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Measuring Economy-wide Impacts of a Financial Shock

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This article analyses the transmission of financial shock to household income distribution using the case of Indonesia. Presumably, those benefiting from currency depreciation and high interest rate during the crisis are the high-income groups. However, the same groups might lose since they were employed in sectors that are highly import-dependent. On the production side, construction was the hardest-hit sector during the crisis, and thus the low-income non-agricultural households were more susceptible due to their heavy reliance on manual work in construction. This sector also proves to be instrumental in transmitting the shock from the credit crunch to the fall in household income. To the extent that a formal social safety net is lacking, an informal system of inter-household network is expected to mitigate the impact on the poor. However, we found that there is no convincing evidence that households acted altruistically to assist their distressed neighbours during the crisis.

I. Introduction

The onset of the Asian financial shock in the summer of 1997 led to a simultaneous contraction of almost all sectors of production in the crisis-hit country. While the theory of propagation mechanisms from the financial to the real sector in business cycle has been explored (see, for example, Bernanke, Gertler, and Gilchrist 1996), empirical works that aim to identify and measure a shock impact within a general equilibrium framework are rare. This paper attempts to fill the gap.

Using the specific case of Indonesia, Thorbecke (1998) and Azis (1998, 2000*a*) were among the first who attempted to adopt a general equilibrium model for such an analysis. While the former used the Social Accounting Matrix (SAM) multipliers, the latter traced the economy-wide impacts using Structural Path Analysis (SPA) and subsequently employed a price-endogenous CGE model with detailed specifications of the financial sector.[1]

The limitation of previous SAM multipliers and SPA studies was the arbitrary manner with which the shock is introduced to the modelled economic system. Within these studies, the standard practice was to induce an artificial fall in the output of sectors that are known *ex-post* to contract during the crisis. Such an *ad hoc* method of introducing shock into the system does not capture the actual mechanics of the crisis which was triggered by movements in the financial variables (i.e., foreign capital) rather than in production. The problem is

that sectoral output can decline because of numerous types of shocks, of which a financial turmoil is only one of them. Simply reducing the sectoral output artificially thus fails to recognize the origin of the crisis and neglects the linkage between financial sector and the rest of the economy.

Another consequence of an *ad hoc* introduction of the shock is that it prohibits us from gauging the magnitude of the contraction if the crisis had been the only shock that occurred, *ceteris paribus*. Instead of determining endogenously the impact of the crisis on production, the decline in production is predetermined exogenously based on actual data as if the decline is all due to the financial crisis. This tacit assumption is likely to bias any study of impact estimation. The sources of the bias are the exclusion of other shocks that had nothing to do with the financial crisis (for example, the El Nino-induced drought that caused agriculture-crop failures, and massive haze problems that led to further decline in the agricultural output).

Using a more sophisticated financial CGE model would be desirable. However, the needed data are often lacking, and capturing the intricate mechanisms of variables in such a model is far from easy. In this paper, we propose an alternative method to transcend the aforementioned limitation of the standard SAM-based approach without having to construct a CGE model. Specifically, we augment the standard SAM by incorporating a fairly detailed financial sector based on the flow-of-funds data, thus allowing financial variables to be the original source of the shock (a standard SAM condenses financial transactions into a single savings/investments account). While the concept of the flow-of-funds matrix is not new, our contribution is in the *explicit* use of such matrix in the SAM system. The construction of the flow-of-funds matrix is described in the Appendix.

II. Methodology

The standard inverse of $(I - A_n)$ from the following multiplier M_a

$$y_n = A_n y_n + x = (I - A_n)^{-1} x = M_a x, \qquad (1)$$

is a useful tool for estimating the impact of an exogenous shock on income of the endogenous accounts. It captures the direct and indirect effects of the shock. However, a multiplier analysis does not reveal the network of paths through which an injection is transmitted (Defourney and Thorbecke 1984). To identify the principal paths of transmission, we employ the SPA method.

The starting point in SPA is to equate the intensity of an "influence" travelling from pole i to pole j as the SAM average propensity a_{ji}.[2] Define an *arc* (i, j) as the link between the pole of origin and that of destination. Define a *path* as a sequence of consecutive arcs — the *length* of which is the number of arcs between the origin and destination poles. For example, *arc* (i, j) is a path with unit length, whereas *path* (i, x, y, j) has length equal to three. An *elementary path* is a path that does not pass more than once through the same pole. In contrast, a *circuit* is a path for which the starting pole of an influence is also its destination pole. For example, the *path* (x, y, z, x) is a circuit.

SPA recognizes three types of "influences", namely (1) direct influence *DI*; (2) total influence *TI*; and (3) global influence *GI*. The distinction among these influences will be explored next. But first, Figure 1 illustrates these three types of influences travelling from pole i to pole j. Figure 1A illustrates direct influence *DI*, Figure 1B total influence *TI*, and Figure 1C global influence *GI*.

Direct influence $DI_{(i \to j)}$ travels through the elementary path that connects two poles i and j. It is defined as the change in income or production of pole j induced by an additional one dollar (or any unit of currency) generated in i. A direct influence $DI_{(i \to j)}$ that travels along an *arc* (i, j) is equal to the average expenditure propensity a_{ji}:

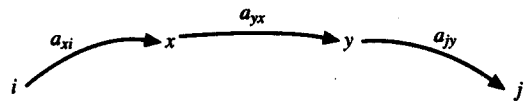
$$DI_{(i \to j)} = a_{ji}. \qquad (2)$$

But $DI_{(i \to j)}$ can also travel along a *path* $(i, \ldots, j)$ with length greater than one, in which case its magnitude is the product of the intensities of the arcs connecting the path. For example, the direct influence that traverses the *path* (i, x, y, j) has the magnitude $a_{xi} \cdot a_{yx} \cdot a_{jy}$ (see Figure 1A).

