruised the country's image and made the prospect for economic recovery gloomier. The exchange rate and the stock market declined. On May 18, 1998, the former touched 17,000 per US dollar and the latter came closer to a low of 400.

4.2. Impact analysis based on model simulation

In terms of model simulation, the described evolution is captured explicitly through a set of shock scenarios, following closely the above sequence of event. While annual data are used in the base-line model, the time period implied in each shock simulation follows closely the timing of the actual sequence of events (not yearly simulations). In each simulation, the values of exogenous variables are adjusted to the actual ones.

In the first stage, outflows of capital, PFCAPOUT, increased, raising the expected exchange rate (EXPEXR) and reducing the total net flows of capital,

[4] How did such a loan scheme occur in the first place? Thanks to widespread optimism about the region's future growth and the celebrated label of "East Asian Miracle" (coined by the World Bank), private investors were poised to expand their activities ever since 1994 (Azis 1998e). The high domestic interest rate did not dampen their enthusiasm, largely because foreign loans were obtained easily at a relatively low rate. The label "miracle" also seems to have swayed lenders and the international financial community so that they recklessly made many high-risk loans (Dooley 1997; Azis 1998e).

[5] It is estimated that the money transactions affected by banks' closures in Jakarta alone reached some US$3 billion each day. The impact across the country was damaging since the economy of many regions outside Jakarta is significantly dependent upon money flows from the capital city.

PFCAP (the complete set of equations is shown in the appendix):

$$\text{EXPEXR} = \Delta_0(\text{PFCAPOUT}^{\Delta 1}.\ \text{FOREX}^{\Delta 2}) \tag{1}$$

$$\text{PFCAP} = \text{PFCAPIN} - \text{PFCAPOUT}, \tag{2}$$

where Δ's are constant. In the second stage, foreign exchange pressures, FOREX, increased by way of making the parameter MATURE greater than unity (its baseline value). The shorter the maturity, the greater the value of MATURE. It should be noted that in the early period of the crisis, there was a significant exchange rate pressure due to local companies' rush for foreign currency in order to meet their short-term debt payments (DEBSERV). Hence, two components add pressures to the exchange rate: the term of maturity (reflected through MATURE, the value of which is ≥ 1) and the dollar amounts of debt payment (DEBSERV):

$$\text{FOREX} = \Sigma_{inl}(\text{MATURE}_{inl}.\ \text{DEBSERV}_{inl}), \tag{3}$$

where subscript *inl* denotes the borrowing institutions (in this case only private companies and banks). While the openness of capital flows remained intact (parameter *degree* in equation 5 is unchanged), the expectation of currency depreciation (EXPEXR) mounted. Worse still, the political situation deteriorated. To capture the phenomenon, a parameter reflecting political risk, labeled POLRISK, is added in the interest parity equation of the Flood & Marion (1996) type. The magnitude of such a parameter is raised when the political situation deteriorates. Meanwhile, outflows of capital (FCAPOUT) continued to occur (stage 3),

$$\begin{aligned}\text{RLOAN} = \text{RFLOAN} &+ (\text{LEXPEXR} - \text{LEXR}) \\ &+ \tau.(\Omega + \Sigma_i(\text{TDH}_i/(\text{TFH}_i + \text{CMFR})\,.\,\text{EXR}) + \text{POLRISK})\end{aligned} \tag{4}$$

where RLOAN is the domestic interest rate, LEXPEXR and LEXR is the natural log of expected and nominal exchange rate, respectively, and subscript i indicate different institutions (households and companies). The foreign interest rate, RFLOAN, and τ and Ω are all constant. The third component in the right hand side is the ratio of domestic to foreign asset holding, reflecting investors' asset risk, where TDH and TFH are the households' time deposit in domestic and foreign currencies, respectively, and CMFR is the commercial banks' foreign reserve.

What about the exchange rate? At the beginning, a crawling-peg system is applied, in which an exchange rate band of 12% is used. This occurred while capital outflows, PFCAPOUT, began to take place, mostly done by foreign fund managers (stage 1). Entering stage 2, the Indonesian government decided to completely float the exchange rate on August 14. Hence, EXR is made to vary in this stage. Since then, the rate persistently moved downward.

Despite the rising RLOAN (imposed through the IMF tight money policy), the collapsed exchange rate raised the expected depreciation (the last item in the bracket) in such that the gross inflows of capital, PFCAPFIN, reduced

dramatically following equation 5 (based on Khan & Zahler, 1989):

$$\text{PFCAPIN} = \sigma_0 + degree.\ \sigma_1.(\text{RLOAN-RFLOAN-RISK-}((\text{EXR}/\text{EXR}_0)\text{-}1)) \quad (5)$$

where *degree* is a parameter that reflects the degree of capital account openness, RISK denotes the country's economic risk, and EXR_0 is the baseline exchange rate.

During the process, the IMF-led policy of money tightening pushed the interest rate upward, adversely affecting the domestic demand for a number of sectors (i.e., trade & services, manufacturing, hotel, financial, and real estate activities).[6] The resulting drop in private investments, PINV, in these sectors is captured through equation (6), lowering total investment, TOTINVEST in (7) and the volume of investment by sectoral destination, DK, in (8),

$$\text{PINV}_p = \lambda_p.\ \text{VA}_p^{\lambda 1p}.(1 + \text{RLOAN}/\text{PINDEX})^{\lambda 2p} \quad (6)$$

$$\text{TOTINVEST} = \Sigma_p(\text{GINV}_p + \text{PINV}_p) \quad (7)$$

$$\text{DK}_p = \text{GINV}_p + \text{PINV}_p - inv_p.\ X_p.\ PQ_p, \quad (8)$$

Where GINV and VA are government investment by sector and value-added by sector, respectively (subscript p indicates sector). VA is to be determined endogenously in the model, while GINV is treated as policy instrument (exogenous). PINDEX is the price index, X is the sectoral output, PQ is the output price, all are endogenously determined, and *inv* is the inventory parameter.

What are the impacts of the above perturbations? Despite the larger disparity of interest rates (between foreign and domestic rates), as the crisis progressing, increased capital outflows are detected (Fig. 1). One of the repercussions is on the exchange rate. Measured by the gap between the expected and the endogenously determined rate, the index of "exchange rate pressures" persistently increases. While at the early stage exports can be boosted, the high import-content of many exporting industries has subsequently hindered export growth.

