

How the Asian Crisis Affected the World Economy: A General Equilibrium Perspective

Xinshen Diao, Wenli Li, and Erinc Yeldan

It has been more than two years since the financial crisis first broke out in East Asia in the summer of 1997. Now that much of the dust has settled, it is clear that the world economy was far from being mired in a global slump.¹ Furthermore, although the growth in the crisis-afflicted countries and other emerging market economies did slow quite significantly, growth was sustained in North America and Western Europe. Indeed, growth accelerated in some cases.²

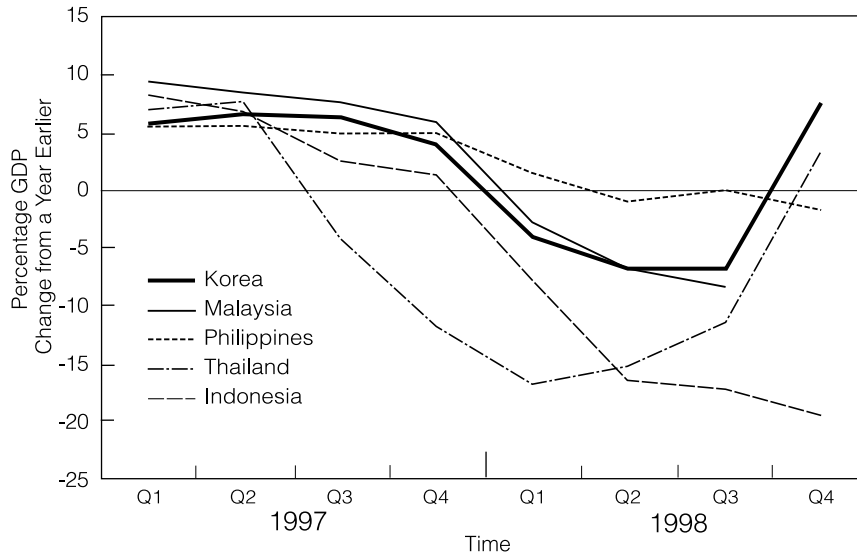
Until very recently, the conventional view was rather pessimistic. Observers feared that the economic stress that had begun in Southeast Asia would worsen and spread. For the world economy as a whole, as well as for key industrial countries, growth was expected to be slower, risks higher, and flows of capital further dislocated. Even in the United States, a country that, for most of its history, has shrugged off economic turmoil abroad, there was a fair amount of nervousness. Many economists forecasted much slower growth rates for the next few years (see among others, DRI forecasts) in light of the intensity of

■ Xinshen Diao: Trade and Macroeconomics Division, International Food Policy Research Institute. Wenli Li: Research Department, Federal Reserve Bank of Richmond. Erinc Yeldan: Department of Economics, Bilkent University, Ankara, Turkey. We would like to thank Bob Hetzel, Ned Prescott, and Roy Webb for their comments. The views expressed in this article are those of the authors; they do not represent the views of the Federal Reserve Bank of Richmond or the Federal Reserve System.

¹ According to “World Economic Outlook” (December 1998 and May 1999), annual percentage changes from a year earlier for world output are 4.3, 4.2, 2.5 and 2.3 for 1996, 1997, 1998, and 1999 respectively. The average growth rate for world output between 1990 and 1999 is 3.4 percent.