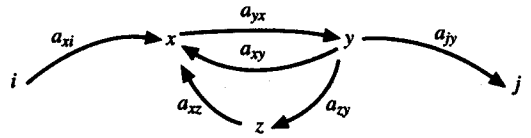
In most cases, poles along an elementary path

FIGURE 1
Types of Influences in a Structural Path Analysis

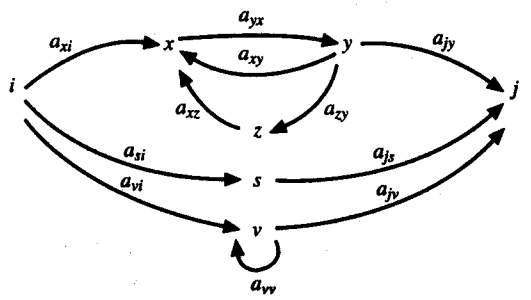
(A) Direct influence on *path*(i, x, y, j)



(B) Total influence on *path*(i, x, y, j), including adjacent circuits



(C) Global influence: All elementary paths and circuits linking poles i and j



are connected to other poles or paths, forming closed circuits that amplify the direct influences. Total influence $TI_{(i\to j)}$ along the *path* $(i, \ldots, j)$ is defined as $DI_{(i\to j)}$ plus all of the indirect effects of the circuits formed along that path. For example, the direct influence $a_{xi}a_{yx}$ in Figure 1B is transmitted back from y to x, creating a circuit with the magnitude $(a_{xi}a_{yx})(a_{xy} + a_{zy}a_{xz})$, which in turn is transmitted back to y. Hence, a series of feedback impulses are generated along that circuit, yielding a new set of multipliers:

$$a_{xi}a_{yx}[I - a_{yx}(a_{xy} + a_{zy}a_{xz})]^{-1}. \quad (3)$$

To compute total influence, the term in Equation 3 has to be multiplied by a_{jy} because an influence has to traverse the *arc* (y, j) before reaching the final destination at pole j (see Figure 1B). The resulting total influence $TI_{(i\to j)}$ is therefore:

$$TI_{(i\to j)} = a_{xi}a_{yx}a_{jy}[I - a_{yx}(a_{xy} + a_{zy}a_{xz})]^{-1}. \quad (4)$$

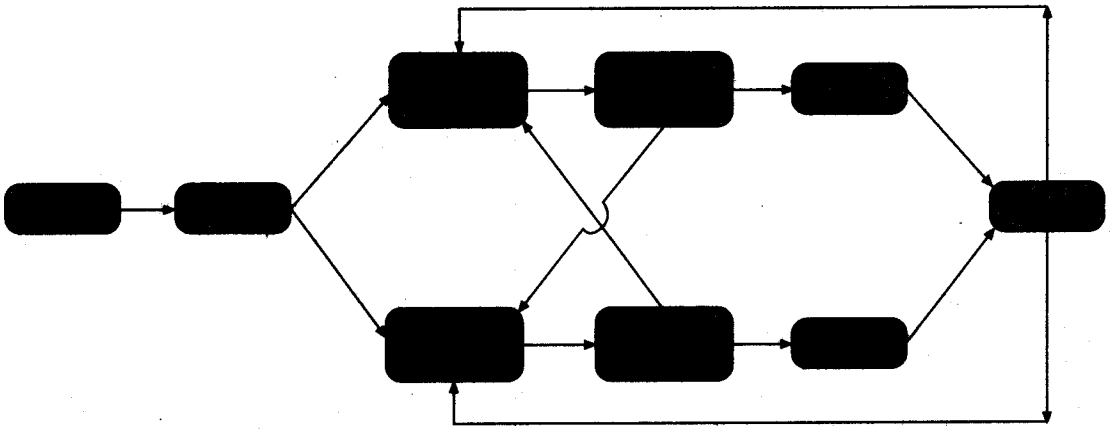
The sum of all total influences $TI_{(i\to j)}$ between poles i and j constitutes global influence $GI_{(i\to j)}$, which measures the total changes in production or income of pole j due to injecting pole i with one dollar of additional income. In effect, global influence $GI_{(i\to j)}$ encapsulates all the direct as well as the feedback effects generated by the adjacent circuits (see Figure 1C). By construction, the magnitude of $GI_{(i\to j)}$ is equal to the SAM multiplier $M_{a_{ij}}$, and hence the matrix of multiplier M_a (see Equation 1) can also be called the matrix of global influence.

In analysing the impact of a crisis, the pertinent question is how the contraction in production due to the shock affects various types of labours and ultimately different household groups.

To see how SPA can be utilized against the backdrop of a financial crisis, consider a hypothetical economy with a single household, two sectors (agriculture and manufacturing), and two factors of production (capital and labour). In such an economy, capital rents and labour wages constitute the total earnings of household. For simplicity, assume also that agriculture exclusively employs labour, while manufacturing employs only capital. However, let us assume that the production of agriculture requires the intermediate input from the manufacturing sector and vice versa.

Suppose that in such a hypothetical economy, foreign investors suddenly decide to withdraw their capital investments (i.e., a financial shock due to the reverse flows of foreign capital). Figure 2 shows the paths through which such an exogenous shock in *Foreign Capital* is transmitted to *Household*. The neoclassical story here is as follows. First, the withdrawal of foreign capital leads to a contraction in real investments, which reduces the sales of both manufacturing and agriculture goods, in turn depressing the production of both. As a result, capital and labour experience a fall in income, which translates into lower household income. Alternatively, the Keynesian story is as follows. An imminent financial crisis due to the flight of foreign capital leads to a general expectation of an economic

FIGURE 2
SPA of a Hypothetical Economy



contraction, and hence falling revenues for business firms. Anticipating a looming depression, firms respond by reducing their inventories *vis-à-vis* lower output, yet in doing so inevitably affect household incomes in an adverse manner.

Consider the elementary path *Foreign Capital → Investments → Manufacturing Sales → Manufacturing Production → Capital → Household.* Component of the shock that travels directly through that elementary path, without detour, represents an instance of the direct influence $DI_{(Foreign\ Capital \rightarrow Household)}$.

However, part of the shock travelled from manufacturing production to agriculture sales via an input-output link, then hitting back manufacturing sales via the other input-output link. Such a path contains the circuit *Sales: Manufacturing → Manufacturing Production → Agriculture Sales → Agriculture Production → Manufacturing Sales* (recall that a circuit begins and ends on the same pole). The direct influence and the circuit-feedback effects constitute an instance of the total influence $TI_{(Foreign\ Capital \rightarrow Household)}$.

Finally, the cumulative impact of all total influences between foreign capital and household represents the global influence $GI_{(Foreign\ Capital \rightarrow Household)}$. By construction, the magnitude of the global influence is equal to the multiplier impact on household income due to $1 of foreign capital withdrawal.

III. Multiplier Analysis

For the multiplier analysis, we endogenize 94 out of 102 accounts from the 1995-SAM. The standard (real sector) SAM is expanded by incorporating the flow-of-funds matrix compiled from various sources.[3]

The following are the stages of simulation:

1. Foreign equity flows (*vis-à-vis* portfolio investments) plunged by 92 per cent between 1995 and 1997.
2. In the same period between 1995 and 1997, time deposits denominated in local currency (rupiah) fell by 75 per cent, while foreign currency deposits rose by 572 per cent.
3. Subsequently, between 1997 and 1998 the flows of foreign private debt fell by 824 per cent. The outflows of private capital, however, were compensated to some extent by the inflows of official foreign debts (mainly IMF debt disbursements). We assume that the

inflows of official debts translated into a 150 per cent increase in government spending (both on- and off-budget).