Meanwhile, imports tend to decline rather sharply (Fig. 2). As a result, the current account position improves.

High interest rate crippled many domestic industries. As depicted in Fig. 3, real investment dropped throughout the end of the simulation period, and real output (GDP) plunged even deeper. The general price index (CPI) continues to rise despite the skyrocketing interest rate.

Some sectors are hardest hit by the crisis. The bar-charts in Fig. 4 indicate the beginning-to-end trend of those sectors.[7] Clearly, the three most hardest

[6] At the same time, weather condition has deteriorated the agricultural sector, particularly the productivity of the food sector.

[7] Unlike in SPA, however, the food processing and textile industries also fall under the "hardest hit" category. Hence, there are six – instead of four – sectors that suffer from significant declines in value-added.

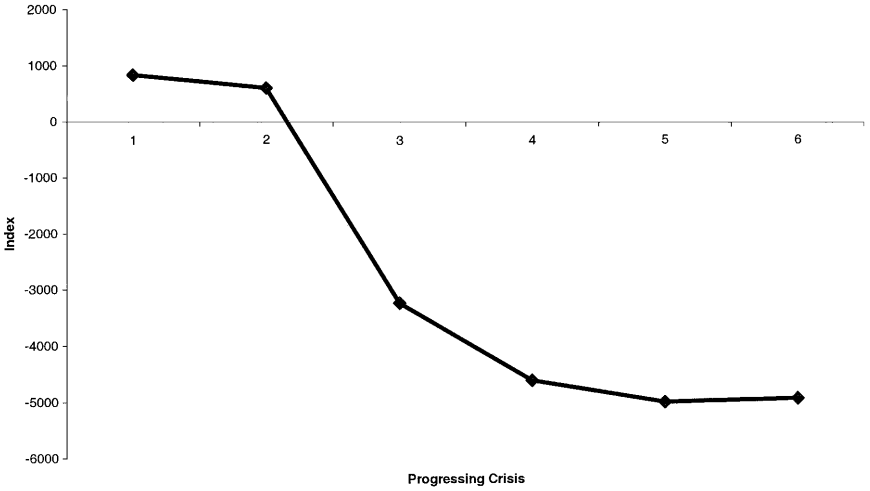


Fig. 1. Trends of foreign capital flows during the crisis

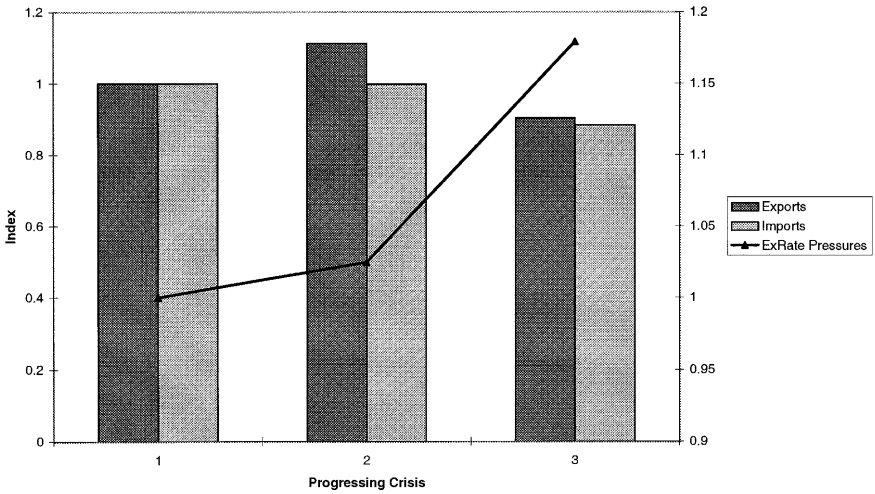


Fig. 2. Exchange rate pressures & exports-imports

hit are: real estate, trade & services, and the financial sector. Such a sectoral composition produces certain patterns of employment loss, as charted in Fig. 5. The model simulation suggests that the largest drop of employment takes place in two labor categories: professional rural (ProsRur) and professional urban (ProsUrb). This category includes managerial staff, military professionals and technical workers. They all constitute the growing middle class of the country.

The large drop of employment in the professional rural suggests that the non-farm activities in the rural area are likely to receive a contagion from the recession in the urban-based economy. This also implies that the urban middle