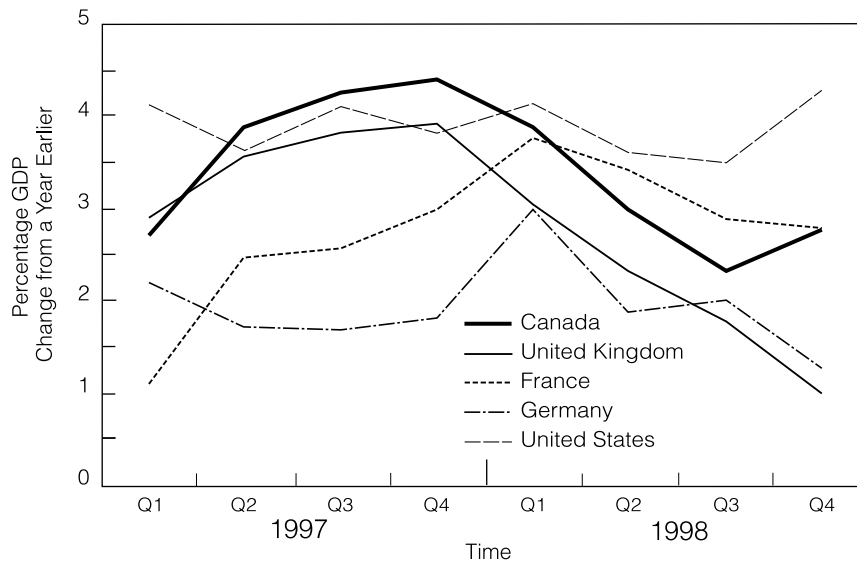
² Figure 1 depicts the change of GDP in selected Asian countries, while Figure 2 contrasts the behavior of GDP over the same period in major industrial economies. Source: “World Economic Outlook and International Capital Markets Interim Assessment,” IMF, December 1998.

Figure 1 Selected Asian Economies: Real GDP Growth



Source: IMF, International Financial Statistics

Figure 2 Selected Industrial Economies: Real GDP Growth



Source: IMF, International Financial Statistics

the Asian crisis and the distinct possibility that it could spread worldwide. The puzzling question that naturally arises is, “Why didn’t the whole world economy enter a slump?”

In this article, we attempt to answer this question from a general equilibrium perspective. The strategy here is to use a standard growth model augmented with multi-region and multi-production sectors to analyze how a set of real shocks hitting crisis countries affects the world economy as well as economies in different regions. These shocks, as will become clear later, are identified by recent research on the causes of the crisis. The mechanism that connects regions and that transmits shocks across them consists of two links: commodity trade and capital flows. Our analysis shows that much of the fear of a global recession spreading to industrial economies was not well grounded. Moreover, the burden of adjustment to the crisis was uneven across regions. The developing countries bore the brunt of this adjustment, suffering declines in economic activities. By contrast, industrial countries escaped largely unscathed. The impact the crisis had on them was small and even positive in its initial stages.

This article does not attempt to explain the crisis and its causes. Rather it measures, with the aid of a general equilibrium model of real trade and capital flows, the spillover effects of the crisis on the other regions of the world. Surprisingly, while various explanations of the East Asian financial crisis have been advanced, little effort has been devoted to analyzing its effects on the world economy. More is the pity, for the importance of such an analysis is great and indeed goes beyond what we conduct in this article. The results here suggest that policy actions that have generally been viewed as responsible for the robust growth of industrialized nations in the face of the financial crisis may not matter much after all. These actions include monetary policies adopted by industrial countries. They also include the stabilization and reform package that Asian crisis countries implemented at the insistence of the IMF. In other words, it could well be that many common concerns were overstated and not based on careful economic analysis.

1. WHAT HAPPENED?

While there is little consensus on the definite causes of the crisis, there is now evidence that the region’s economies had been confronting a deteriorating macroeconomic environment since the early 1990s (see, e.g., Krugman [1998], Radelet and Sachs [1998], Flood and Marion [1998], Corsetti et al. [1998], Chang [1999], and Whitt [1999]). A description shared by many is that given by Chang [1999]).

Several countries in the region experienced a real appreciation in their currencies during the 1990s and by 1997 had sustained sizable current account

deficits. These deficits were mostly financed through short-term foreign borrowing. Foreign portfolio and direct investment, attracted by the region's record economic growth for more than two decades, had also occurred. The growth rate of exports and industrial output in crisis countries, on the other hand, slowed substantially during the same period. This trend was largely the result of the weak Japanese import demand combined with disinflationary aggregate demand policies in most Asian economies.

The rapid inflow of capital and the slowing of growth unveiled a host of inherent structural problems in the region's financial systems. These problems included (1) lack of competition, supervision, and regulation of the financial sector, and (2) heavy government intervention in credit allocation. Under these conditions, financial intermediaries whose liabilities were guaranteed by the respective governments naturally posed a serious problem of moral hazard in which government guarantees subsidized and induced increased risk-taking, and resulted in excessive borrowing and lending, mostly from abroad.