4. During 1997–98 the liquidity credit issued by the Indonesian central bank increased by 690 per cent.
5. Finally, between 1998 and 1999 there was a severe credit crunch such that commercial bank credit plunged by 188 per cent. We assume that in this last stage of the simulation, banks extended no new loans to businesses. That is, extended new credit fell to zero.

A series of tables are generated (available upon request) following the above stages (normalized by setting the base run to unity). On the trend of value-added, at the end of stage 5 the worst performing sectors relative to the base run are, from worst to better, construction, banking and insurance, mining, social services, and trade and storage. The best performing sectors are, in declining order, public administration, textiles, restaurant and hotel, air transportation, and food crops.

The massive decline in service-oriented activities appears due to their close link to the financial sector *vis-à-vis* foreign portfolio investments and commercial bank loans. By contrast, manufacturing sectors performed relatively better because they consist mostly of medium and small-scale enterprises that are less dependent on the banking system. In addition, exports of the manufacturing sector constituted a significant portion of output and thus were less susceptible to a recession in the domestic market.

It is worth noting that the agricultural sector never appears as one of the hardest-hit sectors in any stage of the simulation. This finding shows that the contraction in agricultural sector was not due to the financial crisis, but rather to the fortuitous drought brought about by El Nino and other weather-related factors (Johnson 1998). This sector remains the economy's main generator of employment despite its declining share in output and became even more so during the crisis.[4] The crisis actually had reversed the shift of employment from agriculture to manufacturing. While employment in virtually every other sector contracted, agriculture employment actually rose by 10 per cent. In light of the fall in manufacturing exports, evidently workers had drifted from tradable activities in manufacturing back to agriculture.

On the labour income, at the end of stage 5, the worst-fared factors relative to the base run are, from worst to better, manual paid rural, unpaid urban professionals, manual paid urban, manual unpaid urban, and private capital. While the best performing factors are, in declining order, paid rural professionals, paid urban professionals, clerical paid rural, unpaid agricultural workers, and paid agricultural workers.

The trend of incomes of institutions shows that in stage 1 the flight of foreign equity led to a declining income for all institutions. The hardest-hit households here are rural low (−6.22 per cent), urban low (−5.89 per cent), urban high (−5.31 per cent), small farmers (−5.11 per cent), and medium farmers (−5.10 per cent). In stage 2, the shift from the rupiah time deposits to foreign currency deposits resulted only in a marginal increase of income across all households.

In stage 3, institutions that are most adversely affected are private companies (−157.40 per cent), domestic banks (−45.55 per cent), urban low (−14.77 per cent), urban high (−12.80 per cent), and urban non-labour (−11.26 per cent). At this stage, the five worst-fared institutions relative to the base run are private companies, domestic banks, urban low, urban high, and urban non-labour. It comes as no surprise that private companies and domestic banks suffered the most from the capital outflows. At the same time, however, there is an inflow of official debts (including from the IMF).

It is noteworthy that in contrast to stage 2, at the end of stage 3 urban households become the hardest-hit households replacing their rural counterparts. This reversal of ranking is due to the fact that rural households benefited significantly from increased government spending and, hence, experienced a lower fall in income than did the urban dwellers. Thus, due to higher government expenditures funded by IMF debt disbursements, in stage 3 households that fared the *best* relative to

the base run are those headed by agricultural employees, small farmers, rural low, rural high, and large farmers. The relatively shielded income of agricultural workers is consistent with the actual realization.

In stage 4, liquidity injection from the central bank (*Bantuan Likuiditas Bank Indonesia* or BLBI) to the private sector prevented institutions from a collapse, and in some cases they even grew at the following rates: domestic banks (+65.17 per cent), private companies (+7.30 per cent), urban low (+1.73 per cent), rural low (+1.70 per cent), and urban high (+1.51 per cent). As expected, domestic banks and private companies benefited significantly from BI liquidity injection. At this stage, the hardest-hit institutions relative to the base run consists of private companies, urban low, urban high, urban non-labour, and medium farmers.

However, as the largest recipient banks are politically powerful, BLBI created an extreme opportunity for "moral hazard". More seriously, the facility was extended without the central bank being able to exercise any control over the uses that the recipient banks made of it. Within just a few months, the extended BLBI reached Rp100 trillion, much of which was used to buy foreign exchange and shift assets abroad. As a result, and despite the massive liquidity injection, a credit crunch was inevitable, severely curtailing the income of institutions further. The most adversely affected are private companies (−18.65 per cent), urban low (−13.97 per cent), rural low (−13.78 per cent), urban high (−12.25 per cent), and medium farmers (−11.49 per cent). At the end of this stage, the hardest-hit institutions relative to the base run are (from worst to better) private companies, urban low, urban high, rural low, and medium farmers. The best performing households are (in declining order) agricultural workers, small farmers, rural high, large farmers, and urban non-labour.

While generally the above outcomes are consistent with the actual data, the ranking for real incomes in 1995 and 1998 is slightly different, i.e., urban low (−18.9 per cent), rural non-labour (−17.2 per cent), urban non-labour (−16.1 per cent), rural low (−12.9 per cent), and urban high (−10.9 per cent). Two explanations account for the discrepancy. First, our simulation excludes non-financial shocks that also had adverse consequences on the economy (for example, El Nino-induced draught, the political turmoil that brought down the Soeharto government, and the haze problems). In a sense, our model succeeded in establishing the *net* impact of a shock due to the financial crisis alone by holding everything else constant. The other missing element is the effect of changes in relative prices — due to large currency depreciation and liquidity crunch during the crisis — that cannot be captured within an exogenous-price model. A systematic impact analysis of relative-price changes must resort to a price-endogenous CGE model.

Despite the limited disaggregation of household level, our simulation was able to replicate the actual changes in *aggregate* measures of income inequality. An unambiguous comparison of aggregate inequality requires a cardinal measure. We chose to employ measures that satisfy the symmetry, replication invariance, mean independence, and transfer axioms, namely coefficient of variations, Gini coefficient, and Theil entropy index (Sen 1997).

We compute the inequality measures to facilitate comparison of household income distribution based on actual 1995 SUSENAS data with that implied in the last stage of our model simulation. This comparison is thus based on aggregate data rather than household-level data. It is revealed that all measures suggest the distribution of income became less unequal due to the series of events during the crisis. The more egalitarian distribution is consistent with the *actual* reported Gini coefficients, both overall and in urban and rural areas, which had been on a declining trend during the crisis (Irawan and Romdiati 2000).