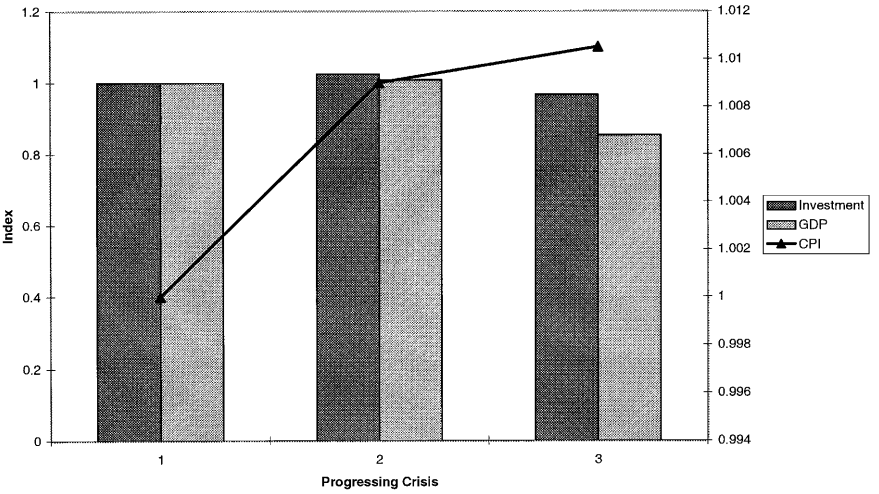


Fig. 3. Aggregate macroeconomic variables

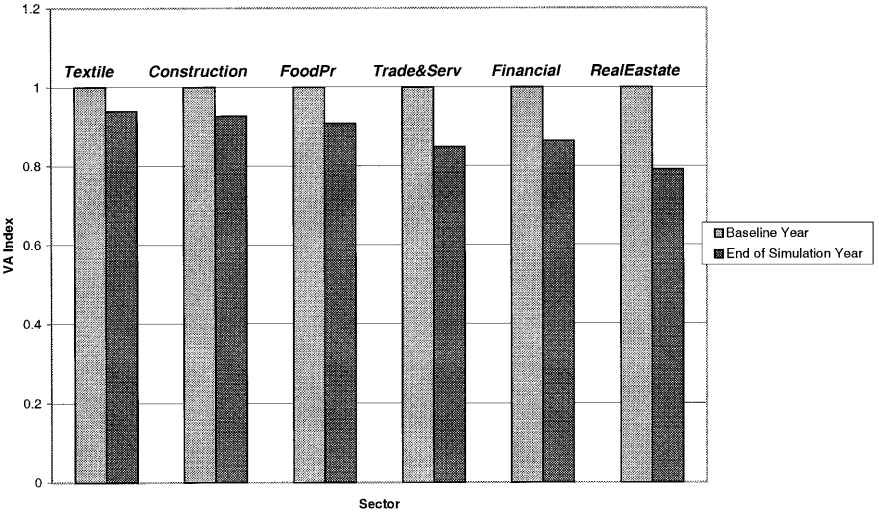


Fig. 4. Hardest hit sectors

class who lost their jobs, who might have opted to return back to their rural home, will find life extremely difficult since no alternative outlet is available in the rural areas. Very likely, some of them will end up working in the informal sector.

Even those who are still lucky to not lose their jobs are faced with inevitable lower wages. Real wages have declined in most of the categories, especially in the urban areas. Figure 6 demonstrates the opposing trend of per-capita consumption between three labor categories, agricultural medium class (AgMed), rural non labor (RurNonLb), and rural high category (RurHigh),

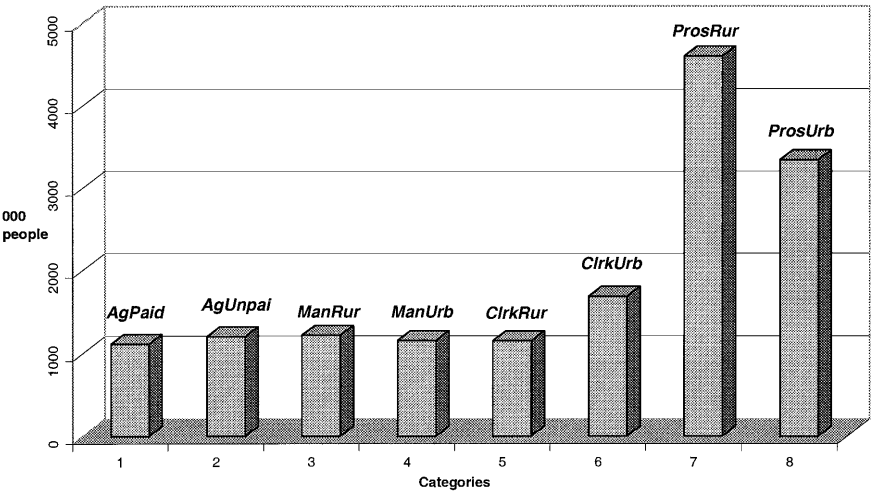


Fig. 5. Sectoral loss in employment

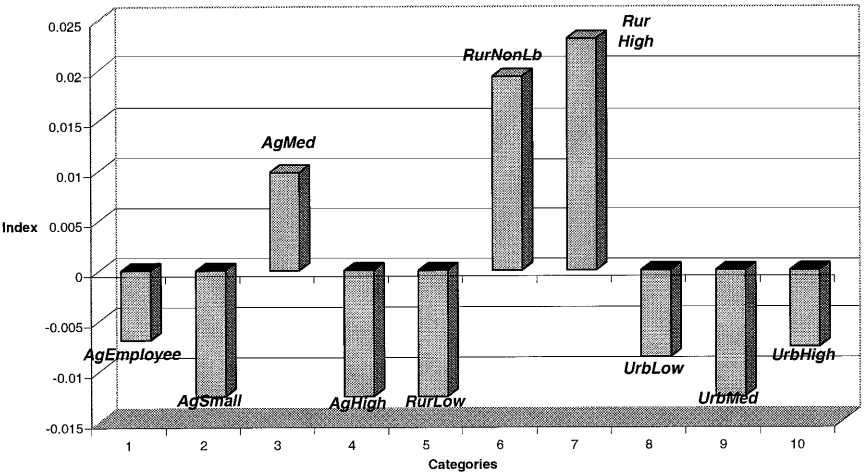


Fig. 6. Changes in per-capita nominal consumption

versus the rest of the labor categories. Obviously, across categories the per-capita consumption of all urban workers drops, the largest decline of which is for the urban medium type (UrbMed). The rising consumption of the three rural labor types is perhaps related to the combination of the relatively larger increase of food prices and the larger share of food expenditures in their total consumption.[8] Some export-oriented sectors in that category also enjoy increased income and consumption.

Spatially, the relative position of the urban sector deteriorates more than

[8] Note that the per-capita consumption depicted in Fig. 6 is measured in nominal terms.

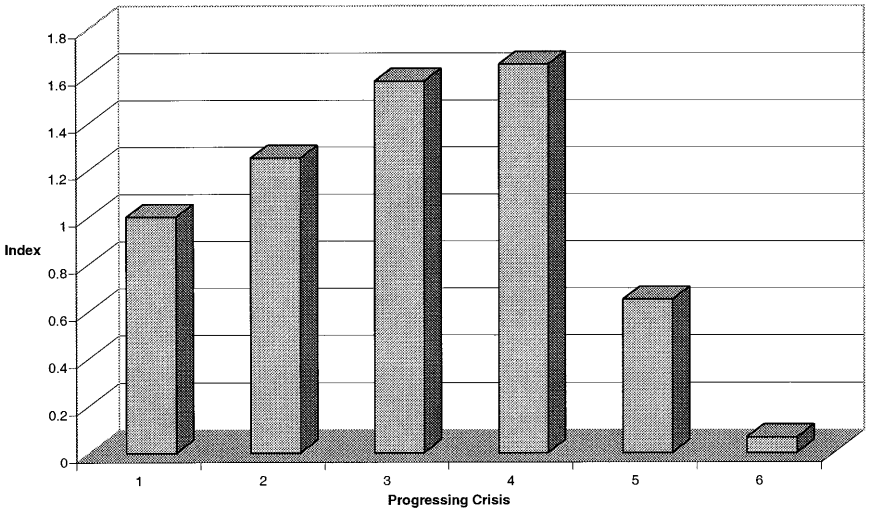


Fig. 7. Total income: ratio of urban to rural (non-farm)