The essence of the crisis was a huge, sudden reversal of capital flows that was a manifestation of private investors attempting to liquidate their claims brought on by a lack of confidence in the countries' financial systems. Accustomed to large-scale capital inflows, the sudden turnaround in flows was an enormous shock to the Asian economies. Moreover, with a dramatic depreciation in the real value of their currencies and high domestic interest rates, domestic credit conditions tightened, which led to a rapid rise in non-performing loans and a sudden loss of bank capital. The resulting collapse of domestic bank capital added to the contraction by further restricting bank lending. The result was the abandonment of planned investments by some firms and the curtailing of production activities by others. Accompanying the decline in current income and diminished expectations of future income, the consumption demand fell. All of the crisis countries experienced a collapse in GDP growth in 1998.

2. ECONOMICS OF ADJUSTMENT TO CRISIS

The crisis affected the rest of the world, not only through the international financial system, but also through international commodity trade and capital mobility. Since one region's imports are another's exports, the decline in imports of crisis countries, agriculture for example, can cause agricultural exporting countries to experience a decrease in their exports, and hence a fall in farm receipts. The higher the ratio of agricultural exports to total production, the larger the negative effects are likely to be.

A decline in the prices of internationally traded inputs tends to lower production cost, thus affecting the competitiveness of various sectors depending on the intensity of the use of these inputs in production. Offsetting the decline in intermediate input cost is the cost of purely domestic resources, such as

labor, that are not traded internationally. The cost of these resources may rise due to the expansion of production at home.

Another effect of the crisis is through capital markets. Capital leaving crisis countries will flow into non-crisis countries, putting downward pressure on interest rates there. The reduced domestic interest rates will in turn stimulate investment and thus growth in the domestic capital stock. Sectors that experienced increased capital formation, either directly or indirectly from these flows, will respond by increasing their demand for other resources whose productivity is increased by growth in capital stock. Thus, the growth in capital stock can, by increasing the demand for labor and associated inputs, also contribute to the bidding up of the prices of purely domestic or non-traded resources and further raise the cost of production.

Effects of the Asian crisis on the world economy depend, in the long run, on three factors: the extent to which pre-crisis expectations of long-run returns to capital were grossly in error; the likelihood that the crisis will spread to other regions; and post-crisis policies of crisis-ridden economies.

3. MODEL ECONOMY

We formalize the argument presented above, and estimate the spillover effects of the crisis on other regions of the world economy in this section. Our model, employed in the following paragraphs, belongs to the family of multi-sector, multiregion, computable general equilibrium setups. These frameworks are used widely to analyze the impact of global trade liberalization and structural adjustment programs. Our model, which draws in many ways upon recent contributions by McKibbin (1993), Mercenier and Sampaio de Souza (1994), Mercenier and Yeldan (1997), and Diao and Somwaru (2000), incorporates considerable detail on sectoral output, consumption, and trade flows—both bilateral and global.³ The model excludes financial market phenomena that capture effects such as investor confidence. Nevertheless, as will be demonstrated later, the model and the assumed shocks that disturb it account for most of the falls in investment, output, and terms of trade observed in the Asian countries. One does not need to revert to less well-defined concepts as “financial contagion,” “financial fragility,” and so on to explain the real effects of the Asian crisis.

Our scheme is to model the inherent structural problem of crisis economies as overinvestment in certain sectors. The outbreak of the crisis and its subsequent development are modeled as an impulse and response mechanism. The impulse takes the form of an adverse shock to sectoral total factor

³ Noland, Robinson, and Wang (1999) uses a similar but static computable general equilibrium framework to analyze the impact of the Asian Financial Crisis on the world economy under the assumption that Japan and/or China depreciate their currencies.

productivity and to the risk premium associated with investment in these sectors. For example, a negative shock means that productivity falls and the risk premium rises. Such an increase in risk premium can be due to either policy changes that eliminate governmental benefits to firms or impair the collateral firms could offer to potential investors.