The robustness of the above finding can be checked through a sensitivity analysis. We found that under a broad range of income elasticities, there is no change in the ranking of hardest-hit sectors, factors, and households due to the multiplier impact of the crisis. Specifically, varying households' income elasticity of consumption

between 0.9 and 1.1 result in the same ranking of hardest-hit sectors, factors, and households. Moreover, under no circumstances the multipliers differ from the original by more than 2 per cent. There is a minor rearrangement outside of the top-five most-affected accounts, but our conclusion from the previous section remains unchanged. Hence, even if, as often suggested, the structure of the SAM changed during the crisis, it has little bearing on the results of our impact analysis.

IV. Structural Path Analysis

To open the "black box", a further step is taken to disentangle the inextricably linked relationship between the financial sector and the real sector and the income block. This is accomplished by using a structural path analysis (SPA), which decomposes the SAM multipliers (or the global influences) into direct and indirect influences.

Decomposing a large-scale SAM is not a trivial task. In the Indonesian case where ninety-four accounts are designated as endogenous, the number of elementary paths between any two poles can be very large.[5] However, we found that in the case of the Indonesian SAM it is extremely rare to find a path of length four or longer transmitting more than 0.1 per cent of the global influence. Below we present the results from applying SPA selectively to the stages in which institutions experienced a decline in income, namely, stages one, three, and five.

Multiplier analysis identifies five institutions that suffered the most from the flight of foreign equity (stage 1), namely, rural low, urban low, urban high, small farmers, and medium farmers. Here we seek to establish the channels through which the shock was transmitted from foreign equity to these households. We shall use the prefixes *P* and *D* to abbreviate production activity and domestic commodity, respectively. For example, *PFood* denotes the activity of producing food crops, whereas *DFood* designates the commodity (output) from that sector that was sold domestically.

Table 1 shows the application of SPA to the paths that link foreign equity *ForEquity* to the hardest-hit household groups. In all cases, households suffered due to the fall in investment demand *Invest* for the output from various sectors. *Construction* proved to be the dominant channel of transmission: either the first- or the second-largest total influence *TI* is transmitted via construction. It can also be seen that except for urban high *UrbHigh*, the hardest-hit households suffered primarily because of the loss in income as manual-paid workers *ManPd* in the construction sector.

In light of the fact that construction was the hardest-hit sector during the crisis, SPA shows how the flight of foreign equity translated into the fall in household income via declining construction activity. However, the extent to which income was affected by the decline in construction is not uniform across different groups. In particular, the low-income non-agricultural households were more susceptible due to heavy reliance on income from their occupation as manual workers in construction. In the case of rural low, the cumulative total influence *TI* transmitted from foreign equity to construction to manual workers (both paid and unpaid) to rural low constituted 44.6 per cent of the global influence *GI* originated in foreign equity (case 1, Table 1). For urban low, cumulative total influence from the same paths made of 31.4 per cent of the global influence (case 2, Table 1).

By contrast, the élite urban high and the poor agricultural households of small and medium farmers exhibited more diversified sources of income. In the case of urban high, the shock from foreign equity was transmitted mainly through clerical paid workers *ClerPdUrb* in the *banking* sector (6.4 per cent of *GI*), while a close second was the transmission via construction to this category of workers (5.9 per cent of *GI*).

Figure 3 exhibits the three largest paths (in terms of *TI/GI*) for each of the three households that were hit the hardest in stage 1, namely, rural low, urban low, and urban high. The figure is meant to show the ubiquitous channels through which construction affects the hardest-hit households.

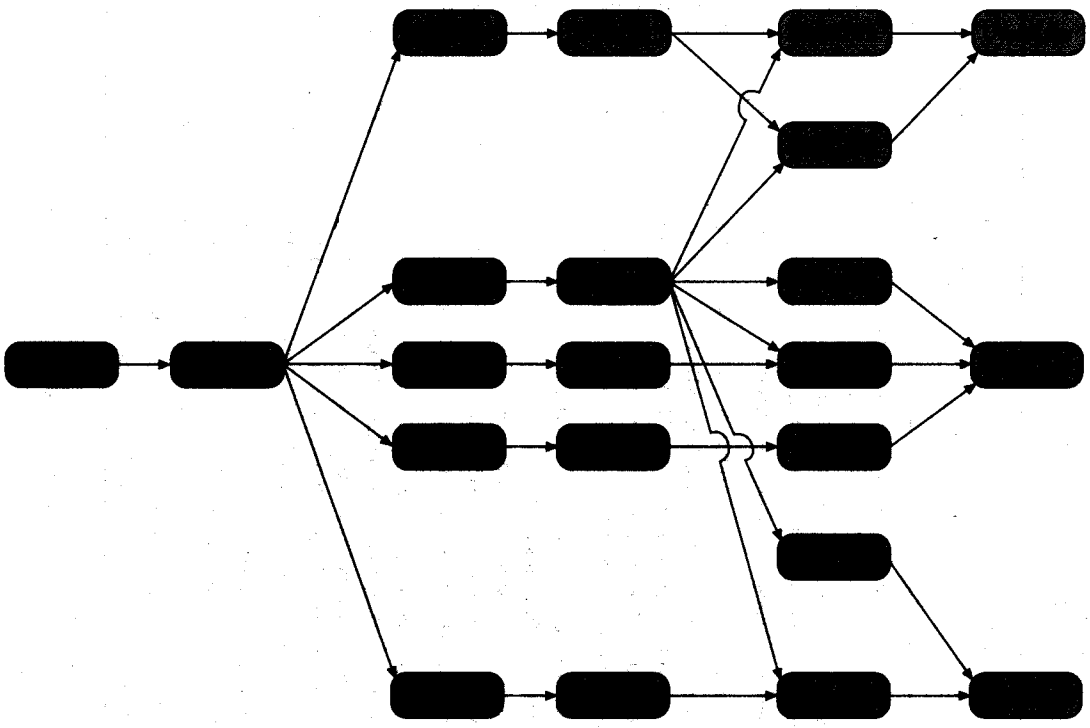
In stage 3, multiplier analysis indicates that private companies, domestic banks, urban low, urban high, and urban non-labour are the