that in the rural area. While at the early stage the *total* (not per-capita) income share of urban households may have improved, Fig. 7 shows that towards the end of the simulation period such a share dropped very sharply. Figures 6 and 7 jointly suggest what has been speculated earlier about the poverty trend. If the crisis lingers, in the short-run the country has to face a massive increase in urban poverty, a fertile ground for internal conflicts and social discontent.

5. Conclusions

The Asian financial crisis has brought a series of far reaching repercussions on peoples' lives. As illustrated in this paper, this has clearly happened in Indonesia. Similar predicaments are also likely to occurr in other crisis-stricken countries.

What was started as a contagion that led to the collapse of the local currency turns out to be more harmful than what many people thought. This has been proven to be an explainable but far from predictable crisis. Other factors, e.g., weather condition leading to a long drought, serious haze problems, a sharp drop in oil price, and increased political tension, which culminated in a dramatic change of government (but which has also led to greater uncertainty), simply aggravated the already vulnerable economy. In the meantime, social conditions are worsening.

Using SPA and CGE model, this study analyzes how the financial crisis turned into a severe social crisis, more particularly in terms of job and income loss. When such a situation occurred along with a general price increase (hence, the need to use a price endogenous model), poverty rises. The two models used in this study are capable of describing the process as well as the detailed break down of economy-wide impact of the crisis. The dynamics of price changes and their impacts are explained through a price endogenous model that incorporates a financial sector.

It is revealed that the contraction of banking, real estate, and trade sectors results in a severe blow to the income of most high urban households, while the depressed manufacturing and construction sector gravely injures the companies' financial position. The largest drop of employment takes place in two labor categories: professional rural and urban, the growing middle class of the country. The large drop of employment in the professional rural suggests that the non-farm activities in the rural area are likely contaminated by the recession in the urban-based economy. Hence, the urban middle class who lost their jobs finds no alternative outlet in the rural areas. Some of them will likely end up working in the informal sector.

Even those who are still lucky to not lose their jobs are faced with inevitable lower wages. Real wages are estimated to decline in most categories, and the per-capita consumption also drops, especially in the urban area. Hence, the relative position of the urban sector deteriorates more than that in the rural area. If the crisis lingers, the country has to face a massive increase in urban poverty, a fertile ground for internal conflicts and social discontent. Indeed, the resulting social impacts from the model simulations can suggest why in Indonesia the social unrest of the nature being observed during 1997–1999 is to be expected.

Appendix

List of equations in the CGE model

Output supply and factor demand

$$X_p = ax_p \,.\, [\delta_p .\ VA_p^{\rho p} + (1-\delta_p).\ INTM_p^{-\rho p}]^{-1/\rho p} \tag{1}$$

$$VA_p = av_p \,.\, [\Sigma_f \beta_{p,f} .\ FACDEM_{p,f}^{-\mu p}]^{-1/\mu p} \tag{2}$$

$$FACDEM_{p,f} = VA_p \,.\, [\beta_{p,f} .\ PV_p/(av^{\mu p} .\ WF_f .\ WFDIST_{p,f})]^{1/(1+\mu p)} \tag{3}$$

$$INTM_p = VA_p/[(PINTM_p/PV_p).\ (\delta_p/(1-\delta_p))]^{1/(1+\rho p)} \tag{4}$$

$$X_p = AT_p \,.\, (\gamma_p .\ E_p^{\tau p} + (1-\gamma_p).\ D_p^{\tau p})^{1/\tau p} \qquad p \in pexp \tag{5}$$

$$X_p = D_p \qquad p \notin pexp$$

$$E_p = D_p \,.\, [PE_p/(PD_p(1-tdom_p-ttd_p)) \,.\, (1-\gamma_p)/\gamma_p]^{1/(\tau p-1)} \qquad p \in pexp \tag{6}$$

$$Q_p = ac_p \,.\, [\eta_p .\ M_p^{-\varepsilon p} + (1-\eta_p).\ D_p^{-\varepsilon p}]^{-1/\varepsilon p} \tag{7}$$

$$M_p = D_p \,.\, [(PD_p/PM_p) \,.\, \eta_p/(1-\eta_p)]^{1/(1+\varepsilon p)} \tag{8}$$

Aggregate demand

$$XINTQ_p = \Sigma_{pp}(aa_{p,pp} \,.\, INTM_{pp}) \tag{9}$$

$$HHCONQ_p = [\Sigma_{ihh}\, alphq_{p,ihh} \,.\, (1\text{-}mps_{ihh}).\ YCONS_{ihh}]/PQ_p \tag{10}$$

$$GC_p = gg_p .\ GTOT \tag{11}$$

$$ID_p = \Sigma_{pp}(capmat_{p,pp} \,.\, DK_{pp}) \tag{12}$$

$$INVEN_p = inv_p \,.\, X_p \tag{13}$$

Prices

$$PX_p = [PD_p .\ D_p(1-tdom_p-ttd_p) + PE_p .\ E_p]/X_p \tag{14}$$

$$PQ_p = [PD_p .\ D_p + PM_p .\ M_p]/Q_p \tag{15}$$

$$PV_p = [PX_p.\ X_p - PINTM_p.\ INTM_p]/VA_p \quad (16)$$
$$PK_p = \Sigma_{pp}\{capmat_{pp,p}.\ PQ_{pp}\} \quad (17)$$
$$PM_p = pwm_p.\ EXR.(1 + tm_p + tti_p) \quad (18)$$
$$PE_p = pwe_p.EXR \quad (19)$$
$$PINTM_p = \Sigma_{pp}\{aaq_{pp,p}.\ PQ_{pp}\} \quad (20)$$
$$PINDEX = \Sigma_i\, wtq_p.\ PQ_p \quad (21)$$
$$PINDOM = \Sigma_p\, wtd_p.\ PD_p \quad (22)$$