The Asian financial crisis has also had serious negative effects on aggregate employment of resources. Many firms throughout the region went bankrupt, and the rate of labor unemployment rose. Instead of specifying increased unemployment or closed factories, however, we allowed all resources to remain employed but reduced their efficiency, thereby generating the same fall in output. The magnitude of these shocks is described in more detail below as we analyze different scenarios.

To begin then, the closed world economy is divided into three open-trading regions: developing economies, developed economies, and crisis economies. We will specify countries in each region in the next section. There are four production sectors in each region, and they each produce a single aggregate commodity. These sectors include (1) agriculture and food processes (agriculture); (2) mineral, materials, and intermediates (intermediaries); (3) manufacturing; and (4) services.

Within each region, a representative consumer makes joint decisions on consumption and savings. Similarly, on the supply side, a representative producer in each sector makes production and investment decisions simultaneously. The model also incorporates multilateral trade and capital flows among the regions. Commodities produced for domestic markets are assumed imperfect substitutes for those imported from abroad. The price of a good imported by a region, therefore, is not necessarily the same as the price of the same good produced at home or exported to other regions. A detailed description of the model is as follows.

Firms

Producers within each sector of a region are aggregated into a representative firm. A firm makes production and investment decisions to maximize its intertemporal profits. In doing so, the firm chooses levels of labor and intermediate inputs every period, taking as given prices of outputs, the wage rate, prices of intermediate inputs, and the stock of capital. Outputs are either sold in the domestic market or exported to foreign markets.

Firms are owned by a representative household or consumer, and investment is financed by the household's domestic saving and international borrowing. At each period, firms' profits, $div_{n,i,t}$ —equivalent to the gross revenue minus labor costs, intermediate input costs, and investment costs—are distributed to the household. Investment raises the stock of capital but there exist capital adjustment costs. Investment goods are purchased from other sectors,

as well as from firms' outputs. Investment goods can also be imported from abroad. Formally, a firm's problem can be described as follows:

$$\max_{\{I_{n,i,t}, L_{n,i,t}, ITD_{n,j_1,i,t}, \dots, ITD_{n,j_J,i,t}\}} V_{n,i} = \sum_{t=1}^{\infty} R_{n,i,t} div_{n,i,t} \quad (3.1)$$

s.t.

$$X_{n,i,t} = f(L_{n,i,t}, K_{n,i,t}, ITD_{n,j_1,i,t}, \dots, ITD_{n,j_J,i,t}), \quad (3.2)$$

$$K_{n,i,t+1} = (1 - \delta_{n,i})K_{n,i,t} + I_{n,i,t}, \quad (3.3)$$

where $div_{n,i,t} \equiv P_{n,i,t}X_{n,i,t} - \sum_j PC_{n,j,t}ITD_{n,j,i,t} - w_{n,t}L_{n,i,t} - PI_{n,i,t}I_{n,i,t}(1 + \phi_{n,i}\frac{I_{n,i,t}}{K_{n,i,t}})$; $V_{n,i}$ is the value of firm i in region n in the first period; $R_{n,i,t} = \prod_{s=1}^t \frac{1}{1+r_{n,s}}$ is the discount factor for future returns; $X_{n,i,t}$ is the final output; $P_{n,i,t}$ is the price of the output; $L_{n,i,t}$, $K_{n,i,t}$, and $ITD_{n,j,i,t}$ are, respectively, labor, capital, and intermediate inputs in the production of $X_{n,i,t}$; $w_{n,t}$ is the wage rate; $PC_{n,j,t}$ is the price of the intermediate input used by firm i in the production of $X_{n,i,t}$; $I_{n,i,t}$ is the quantity of new capital equipment built through investments at time t ; $PI_{n,i,t}$ is the price of the investment good; $\delta_{n,i}$ is the capital depreciation rate; and $\phi_{n,i}\frac{I_{n,i,t}}{K_{n,i,t}}$ is the adjustment cost per unit of capital investment.