TABLE 1
Structural Path Analysis: Foreign Equity as the Pole of Origin

Case	*Origin of Shock (i)*	*Destination (j)*	*Global Influence GI*	*Elemenary Path i → j*	*Direct Influence DI*	*Path Multiplier M_p*	*Total Influence TI*	*TI/GI (%)*
1	ForEquity	RurLow	0.103	ForEquity → Invest → DConstruct → PConstruct → ManPdRur → RurLow	0.032	1.267	0.041	39.5
				ForEquity → Invest → DConstruct → PConstruct → ManURur → RurLow	0.004	1.267	0.005	5.1
				ForEquity → Invest → DNonFood → PNonFood → Land → RurLow	0.000	1.651	0.001	0.5
				ForEquity → Invest → Dmining → PMining → ManPRur → RurLow	0.001	1.271	0.001	1.0
				ForEquity → Invest → Dmining → PMining → ManURur → RurLow	0.001	1.270	0.001	0.6
2	ForEquity	UrbLow	0.138	ForEquity → Invest → DConstruct → PConstruct → ManPdUrb → UrbLow	0.028	1.313	0.037	26.7
				ForEquity → Invest → DConstruct → PConstruct → ManUUrb → UrbLow	0.005	1.306	0.006	4.7
				ForEquity → Invest → DTextile → PTextile → ManPdUrb → UrbLow	0.002	1.680	0.003	2.4
				ForEquity → Invest → DConstruct → PConstruct → ClerPdUrb → UrbLow	0.002	1.365	0.003	2.0
				ForEquity → Invest → Dbank → PBank → ClerPdUrb → UrbLow	0.002	1.459	0.003	2.2
3	ForEquity	UrbHigh	0.141	ForEquity → Invest → DBank → PBank → ClerPdUrb → UrbHigh	0.006	1.446	0.009	6.4
				ForEquity → Invest → DConstruct → PConstruct → ClerPdUrb → UrbHigh	0.006	1.357	0.008	5.9
				ForEquity → Invest → DConstruct → PConstruct → ProfPdUrb → UrbHigh	0.005	1.329	0.007	5.0
				ForEquity → Invest → DConstruct → PConstruct → OtCapUrb → UrbHigh	0.004	1.357	0.005	3.8
				ForEquity → Invest → DConstruct → PConstruct → ManPdUrb → UrbHigh	0.003	1.378	0.004	3.0
4	ForEquity	FarmSml	0.050	ForEquity → Invest → DConstruct → PConstruct → ManPdRur → FarmSml	0.004	1.278	0.005	10.1
				ForEquity → Invest → DConstruct → PConstruct → OtCapRur → FarmSml	0.001	1.315	0.002	3.7
				ForEquity → Invest → DNonFood → PNonFood → AgUnpaid → FarmSml	0.000	1.724	0.001	1.1
				ForEquity → Invest → DTextile → PTextile → OtCapRur → FarmSml	0.000	1.681	0.001	1.4
				ForEquity → Invest → Dconstruct → PConstruct → ManPdUrb → FarmSml	0.001	1.303	0.001	1.4
5	ForEquity	FarmMed	0.027	ForEquity → Invest → DConstruct → PConstruct → ManPdRur → FarmMed	0.001	1.241	0.001	4.8
				ForEquity → Invest → DConstruct → PConstruct → OtCapRur → FarmMed	0.001	1.285	0.001	3.6
				ForEquity → Invest → DNonFood → PNonFood → AgPaid → FarmMed	0.000	1.609	0.000	0.1
				ForEquity → Invest → DNonFood → PNonFood → AgUnpaid → FarmMed	0.000	1.706	0.000	1.2
				ForEquity → Invest → DNonFood → PNonFood → ManPRur → FarmMed	0.000	1.611	0.000	0.0

NOTES: These abbreviations are used: For factors of production: *Ag* = Agricultural, *Man* = Manual Operator, *Cler* = Clerical, *Pro* = Professional, *Pd* = Paid, *U* = Unpaid, *Rur* = Rural, *Urb* = Urban (e.g. *AgPdUrb* = Agricultural Paid Urban), *OtCapRur* = Other (Unincorporated) Rural Capital, *OtCapUrb* = Other (Unincorporated) Urban Capital, *PrivCap* = Private Capital. For institutions: *Rur* = Rural, *Urb* = Urban. For production: *P* = Production sector, *D* = Domestic Commodity.
SOURCE: Authors' simulation using the Indonesian 1995 SAM augmented by the flow of funds.

FIGURE 3
Paths from a Shock in Foreign Equity: Ubiquitous Channels Through Which Construction Affects Household Incomes



institutions that suffered the most when foreign lenders refused to rollover the debts of the private sector. Table 2 shows that the impact on private companies was a direct consequence of the sudden reversal in foreign debt flows (98.5 per cent of *GI*), while other channels were essentially trivial. It is thus through the direct impact of the reversal in foreign debt flows that Indonesian corporations ended up as the most battered institution during the crisis. In the case of domestic banks, *DomBank*, the direct channel was also dominant (33.7 per cent of *GI*), but the indirect impact due to client companies withdrawing their time deposits (23.2 per cent of *GI*) and reducing their equity participation (22.8 per cent) was significant as well. Indeed, the inter-linkages between client firms and banks during the Asian financial crisis based on the balance sheet effect (Krugman 2001) have been identified clearly by some authors. Using the case of Korea, Bae, Kang, and Lim (2002) discussed such inter-linkages through the bank and firm values.

For the three household groups that were hardest hit in this stage, none of the individual paths was significant enough to contribute more than 2 per cent of *GI*.

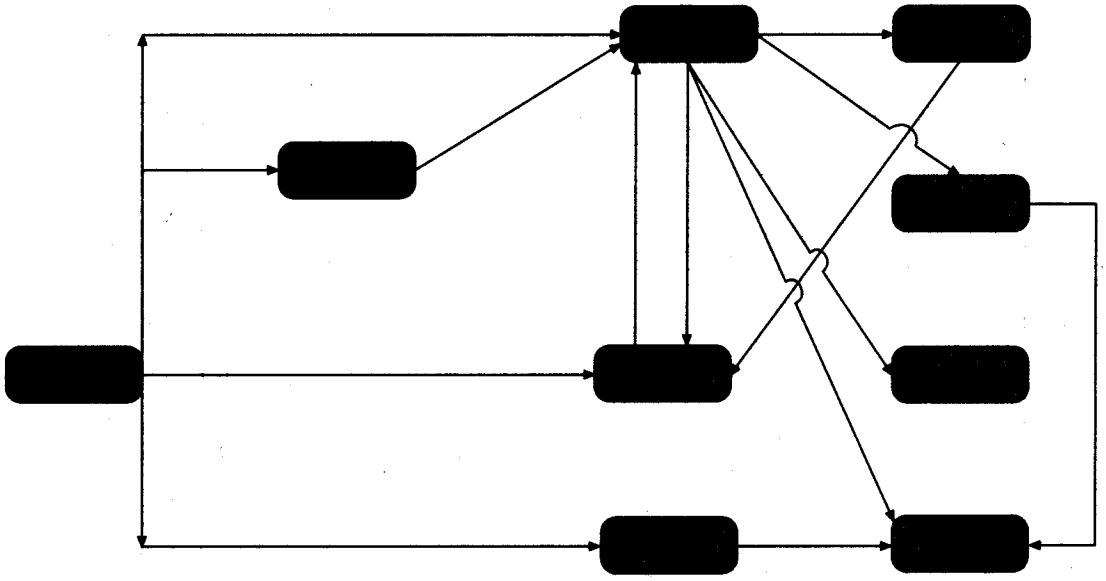
Figure 4 illustrates the relationships contained in Table 2. To avoid clutter we show only the three largest paths (in terms of *TI/GI*) for each of the five institutions that were hardest hit in stage 1. Figure 4 reveals that, in contrast to stage 1 where the shock from foreign equity was reverberated to households via production activities, here the shock from foreign debt was transmitted either directly or through inter-institution transfers. Further, the role of private companies is pivotal in the circular distribution of the transfers. For example, the shock from foreign debt was partly