Income and saving

$$YE_f = \Sigma_p(WF_f.\ WFDPST_{p,f}.\ FACDEM_{p,f})\ f \neq capital \quad (23a)$$
$$YF_{capital} = \Sigma_p(WF_{capital}.\ WFDPST_{p,capital}.\ FACDEM_{p,capital}) - EXR.\ REPAT \quad (23b)$$
$$YCORP = factoin_{compny,capital}.\ YF_{capital} - EXR.\ INTEREST_{compny} \quad (24)$$
$$YHH_{ihh} = \Sigma_f\, factoin_{ihh,f}.\ YF_f + EXR^{*}\, ROWTRAN_{ihh} + \Sigma_{ihh}\, transihh_{ihh,ihhh}.\ YHH_{ihhh} + gtran_{ihh}.\ GTRANTOT + compdist_{ihh}.(1 - ctax).\ YCORP \quad (25)$$
$$YCONS_{ihh} = YHH_{ihh.}.(1 - th_{ihh}).(1 - mps_{ihh} - \Sigma_{ihh}\, transihh_{ihh,ihhh}) \quad (26)$$
$$HHSAV = \Sigma_{ihh}\, mps_{ihh}.\ YHH_{ihh}.(1 - th_{ihh}) \quad (27)$$
$$INDTAX = \Sigma_p(tdom_p.\ PD_p.\ D_p + tm_p.\ pwm_p.\ EXR.\ M_p) \quad (28)$$
$$TTMTOT = \Sigma_p(ttd_p.\ PD_p.\ D_p + tti_p.\ pwm_p.\ EXR.\ M_p) \quad (29)$$
$$GOVREV = INDTAX + \Sigma_{ihh}\, th_{ihh}.\ YHH_{ihh} + YCORP.\, ctax + factoin_{govt,capital}.\ YF_{capital} \quad (30)$$
$$GOVEXP = \Sigma_p\, PQ_p.\ GC_p + EXR.\, INTEREST_{govt} + GTRANTOT \quad (31)$$
$$GOVSAV = GOVREV - GOVEXP \quad (32)$$
$$CORSAV = YCORP.(1 - ctax).(1 - \Sigma_{ihh}\, compdist_{ihh}) \quad (33)$$
$$FSAV = -(\Sigma_p\, pwe_p.\ E_p - \Sigma_p\, pwm_p.\ M_p + \Sigma_{ihh}\, ROWTRAN_{ihh} - REPAT - \Sigma_{inl}\, INTEREST_{inl}) \quad (34)$$
$$SAVING = HHSAV + GOVSAV + CORPSAV + EXR.\ FSAV \quad (35)$$

Labor market

$$WAGES_p = PINDEX^{vp/1.5}.(PV_p/PV0_p)^{(1-vp)/1.5}.(X_p/\Sigma_{fl}\, FACDEM_{p,fl}/PDL0_p)^{\pi p} \quad (36)$$
$$WF_{fl} = WF0_{fl}.\ \Sigma_p\, WAGES_p.\ wshare_{p,fl} \quad (37)$$
$$PDL_p = X_p/\Sigma_{fl}\, FACDEM_{p,fl} \quad (38)$$

Investment and capital flows

$$PFCAPIN = \sigma_0 + degree.\ \sigma_1.\ (RLOAN\text{-}RFLOAN\text{-}RISK\text{-}((EXR/EXR0)\text{-}1)) \quad (39)$$
$$RISK = \alpha_0 + \alpha_1.(\Sigma_{inl}\, INTEREST_{inl})/\Sigma_p\, E_p.\ pwe_p) \quad (40)$$
$$FORINVNET = FCAP - \Sigma_{inl}\, BORROW_{inl} \quad (41)$$
$$DFR = FSAV - FCAP \quad (42)$$
$$PINV_p = \lambda_p.\ VA_p^{\lambda 1p}.(1 + RLOAN/PINDEX)^{\lambda 2p} \quad (43)$$
$$TOTINVEST = \Sigma_p(GINV_p + PINV_p) \quad (44)$$
$$DK_p = GINV_p + PINV_p - inv_p.\ X_p.\ PQ_p \quad (45)$$
$$FOREX = \Sigma_{inl}(MATURE_{inl}.\, DEBSERV_{inl}) \quad (91)$$
$$EXPEXR = \Delta_0(PFCAPOUT^{\Delta 1}.\, FOREX^{\Delta 2}) \quad (92)$$

$$PFCAP = PFCAPIN - PFCAPOUT \tag{93}$$

$$RLOAN = RFLOAN + (LEXPEXR - LEXR) + \tau.(\Omega + \Sigma_i(TDH_i/(TFH_i + CMFR)\,.\,EXR) + POLRISK) \tag{94}$$

Real sector market clearing

$$Q_p = XINTQ_p + HHCONQ_p + GC_p + ID_p + INVEN_p + ttind_p TTMTOT/PQ_p \tag{46}$$

$$FS_f = \Sigma_p\, FACDEM_{p,f} \tag{47}$$

$$SAVING = TOTINVEST \tag{48}*$$

$$GDPVA = \Sigma_p\, PVA_p.\ VA_p + INDTAX + TTMTOT \tag{49}$$

Note * Eq (48) is not explicitly included in the system; its function is merely to check Walras Law

Institution savings

$$BANKSAV = cm_1.\ X_{finser} \tag{50}$$

$$FIRMSAV = CORSAV - BANKSAV \tag{51}$$

$$BORROW_{govt} = (\Sigma_p\, GOVINV_p - GOVSAV)/EXR \tag{52}$$

Interest rates

$$RT = RLOAN - 0.03 \tag{53}$$

$$RAVG = (RT.(\Sigma_{ihh}\, TDH_{ihh} + \Sigma_p\, TDI_p + TDGOV) + RW.\ EXR.(\Sigma_{ihh}\, TFH_{ihh} + \Sigma_p\, TFI_p))/(\Sigma_{ihh}(TDH_{ihh} + EXR.\ TFH_{ihh}) + \Sigma_p(TDI_p + EXR.\ TFI_p + TDGOV)) \tag{54}$$

$$RQ = (Yf_{capital} - (RLOAN).\ \Sigma_p(LOAND_p + CBLOAN_p))/PEQ.\ \Sigma_p\, EQF_p \tag{55}$$