Due to the presence of adjustment cost on capital, marginal products of capital differ across sectors resulting in unequal, though optimal, rates of investments. Furthermore, once investment becomes realized as fixed physical capital, it cannot be reinvested in other sectors, especially in other assets such as foreign bonds. There also exists other regional risk factors associated with investment. We model such risk by adding a risk premium on the interest rate faced by firms. That is, in each region, firms face an interest rate defined as

$$r_{n,t} = (1 + \pi_{n,t})r_t, \quad (3.4)$$

where $\pi_{n,t}$ is the risk premium for firms and is defined as an exogenous variable in the model, and r_t is the riskless interest rate facing the world. For our purposes, we assume the riskless interest rate prevails in developed economies.

A Cobb-Douglas production function relates the output of new capital equipments with the inputs in the form of sectoral goods. These inputs can be either produced domestically or imported. Hence, $PI_{n,i,t}$ can be written as a function of composite prices:

$$PI_{n,i,t} = A_{n,i}\Pi_j PC_{n,j,t}^{d_{n,i,j}}, \quad (3.5)$$

where $A_{n,i}$ is the efficient coefficient for investment, $PC_{n,j,t}$ is the price of the composite good, $0 < d_{n,i,j} < 1$ and $\sum_j d_{n,i,j} = 1$.

Households

In each region a representative household owns labor and financial assets, including the equity in domestic firms and foreign bonds. The household allocates income to consumption and savings to maximize lifetime utility:

$$\max \sum_{t=1}^{\infty} \left(\frac{1}{1+\rho} \right)^t U(TC_{n,t}) \quad (3.6)$$

subject to the following budget constraint:

$$SAV_{n,t} = w_{n,t}L_{n,t} + TI_{n,t} + div_{n,t} + r_t B_{n,t-1} - PTC_{n,t}TC_{n,t}, \quad (3.7)$$

where ρ is the positive rate of time preference, $TC_{n,t}$ is the aggregate consumption at time t , $SAV_{n,t}$ is the household saving, $B_{n,t-1}$ is the stock of foreign assets, $r_t B_{n,t-1}$ is the interest earned from ownership of foreign bonds, $PTC_{n,t}$ is the consumer price index, and $TI_{n,t}$ is the lump-sum transfer of government revenues from taxes and tariffs. We assume no government saving-investment behavior. The government spends all its tax revenues either on consumption or as transfers to the household. $TC_{n,t}$, the instantaneous consumption, is generated from the consumption of final goods by maximizing a Cobb-Douglas function:

$$TC_{n,t} = \Pi_t c_{n,i,t}^{b_{n,i}}, \quad (3.8)$$

subject to

$$\sum_i PC_{n,i,t} c_{n,i,t} = PTC_{n,t} TC_{n,t}, \quad (3.9)$$

where $c_{n,i,t}$ is the final consumption for good i and consumption shares $b_{n,i}$ satisfy $0 < b_{n,i} < 1$, and $\sum_i b_{n,i} = 1$.

World Commodity Markets and Capital Flows

International trade flows are tracked by their origin and destination. The variable $M_{n,s,i,t}$ represents the trade flow of commodity i from region n to s at time t and is endogenous in the model.

When a country's current consumption plus its investments exceeds its current domestic income, the country experiences a trade deficit in which imports exceed exports. If the reverse is true, the country experiences a trade surplus, or an excess in exports over imports. If the country does not own enough foreign assets to offset a deficit, the trade deficit has to be financed by international borrowing (i.e., $SAV_{n,t}$ is negative). Once international borrowing occurs, foreign capital flows into the country. The current period's foreign borrowing becomes a net debt burden that either increases the country's total outstanding debt or reduces its foreign assets, i.e.,

$$FB_{n,t} = \sum_i^J \sum_s^N (PW_{n,s,i,t} M_{n,s,i,t} - PW_{s,n,i,t} M_{s,n,i,t}), \quad (3.10)$$

$$B_{n,t+1} = (1 + r_t)B_{n,t} + FB_{n,t}, \quad (3.11)$$

where $FB_{n,t}$ is the foreign trade deficit of region n , $PW_{n,s,i,t}$ is the world price of commodity i from region n to s at time t , and $B_{n,t}$ is the foreign debt. A negative $FB_{n,t}$ implies trade surplus for region n , while a negative $B_{n,t}$ is foreign assets for n .