TABLE 2
Structural Path Analysis: Foreign Debt as the Pole of Origin

Case	*Origin of Shock (i)*	*Destination (j)*	*Global Influence GI*	*Elemenary Path i → j*	*Direct Influence DI*	*Path Multiplier M_p*	*Total Influence TI*	*TI/GI (%)*
1	ForDebt	Company	0.708	ForDebt → Company	0.642	1.087	0.697	98.5
				ForDebt → DomBank → Company	0.001	1.146	0.001	0.2
				ForDebt → CentralBank → Company	0.000	1.105	0.000	0.0
				ForDebt → CentralBank → DomBank → Company	0.000	1.146	0.000	0.0
				ForDebt → ForBank → CentralBank → Company	0.000	1.106	0.000	0.0
2	ForDebt	DomBank	0.189	ForDebt → DomBank	0.059	1.081	0.064	33.7
				ForDebt → Company → TimeDpt → DomBank	0.038	1.146	0.044	23.2
				ForDebt → Company → DomBank	0.038	1.146	0.043	22.8
				ForDebt → Company → ForDpt → DomBank	0.012	1.147	0.014	7.6
				ForDebt → Company → DemandDpt → DomBank	0.008	1.146	0.009	5.0
3	ForDebt	UrbLow	0.048	ForDebt → Company → UrbLow	0.000	1.246	0.000	0.2
				ForDebt → DomBank → Company → UrbLow	0.000	1.303	0.000	0.0
4	ForDebt	UrbHigh	0.049	ForDebt → Company → UrbHigh	0.000	1.282	0.000	0.1
				ForDebt → DomBank → Company → UrbHigh	0.000	1.330	0.000	0.0
5	ForDebt	UrbNonLabour	0.010	ForDebt → Company → UrbNonLabour	0.000	1.123	0.000	1.6
				ForDebt → Company → RurHigh → UrbNonLabour	0.000	1.257	0.000	0.0
				ForDebt → Company → UrbLow → UrbNonLabour	0.000	1.282	0.000	0.0
				ForDebt → DomBank → Company → UrbNonLabour	0.000	1.180	0.000	0.0

NOTES: These abbreviations are used: For factors of production: *Ag* = Agricultural, *Man* = Manual Operator, *Cler* = Clerical, *Pro* = Professional, *Pd* = Paid, *U* = Unpaid, *Rur* = Rural, *Urb* = Urban (e.g., *AgPdUrb* = Agricultural Paid Urban), *OtCapRur* = Other (Unincorporated) Rural Capital, *OtCapUrb* = Other (Unincorporated) Urban Capital, *PrivCap* = Private Capital. For institutions: *Rur* = Rural, *Urb* = Urban. For production: *P* = Production sector, *D* = Domestic Commodity.
SOURCE: Authors' simulation using the Indonesian 1995 SAM augmented by the flow of funds.

FIGURE 4
Paths from a Shock in Foreign Debt: Channels Through Which Corporate and Banking Sectors Affect Household Incomes



transmitted via the banking system to companies, which in turn withdrew their time deposits in domestic banks and reduced their dividend payments to urban low, urban high, and urban non-labour.

In the final stage, multiplier analysis shows that credit crunch severely curtailed the income of private companies, urban low, rural low, urban high, and medium farmers. Table 3 shows that here also the construction sector proves to be instrumental in transmitting the shock from the credit crunch to the fall in household income. But the *textile* sector emerges as an important secondary channel, particularly for companies, urban low, and rural low. Figure 5 illustrates these relationships, but limited to the three largest paths for the top three institutions that were hardest hit in this stage.

There is a held belief that in the absence of a reliable social security system, household transfers in Indonesia rose spontaneously as a substitute. Household transfers flowing through the network of households that are closely connected due to family ties, same ethnic background, location proximity, or just plain desire to assist the poor during a period of hardship. This network is a manifestation of the "Asian value" that encourages the voluntary act of helping the poor neighbours. In effect, transfers serve as a privately-funded social safety net that arose from the altruistic motive of the benevolent, better-off households. Thus, changes in the SAM transfer matrix are of special interest because they may reflect the altruistic motive of households to assist their distressed neighbours.

Here we shall examine the transfers of income among various economic institutions. Inter-institutional transfers, which constitute a redistribution of income, can originate from households (for example, rural parents supporting students in urban areas or urban workers sending remittances to retired parents in rural areas), from companies (for example, dividends), and from the government (for example, direct subsidy to poor households). The term "transfer" refers to the occasion where money changed hands between two parties but not in exchange for goods consumed or services rendered.