Institution portfolio

$$MDH_{ihh} = bmh_{0ihh}.\ YDISP_{ihh}^{bmh1ihh}.\ e^{(RT.bmh2ihh + (PINDEX - PINDEX0).bmh3ihh)}.\ PINDEX^{(1-bmh1ihh)} \tag{56}$$

$$CURRENCY = \Sigma_{ihh}\, MDH_{ihh}/(1 + ddcur) \tag{57}$$

$$MDI_p = gf_{1p}.\ PX_p.\ X_p \tag{58}$$

$$gh_{1hfin}/(1 - gh_{1hfin}) = phih_{1hfin}.((1 + RAVG)/(1 + RQ))^{epsh1hfin} \tag{59}$$

$$gh_{2hfor}/(1 - gh_{2hfor}) = phih_{2hfor}.((1 + RT)/(1 + RW + (EXR - EXR0)/EXR0))^{epsh2hfor} \tag{60}$$

$$TDH_{ihh} = gh_{2ihh}.\ gh_{1ihh}.(WEALH_{ihh} - MDH_{ihh})/EXR \tag{61}$$

$$TDI_p = gdi_p.\ LOAND_p \tag{62}$$

$$TFH_{ihh} = (1 - gh_{2ihh}).\ gh_{1ihh}.(WEALH_{ihh} - MDH_{ihh})/EXR \tag{63}$$

$$TFI_p = gfi_p.\ PK_p.\ DK_p/EXR \tag{64}$$

$$PEQ.\ EQH_{ihh} = (1 - gh_{1ihh})(WEALH_{ihh} - MDH_{ihh}) \tag{65}$$

$$EQROW = OEQROW + FORINVNET/PEQ \tag{66}$$

$$frow/(1 - frow) = phirow.((1 + RW)/(1 + RQ - EXR/EXR0))^{epsrow} \tag{67}$$

$$FORINVNET = (1 - frow).(FCAP - BORROW_{govt}) \tag{68}$$

$$BORROW_{compny} = frow.(FCAP - BORROW_{govt}) \tag{69}$$

$$fb_2/(1 - fb_2) = phib_2.((1 + RLOAN)/(1 + RW + (EXR - EXR0)/EXR0))^{epsb2} \tag{70}$$

Institution wealth

$$WEALH_{ihh} = mps_{ihh}.\ YHH_{ihh}.(1 - th_{ihh}) + OWEALH_{ihh} + (EXR - EXR0).\ OTFH_{ihh} + (PEQ - PEQ0).\ OEQH \quad (71)$$

$$WEALB = BANKSAV + OWEALB + (EXR - EXR0).(OCMFR - \Sigma_{ihh}\, OTFH_{ihh} - \Sigma_p\, OTFI_p) \quad (72)$$

$$WEALCB = CBSAV + OWEALCB + (EXR - EXR0).\ OCBFR \quad (73)$$

$$WEALG = GOVERNSAV + OWEALG - (EXR - EXR0).\ OGFBOR + (PEQ - PEQ0).\ OEQGOV \quad (74)$$

$$WEALROW = OWEALROW + FSAV + (PEQ - PEQ0).\ OEQROW \quad (75)$$

$$WEALF = OWEALF + FIRMSAV + (PEQ - PEQ0).\ OEQF \quad (76)$$

Institution financial constraint

$$CMRES = resd.(ddcur.\ CURRENCY + \Sigma_p\, MDI_p) + rest.(\Sigma_{ihh}(TDH_{ihh} + EXR.\ TFH_{ihh}) + \Sigma_p(TDI_p + EXR.\ TFI_p) + TDGOV) \quad (77)$$

$$BANKF = WEALB + ddcur.\ CURRENCY + \Sigma_{ihh}(TDH_{ihh} + EXR.\ TFH_{ihh}) + \Sigma_p(MDI_p + TDI_p + EXR^{*}TFI_p) + TDGOV - CMRES - SBI - PEQ.\ EQB \quad (78)$$

$$LOAND_p = lnshare_p.\ fb_2.\ BANKF \quad (79)$$

$$CMFR = (1 - fb_2).\ BANKF/EXR \quad (80)$$

$$CBFR = OCMFR + OCBFR - CMFR - DFR \quad (81)$$

$$RM = WEALCB + SBI + CMRES + CURRENCY \quad (82)$$

$$WEALF + EXR.(OFBOR + BORROW_{compny}) = PEQ.\ EQFF \quad (83)$$

$$RM + DDGOV = EXR.\ CBFR + PEQ.\ EQCB + \Sigma_p\, CBLOAN_p \quad (84)$$

$$WEALG + EXR.(OGFBOR + BORROW_{govt}) = DDGOV + TDGOV + PEQ.\ EQGOV \quad (85)$$

$$WEALROW + CBFR + CMFR = OGFBOR + OFBOR + \Sigma_{inl}\, BORROW_{inl} + PEQ.\ EQROW \quad (86)$$

$$PEQ.\ EQF_p + CBLOAN_p + LOAND_p = PK_p.\ FACDEM_{p,\,capital} + FACDEM_{p,\,land} + GOVINV_p + PINV_p + MDI_p + TDI_p + EXR.\ TFI_p \quad (87)$$

Equilibrium in asset market

$$\Sigma_p\, EQF_p = \Sigma_{ihh}\, EQH_{ihh} + EQFF + EQGOV + EXR.\ EQROW + EQB + EQCB \quad (88)$$

$$MULT = ((1 + ddcur) + (\Sigma_{ihh}(TDH_{ihh} + EXR.\ TFH_{ihh}) + \Sigma_p(MDI_p + TDI_p + EXR.\ TFI_p))/CURRENCY)/(1 + (WEALCB + CMRES + SBI)/CURRENCY) \quad (89)$$

$$CHECKV = \Sigma_{ihh}\, WEALH_{ihh} + WEALB + WEALCB + WEALF + WEALG + EXR.\ WEALROW - \Sigma_p(PK_p.\ FACDEM_{p,\,capital} + FACDEM_{p,\,land} + GOVINV_p + PINV_p) \quad (90)$$