We define a region's real exchange rate as a ratio of the region's consumer price index over the same index for the region of developed economies, i.e., the consumer price index for developed economies is chosen as a numeraire.⁴ Movements in a region's real exchange rate reflect changes in the price level relative to that of developed economies. These movements do not capture any changes in the region's exchange rate policy or policies for financial or monetary sectors.

Government Policies

Government policy instruments include import tariffs, indirect taxes imposed on production processes, and sales taxes on final consumption.⁵ Our main purpose here is to suggest how the effects of government interventions and weak financial systems might lead to overinvestment in financially dubious projects within crisis-ridden economies. Information necessary to address these matters, however, is not available in a quantifiable form in the original database. For, as discussed earlier, such government intervention has often taken the form of implicit insurance that is equivalent to a stock of contingent public liabilities reflected neither by data on debt nor on the deficit until contingent liabilities become actual ones, that is, until the crisis occurred. Even though there were differences in the specifics of the governments' policies to enable firms to expand their investment, they all led to the same outcome: excessive concentration of investments in certain key sectors of the economy. For these reasons, we introduce an "investment subsidy policy" to capture the basic features of government interventions in firms' investment strategies. The subsidy, granted only for manufacturing firms with no comparable provisions for the other three sectors,⁶ is designed to lower firms' capital installation (adjustment) costs as

⁴ This price index is the average of consumption good prices weighted by their base year levels of consumption.

⁵ Further information about these instruments along with their initial levels are included in the database used for conducting the calibration. See Global Trade Analysis Project (GTAP) Database, version 3, in McDougall (1997).

⁶ In Korea, excess investments and associated profitability problems were concentrated in the manufacturing sector, whereas in other countries, such as Thailand, the focus was on the real estate sector (Huh 1997). Data availability limits our analysis to the case of subsidy to the manufacturing sector. Since the manufacturing sector is more export-oriented, this arrangement allows for a higher probability that the crisis will be propagated to the rest of the world. Therefore, our analysis can be viewed as a worst-case scenario from the viewpoint of non-crisis economies.

well as to put a ceiling on the interest rate they face. We assume that the investment subsidy is financed by a lump-sum tax on (or a lowered government transfer to) the household.

More formally, let $s_{n,i,t}$ be the subsidy rate on the capital installation cost, and $\gamma_{n,i,t}$ be the difference in percentage between the market interest rate and government's interest ceiling. Then the capital adjustment cost function is redefined for the manufacturing sector of crisis-ridden economies as $(1 - s_{n,i,t})\phi_{n,i}\frac{I_{n,i,t}^2}{K_{n,i,t}}$ and equation (3.4) becomes

$$r_{n,i,t} = (1 + \pi_{n,t})(1 - \gamma_{n,i,t})r_t, \quad (3.12)$$

where $s_{n,i,t}$ and $\gamma_{n,i,t}$ are positive for manufacturing and zero for the other three sectors in crisis economies.

Equilibrium

Equilibrium requires that at each time period three conditions hold. First, in each region, the demand for production factors equal their supply. Second, the world total demand for each sectoral good equals its total supply. Third, aggregate household savings equal zero. In the steady state equilibrium, the following constraints must also be satisfied for each region:

$$r_n = r_{ss},$$

$$r_{ss} = \frac{div_{i,ss}}{V_{i,ss}},$$

$$I_{i,ss} = \delta_i K_{i,ss},$$

$$FB_{ss} + r_{ss}B_{ss} = 0.$$

Readers can find more details of the model, including Euler equations used to solve the model and a glossary of variables, in the appendix of our working paper, "Challenges and Choices in Post-Crisis East-Asia: Simulations of Investment Policy Reform in an Intertemporal, Global Model" (Federal Reserve Bank of Richmond Working Paper 98-7).