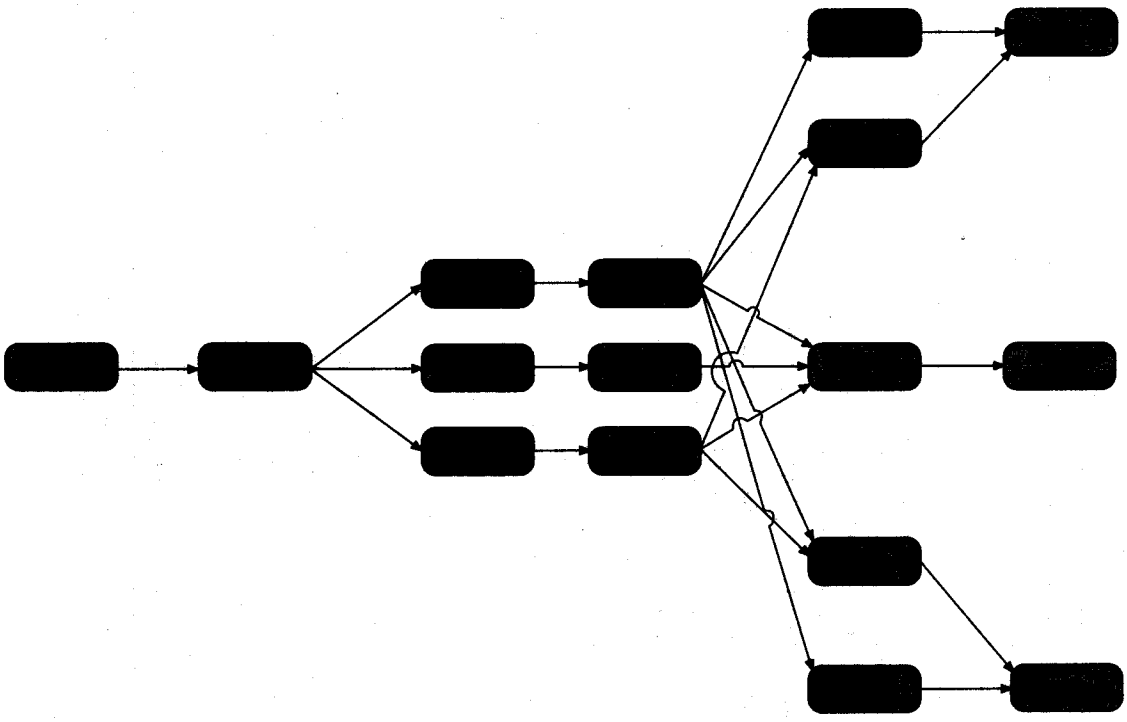
TABLE 3
Structural Path Analysis: Credit as the Pole of Origin

Case	*Origin of Shock (i)*	*Destination (j)*	*Global Influence GI*	*Elemenary Path i → j*	*Direct Influence DI*	*Path Multiplier M_p*	*Total Influence TI*	*TI/GI (%)*
1	Credit	Company	0.148	Credit → Invest → DConstruct → PConstruct → PrivCap → Company	0.043	1.181	0.051	34.2
				Credit → Invest → DBank → PBank → PrivCap → Company	0.008	1.281	0.010	6.6
				Credit → Invest → DTextile → PTextile → PrivCap → Company	0.004	1.513	0.005	3.7
				Credit → Invest → DPaper → PPaper → PrivCap → Company	0.002	1.409	0.003	1.9
				Credit → Invest → DConstruct → PConstruct → OtCapUrb → Company	0.001	1.273	0.001	0.5
2	Credit	UrbLow	0.138	Credit → Invest → DConstruct → PConstruct → ManPdUrb → UrbLow	0.028	1.313	0.037	26.7
				Credit → Invest → DConstruct → PConstruct → ManUUrb → UrbLow	0.005	1.306	0.006	4.7
				Credit → Invest → DTextile → PTextile → ManPdUrb → UrbLow	0.002	1.68	0.003	2.4
				Credit → Invest → DConstruct → PConstruct → ClerPdUrb → UrbLow	0.002	1.365	0.003	2.0
				Credit → Invest → DBank → PBank → ClerPddUrb → UrbLow	0.002	1.459	0.003	2.2
3	Credit	RurLow	0.103	Credit → Invest → DConstruct → PConstruct → ManPdRur → RurLow	0.032	1.267	0.041	39.5
				Credit → Invest → DConstruct → PConstruct → ManURur → RurLow	0.004	1.267	0.005	5.1
				Credit → Invest → DTextile → PTextile → ManPdRur → RurLow	0.001	1.626	0.001	1.1
				Credit → Invest → DConstruct → PConstruct → OtCapRur → RurLow	0.001	1.332	0.001	1.1
				Credit → Invest → DMining → PMining → ManPdRur → RurLow	0.001	1.271	0.001	1.0
4	Credit	UrbHigh	0.141	Credit → Invest → DBank → PBank → ClerPdUrb → UrbHigh	0.006	1.446	0.009	6.4
				Credit → Invest → DConstruct → PConstruct → ClerPdUrb → UrbHigh	0.006	1.357	0.008	5.9
				Credit → Invest → DConstruct → PConstruct → ProPdUrb → UrbHigh	0.005	1.329	0.007	5.0
				Credit → Invest → DConstruct → PConstruct → OtCapUrb → UrbHigh	0.004	1.357	0.005	3.8
				Credit → Invest → DConstruct → PConstruct → ManPdUrb → UrbHigh	0.003	1.378	0.004	3.0
5	Credit	FarmMed	0.027	Credit → Invest → DConstruct → PConstruct → ManPdRur → FarmMed	0.001	1.241	0.001	4.8
				Credit → Invest → DConstruct → PConstruct → OtCapRur → FarmMed	0.001	1.285	0.001	3.6
				Credit → Invest → DNonFood → PNonFood → AgPaid → FarmMed	0.000	1.609	0.000	0.1
				Credit → Invest → DNonFood → PNonFood → AgUnpaid → FarmMed	0.000	1.706	0.000	1.2
				Credit → Invest → DNonFood → PNonFood → ManPdRur → FarmMed	0.000	1.611	0.000	0.0

NOTES: These abbreviations are used: For factors of production: *Ag* = Agricultural, *Man* = Manual Operator, *Cler* = Clerical, *Pro* = Professional, *Pd* = Paid, *U* = Unpaid, *Rur* = Rural, *Urb* = Urban (e.g. *AgPdUrb* = Agricultural Paid Urban), *OtCapRur* = Other (Unincorporated) Rural Capital, *OtCapUrb* = Other (Unincorporated) Urban Capital, *PrivCap* = Private Capital. For institutions: *Rur* = Rural, *Urb* = Urban. For production: *P* = Production sector, *D* = Domestic Commodity.
SOURCE: Authors' simulation using the Indonesian 1995 SAM augmented by the flow of funds.

FIGURE 5

Paths from a Shock in Bank Credits: Channels Through Which Financial, Real, and Construction Sectors Affect Household Incomes



If altruism indeed motivated households to assist their low-income and hardest-hit neighbours, then we would expect to see an increasing share of transfers to low-level urban and rural households as well as to small farmers. Based on the 1995 and 1999 data, it is revealed that the percentage of transfers to the low-income and hardest-hit households actually *decreased* virtually across the board.