A) Subscripts

p, pp	*Production sectors*
f	*Factors of production*

i	*Institutions*
inl	*Non-labor institution (Govt, Compny)*
ihh, ihhh	*Household (HH) categories*
pexp	*Export sectors*
hfin	*HH with interest-bearing assets*
hfor	*HH with foreign currency denominated assets*

B) Variables

Output supply and factor demand

D_p	*SALES OF DOMESTIC OUTPUT*
E_p	*EXPORTS*
M_p	*IMPORTS*
$INTM_p$	*COMPOSITE INTERMEDIATE INPUTS*
VA_p	*VALUE ADDED*
X_p	*DOMESTIC OUTPUT*
$FACDEM_{p,f}$	*SECTORAL FACTOR DEMAND*
WF_f	*AVERAGE (ACROSS SECTOR) FACTOR PRICE*
$WFDIST_{p,f}$	*FACTOR PRICE DISTORTION*

Aggregate demand

$XINTQ_p$	*TOTAL INTERMEDIATE DEMAND*
$HHCONQ_p$	*SECTORAL FINAL DEMAND FOR PRIVATE CONSUMPTION*
GC_p	*SECTORAL FINAL DEMAND FOR GOVERNMENT CONSUMPTION*
$\underline{GCTOT}$	*TOTAL VOLUME OF GOVERNMENT CONSUMPTION*
ID_p	*SECTORAL FINAL DEMAND FOR PRODUCTIVE INVESTMENT*
$INVEN_p$	*INVENTORY INVESTMENT BY SECTOR*

Prices

$\underline{EXR}$	*EXCHANGE RATE (Rupiah per US Dollar)*
PD_p	*DOMESTIC SALES PRICES*
PE_p	*DOMESTIC PRICES OF EXPORTS*
PINDEX	*COMPOSITE PRICE INDEX*
$\underline{PINDOM}$	*DOMESTIC PRICE INDEX*
PK_p	*PRICE OF CAPITAL GOODS BY SECTOR OF DESTINATION*
PM_p	*DOMESTIC PRICE OF IMPORTS*
$PINTM_p$	*INTERMEDIATE INPUT PRICE BY SECTOR*
PQ_p	*PRICE OF COMPOSITE GOODS (SUPPLY)*
PV_p	*VALUE ADDED PRICES*
PX_p	*AVERAGE OUTPUT PRICES*

Income and saving

YHH_{ihh}	HOUSEHOLD INCOME
$YCONS_{ihh}$	HOUSEHOLD DISPOSABLE INCOME
YF_f	FACTOR INCOME
YCORP	CORPORATE INCOME
REPAT	REPATRIATED PROFITS
$YCAP_{ihh}$	PERCAPITA HOUSEHOLD INCOME
GOVSAV	GOVERNMENT SAVINGS
GOVREV	GOVERNMENT REVENUE
GOVEXP	GOVERNMENT EXPENDITURE
HHSAV	HOUSEHOLD SAVINGS
INDTAX	INDIRECT TAX REVENUE (INCL. TARIFF)
TTMTOT	TOTAL TRADE&TRANSPORT MARGIN REVENUE
CORSAV	CORPORATE SAVINGS
SAVING	TOTAL SAVINGS

Investment and capital flows

FORINVNET	NET DIRECT FOREIGN INVESTMENT
DFR	CHANGE IN FOREIGN RESERVES
FSAV	FOREIGN SAVING
$BORROW_{inl}$	FOREIGN BORROWING
$INTEREST_{inl}$	INTEREST PAYMENTS ON FOREIGN DEBT (INCL. AMORTIZATION)
RLOAN	DOMESTIC LOAN INTEREST RATE
RFLOAN	FOREIGN LOAN INTEREST RATE
REPAT	PROFIT REPATRIATION
RISK	COUNTRY RISK
PFCAP	NET FOREIGN CAPITAL (BORROWING PLUS FOREIGN INVESTMENT)
TOTINVEST	TOTAL INVESTMENT
$PINV_p$	SECTORAL PRIVATE INVESTMENT BY SECTOR OF DESTINATION
DK_p	VOLUME OF INVESTMENT BY SECTOR OF DESTINATION
PFCAPOUT	PRIVATE CAPITAL OUTFLOWS
PFCAPIN	GROSS PRIVATE CAPITAL INFLOWS
PFCAP	NET PRIVATE CAPITAL INFLOWS
FOREX	FOREIGN EXCHANGE PRESSURE
EXPEXR	EXPECTED EXCHANGE RATE
LEXPEXR	LN(EXPECTED EXCHANGE RATE)
LEXR	LN(EXCHANGE RATE)

Interest rates and returns

RAVG	TIME DEPOSIT INTEREST RATE WEIGHTED AVERAGE
RW	WORLD INTEREST RATE(NOMINAL)
RQ	RATE OF RETURN TO EQUITY
RT	DOMESTIC TIME DEPOSIT INTEREST RATE

Savings

CBSAV	*CENTRAL BANK SAVING*
GOVERNSAV	*GOVT (EXCL CENTRAL BANK) SAVING*
BANKSAV	*COMMERCIAL BANK SAVING*
FIRMSAV	*FIRMS (EXCL COMM. BANKS) SAVING*

Wealth

$WEALH_{ihh}$	*HOUSEHOLD WEALTH*
WEALB	*COMMERCIAL BANK WEALTH*
WEALCB	*CENTRAL BANK WEALTH*
WEALG	*GOVERNMENT WEALTH*
WEALF	*FIRMS WEALTH*
WEALROW	*ROW WEALTH*

Equity

EQH_{ihh}	*HOUSEHOLD EQUITY HOLDING*
EQB	*COMMERCIAL BANK EQUITY HOLDING*
EQCB	*CENTRAL BANK EQUITY HOLDING*
EQFF	*FIRMS EQUITY HOLDING*
EQF_p	*SECTORAL EQUITY ISSUED*
EQGOV	*GOVERNMENT EQUITY HOLDING*
EQROW	*ROW EQUITY HOLDING*
PEQ	*PRICE OF EQUITY*