4. SIMULATION ANALYSIS

In their recent paper, Corsetti, Pesenti, and Roubini (1998) undertake an extensive analysis of the macroeconomic environment and financial system of crisis-ridden economies. Shunning a purely financial panic explanation, they conclude that common domestic and international shocks hit several East Asian economies in the 1996–1997 period. Our simulation pursues this line of argument. Because we lack a full-fledged theory on financial-real economy linkages, however, we directly implement the real, or nonmonetary, consequences of the

crisis on investment patterns. We do so by shocking the model (that is, by increasing the risk premium and the difficulty of undertaking capital investment in the region) to simulate the investment contraction. The actual crisis produces currency depreciation as well as increases in domestic interest rates, prices, unemployment, and bankruptcy rates in the affected countries. Such outcomes are likely to cause investment to fall and economic growth to slow. Since the intertemporal general equilibrium is a real or nonmonetary phenomenon in which variables expressed as nominal or monetary magnitudes, including currency exchange rates and many financial assets, are not explicitly recognized, it cannot capture directly the effects of currency depreciation on world financial and asset markets.⁷

Our list of crisis economies includes a number of Asian countries (Indonesia, Korea, the Philippines, Thailand, Malaysia, Singapore, Hong Kong, and Taiwan), two Latin American countries (Brazil and Argentina), and one European country (Russia) to better capture the later development of the crisis. The developed region includes EU countries, the United States, Canada, Australia, New Zealand, and Japan. The remaining countries are in the group of developing nations.

Tables 1 and 2 summarize the trade flows for the three regions across the agriculture, intermediaries, manufacturing, and services sectors. Crisis economies import chiefly from developed economies. Other developing economies import from crisis and developed economies. Finally, developed economies import agriculture, intermediary goods, and services from both crisis and other developing economies, but import manufacturing goods mostly from the former. Crisis economies share with other developing economies a similar trade structure in the sense that they export most of their commodities to developed economies in all sectors except manufacturing. Developed economies export to both crisis and other developing economies.

Our model employs investment subsidy to reduce the cost of capital adjustment. It also uses a ceiling on interest rates to reduce the risk of investment in the manufacturing sector. For our baseline solution, we choose the subsidy rate that produces a total subsidy equal to 2.2 percent of total investment. Similarly, we choose an interest rate ceiling that results in manufacturing firms facing a rate 30 percent lower than the market rate of crisis economies. The subsidies are received only by firms investing in the manufacturing sector and they are set equivalent to 40 percent of the capital adjustment costs of this sector.⁸ The rest

⁷ However, the apparatus allows us to introduce the concept of real exchange rate as the ratio of domestic versus foreign commodity baskets. See Obstfeld and Rogoff (1996, Ch. 4) for an analytical exposure.

⁸ According to Dalla and Khatkhate (1995)'s calculation, the interest subsidy involved in policy loans in Korea amounted to over 1 percent of GNP and 6.2 percent of government expenditure in 1991; the cumulative subsidy during 1981–1991 amounted to 2 trillion won per annum.

Table 1 Share of Imports by Region and Sector

Imp. Region	Exp. Region	Agriculture	Intermediaries	Manufacturing	Services
Crisis	Developing	0.08	0.055	0.01	0.03
	Developed	0.92	0.945	0.99	0.97
Developing	Crisis	0.292	0.41	0.174	0.194
	Developed	0.708	0.59	0.826	0.806
Developed	Crisis	0.784	0.852	0.976	0.85
	Developing	0.216	0.148	0.024	0.15

Table 2 Share of Exports by Region and Sector

Exp. Region	Imp. Region	Agriculture	Intermediaries	Manufacturing	Services
Crisis	Developing	0.222	0.062	0.054	0.042
	Developed	0.778	0.938	0.946	0.958
Developing	Crisis	0.06	0.171	0.426	0.172
	Developed	0.94	0.829	0.574	0.865
Developed	Crisis	0.854	0.866	0.881	0.865
	Developing	0.146	0.134	0.119	0.135

of the model is calibrated to the 1995 Global Trade Analysis Project (GTAP) Database (see footnote 4) under the assumption that the initial current account is in balance for each region. That is, each region's initial current account is assumed to be "sustainable" and consistent with its initial interest rate.