The decrease in the share of transfers to hardest-hit groups must be offset by an increase somewhere else. In 1999, the majority of households increased their share of transfers mainly to rural non-labour force and rural high households. This finding is unexpected since these two household groups were neither the poorest nor the hardest hit by the crisis. Even more baffling is the fact that a number of households — notably large farmers, rural high, and the poor urban low — significantly increased their share of transfers to the affluent high-level urban households. Although urban high households experienced a sharp percentage decline in real per capita income, their absolute level of income was still comfortably greater than urban low households which, against all conventional wisdom, increased their transfers to urban high by 150 per cent.

To summarize, there is no convincing evidence that households acted altruistically to assist their distressed neighbours during the crisis. In addition, it appears that redistribution *vis-à-vis* inter-household transfers has become increasingly more *regressive*. That is, households allocated a lower share of their transfers to the destitute and hardest-hit small farmers and rural low households, while allocating higher shares to the well-off rural high and urban high households.

IV. Conclusions

The transmission of financial shock to household income distribution is analysed using the case of Indonesia. It is shown that a general equilibrium approach based on a financial sector-augmented SAM can be used to overcome some of the major limitations of the standard SAM-based approach. By integrating financial and real sector, the model can capture clear inter-linkages among variables, resolving some arbitrary hypotheses. The Asian financial crisis that began with the massive selling of financial assets (currency, stocks, and debts) in anticipation of further exchange rate depreciation, generated a particular pattern of income distribution. Those benefiting from currency depreciation and high interest rate are presumably the high-income groups who held dollar-denominated assets and had a large saving account. However, the same income groups might lose if they were employed in sectors that are highly dependent on imports. As shown in the case of Indonesia, the resulting net impact on the relative income distribution is ambiguous because the movement of financial variables often compensates the effect of real-side variables.

In view of the fact that construction was the hardest-hit sector, the low-income non-agricultural households were more susceptible due to their heavy reliance on manual work in that sector. The construction sector also proves to be instrumental in transmitting the shock from the credit crunch to the fall in household income. To the extent that a formal social safety net is lacking, informal system is expected to mitigate the impact on the poor. It is therefore intriguing that we found no convincing evidence that households acted altruistically to assist their distressed neighbours during the crisis. The redistribution *vis-à-vis* inter-household transfers has in fact become increasingly more *regressive*.

Yet another key finding of our study is the pivotal role of government current expenditures (both on- and off-budget) in protecting the income of rural households. We showed that without an increase in government expenditures, rural households would have ended up as the hardest-hit households. Thus, even despite the absence of formal social safety nets (i.e., direct transfers from the government to low-income households), government expenditures could stimulate production in those sectors that provide the principal source of employment for rural households.

Since SAM is now available in practically all ASEAN countries hit by the crisis, it would be useful to conduct a similar analysis in those countries. While the multiplier analysis provides the direct and indirect effects of the shock (the "what"), SPA is able to capture the mechanism that produce such effects (the "how").

Appendix

Construction of the Flow of Funds

Merging the real SAM with the flow of funds guarantees that the base run is equilibrated in two fronts (Robinson 1991). First, the real SAM assures equilibrium in the commodity markets and in the balance of payments. The second equilibrium is in the market for loanable funds, guaranteed by the flow-of-funds matrix *vis-à-vis* the matching of aggregate savings (supply of funds) with total investments (demand for funds). The matrix of flow of funds can be inserted into the real SAM by replacing the column of investments and the row of savings, in effect "zooming into" the saving/investment account. However, the Indonesian statistical bureau (BPS) has yet to publish the flow of funds in a matrix format. The data for the construction of the flow-of-fund matrix thus have to be compiled from various sources. First, savings and investments data are derived from the real SAM, which is necessary to guarantee the consistency between the real economy and the financial sector. The assets and liabilities of commercial banks and the monetary authority (i.e., the central bank) are posted in the website of Bank of Indonesia (http://www.bi.go.id). Foreign portfolio investments, direct investments, and debts are taken from the World Bank publication of *Global Development Finance*. Government's equity participation is proxied by the development expenditures of the central government posted in the website of the Indonesian statistical bureau (http:// www.bps.go.id). Finally, the exchange rate (the average Rp/U.S.$ rate is used to convert transactions denominated in foreign currency) is from the IMF publication of *International Financial Statistics*.

Our starting point is to divide companies, which is recognized as a single institution in the real SAM, into commercial banks and non-bank "companies". The former is broken down further into "domestic banks" and "foreign banks". The government, which was a single entity in the real SAM, is divided into the "central bank" and the "government"; the former regulates the monetary sector, while the latter affects the economy primarily through fiscal policies. The financial actors thus consist of households, production sectors, the central bank, the government, domestic banks, foreign banks, companies, and the rest of the world.

Next, we need to select the different categories of financial instruments. At the top level, we classify financial assets into five types: "foreign non-equity assets", "domestic currency and bank deposits", "equity", "domestic loans", and "interbank instruments". Foreign non-equity assets include those assets issued abroad, such as U.S. T-bills, as well as foreign holding of domestically issued debts, which consist of both long-term and short-term debts of the government and the private sector. Bank deposits comprise those components of broad money M_2, namely demand (checking) deposits, time deposits, and deposits denominated in foreign currencies. Equity is subdivided according to whether the owner is domestic or foreign. The last category is the interbank instruments which refer to those at the disposal of the central bank to regulate the banking system, including required reserves and liquidity support.

A proper analysis of the resulting change in income distribution requires a disaggregation of households' flow of funds. Since the breakdown of the flow of funds by household groups is not available, we use the distribution of currency and bank deposits by household groups as in Thorbecke (1992). To guarantee that savings of household group j are consistent with the real SAM figures, we compute household j's change in equity holding as the residual, i.e., by subtracting changes in currency and bank deposits from savings.

NOTES

1. A similar approach was also used in Azis (2000*b*) to investigate the impact of the downfall of the manufacturing sector on household income.
2. An "influence" is the metaphor in the literature for an additional flow of income or output, which can be either positive or negative.
3. The eight exogenous variables are as follows: foreign equity (comprising foreign portfolio and direct investments), foreign non-equity assets (including public and private debt values), time deposits denominated in rupiah, deposits denominated in foreign currency (both checking and saving deposits), commercial bank credits, central bank, the government, and the rest of the world. In our simulation, we replicate the series of shocks according to the actual changes of these exogenous variables between 1995 and 1999.
4. The agricultural sector accounts for one-third of GDP in the early 1970s, 23 per cent in the early 1980s, and 15 per cent in 1997.
5. For example, 844 elementary paths were identified in the French input-output table, which was disaggregated into only *six* sectors. See Defourny and Thorbecke (1984, p. 123).

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