Financial assets

CURRENCY	*TOTAL DOMESTIC CURRENCY*
CMRES	*TOTAL COM BANK REQUIRED RESERVE IN CENTRAL BANK*
SBI	*CENTRAL BANK CERTIFICATE HELD BY COM BANK*
CMFR	*COM BANK FOREIGN RESERVES*
CBFR	*CENTRAL BANK FOREIGN RESERVES*
$LOAND_p$	*SECTORAL COM BANK LOAN DEMAND*
$CBLOAN_p$	*SECTORAL CENTRAL BANK LOAN DEMAND*
DDGOV	*GOVERNMENT DEMAND DEPOSIT AT CENTRAL BANK*
MDH_{ihh}	*HH MONEY DEMAND*
MDI_p	*SECTORAL COMPANY DEMAND DEPOSIT*
TDH_{ihh}	*HH DOMESTIC TIME DEPOSIT*
TDI_p	*SECTORAL COMPANY DOMESTIC TIME DEPOSITS*
TFH_{ihh}	*HH TIME DEPOSITS IN FOREIGN CURRENCY*
TFI_p	*SECTORAL TIME DEPOSITS IN FOREIGN CURRENCY*
TDGOV	*GOVT DOMESTIC TIME DEPOSIT AT COM BANK*
RM	*CENTRAL BANK RESERVE MONEY*
M2	*BROAD MONEY*
MULT	*BROAD MONEY MULTIPLIER*
BANKF	*AVAILABLE COM BANK FINANCIAL FUND*

Market clearing

Q_p	*SUPPLY OF COMPOSITE GOODS*
$\underline{FS}_{f\_}$	*SUPPLY OF FACTORS*
CHECKV	*CHECK VARIABLE*
GDP	*GDP AS SUM OF VALUE ADDED IN MARKET PRICES*

C) Parameters

mps_{ihh}	*MARGINAL PROPENSITY TO SAVE BY HOUSEHOLD TYPE*
$transihh_{ihh,\,ihhh}$	*INTER-HOUSEHOLDS TRANSFER RATE*
ctax	*TAX RATE FOR CORPORATE INCOME*
$gconsq_p$	*SECTORAL SHARES OF GOVERNMENT CONSUMPTION*
ε_p	*EXPONENT FOR ARMINGTON FUNCTION*
τ_p	*EXPONENT FOR CET FUNCTION*
η_p	*CES (ARMINGTON) FUNCTION SHARE PARAMETER*
μ_p	*EXPONENT FOR VALUE ADDED FUNCTION*
ρ_p	*EXPONENT FOR OUTPUT PRODUCTION FUNCTION*
tm_p	*TARIFF RATES ON IMPORTS*
$tdom_p$	*INDIRECT TAX RATES ON DOMESTIC GOODS*
ttd_p	*TRADE&TRANSPORT MARGIN RATE ON DOMESTIC GOODS*
tti_p	*TRADE&TRANSPORT MARGIN RATE ON IMPORT GOODS*
$ttind_p$	*SHARE OF TTMTOT SPENT ON COMPOSITE GOODS*
th_{ihh}	*HOUSEHOLD TAX RATE*
λ_p	*SHIFT PARAMETER FOR PRIVATE INVESTMENT*
$\lambda 1_p$	*VALUE-ADDED ELASTICITIES FOR PRIVATE INVESTMENT*
$\lambda 2_p$	*DOMESTIC INTEREST RATE ELASTICITIES FOR PRIVATE INVESTMENT*
α_0	*INTERCEPT FOR RISK EQUATION*
α_1	*COEFFICIENT FOR RISK EQUATION*
degree	*DEGREE OF OPENESS OF CAPITAL ACCOUNT*
σ_1	*COEFFICIENT FOR FOREIGN CAPITAL RELATED TO "degree"*
σ_0	*INTERCEPT FOR FOREIGN CAPITAL (AUTONOMOUS)*
$aaq_{p,pp}$	*INPUT-OUTPUT COEFFICIENT*
ac_p	*ARMINGTON FUNCTION SHIFT PARAMETER*
at_p	*CET FUNCTION SHIFT PARAMETER*
av_p	*VALUE ADDED FUNCTION SHIFT PARAMETER*
ax_p	*OUPUT PRODUCTION FUNCTION SHIFT PARAMETER*
bc_p	*ARMINGTON FUNCTION SHARE PARAMETER*

$alphq_{p,ihh}$	*HHLD CONSUMPTION SHARE PARAMETER (COBB-DOUGLAS)*
bt_p	*CET FUNCTION SHARE PARAMETER*
$\beta_{p,f}$	*FACTOR SHARE PARAMETER FOR VALUE ADDED FUNCTION*
δ_p	*OUTPUT PRODUCTION FUNCTION SHARE PARAMETER*
wtd_p	*SECTORAL WEIGHTS FOR DOMESTIC PRICE INDEX*
wtq_p	*SECTORAL WEIGHTS FOR COMPOSITE PRICE INDEX*
$GINV_p$	*SECTORAL GOVERNMENT INVESTMENT*
GTRANTOT	*TOTAL GOVT TRANSFERS TO HOUSEHOLDS*
$ROWTRAN_{ihh}$	*FOREIGN TRANSFERS TO HOUSEHOLDS*
inv_p	*RATIO OF INVENTORY INVESTMENT TO GROSS OUTPUT*
$capmat_{p,pp}$	*CAPITAL MATRIX*
pwe_p	*WORLD PRICE OF EXPORTS*
pwm_p	*WORLD PRICE OF IMPORTS*
$factoin_{i,f}$	*COEFFICIENT FOR MAPPING FACTOR INCOME TO INSTITUTIONS*
MATURE	*MEASURE OF MATURITY*
POLRISK	*POLITICAL RISK*

Portfolio shares

$gh1_{ihh}$	*SHARE OF HH PORTFOLIO IN TIME DEPOSIT*
$gh2_{ihh}$	*SHARE OF HH TIME DEPOSIT IN DOMESTIC TIME DEPOSIT*
fb_2	*SHARE OF BANK FUND IN LOAN*
frow	*SHARE OF FOREIGN CAPITAL IN PRIVATE BORROWING*

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