Baseline Scenario

In our baseline simulation, we proceed as follows. For the first three years, we exogenously raise the value of the region's risk premium, $\pi_{n,t}$, in Equation (3.12) and reduce the technological coefficient, $A_{n,i}$, in the sectoral investment functions in equation (3.5) for crisis-ridden countries. Then, for the following three years, we slowly lower the risk premium and raise $A_{n,i}$ to its original level. The shocks are chosen so that simulated changes in output in the crisis economies match, during the first seven years, that of the actual changes in these regions in the years 1997, 1998, and 1999 and the IMF projection for these countries for the years 2000–2003 ("World Economic Outlook and International Capital Markets Interim Assessment," International Monetary Fund,

December 1998).⁹ The comparison of simulated and actual results, as well as the IMF projections, is in Figure 3. The simulation results for other variables and for the other two regions are summarized in Figures 4–6.

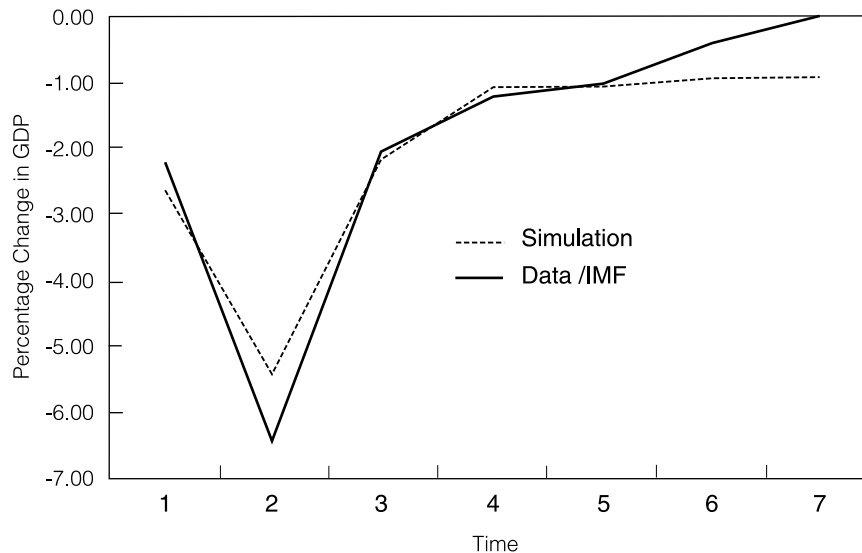
Outcomes of the simulation closely track both the development of the crisis and the IMF's projections. GDP in crisis countries decreases with a fall in investment. With the depreciation of the crisis area's real exchange rate, the price of traded goods increases relative to the price of goods domestically produced and consumed. Exports increase, imports decrease, and the trade balance improves. A trade surplus together with a low level of investment produces a current account surplus for these crisis economies.

The model also depicts the simulated effects of the crisis on the world economy as well as on the other countries. As can be seen in Figure 4, world GDP falls by 0.47 percent in the first year of the simulation. GDP falls 0.23 percent in developing economies but rises slightly (0.02 percent) in the developed region in the first year. Growth further slowed for all three regions in the second year and started to recover beginning in the third year. These effects are mainly the results of corresponding changes in the levels of international commodity trade and capital mobility.¹⁰

The counterpart of the decline in commodity imports of crisis economies is a corresponding fall in the exports of non-crisis regions. In the simulation, exports fall by 5–8 percent in developed economies and 1–2 percent in developing economies during the first two years after the crisis. Since exports as a percentage of total output are smaller in developed economies (11.7 percent) than in developing economies (19.2 percent), it follows that the same degree of export decline has a relatively smaller impact on GDP of developed economies. Moreover, the export decline in developed economies stems from decreased demand, especially for manufacturing and services of crisis economies and other developing economies. Conversely, the export fall experienced by developing economies stems mainly from competitive pressure exerted by crisis economies who have a trade structure similar to their developing country counterparts. Although the simulation produced a depreciation in the real exchange rate in developing economies, it was relatively

⁹ The growth rate for the crisis-ridden region is a weighted (by GDP) average of the growth rates of each country in the region minus their average growth rate from 1990–1996. These numbers correspond to the percentage changes in GDP from the steady state reported from the model.

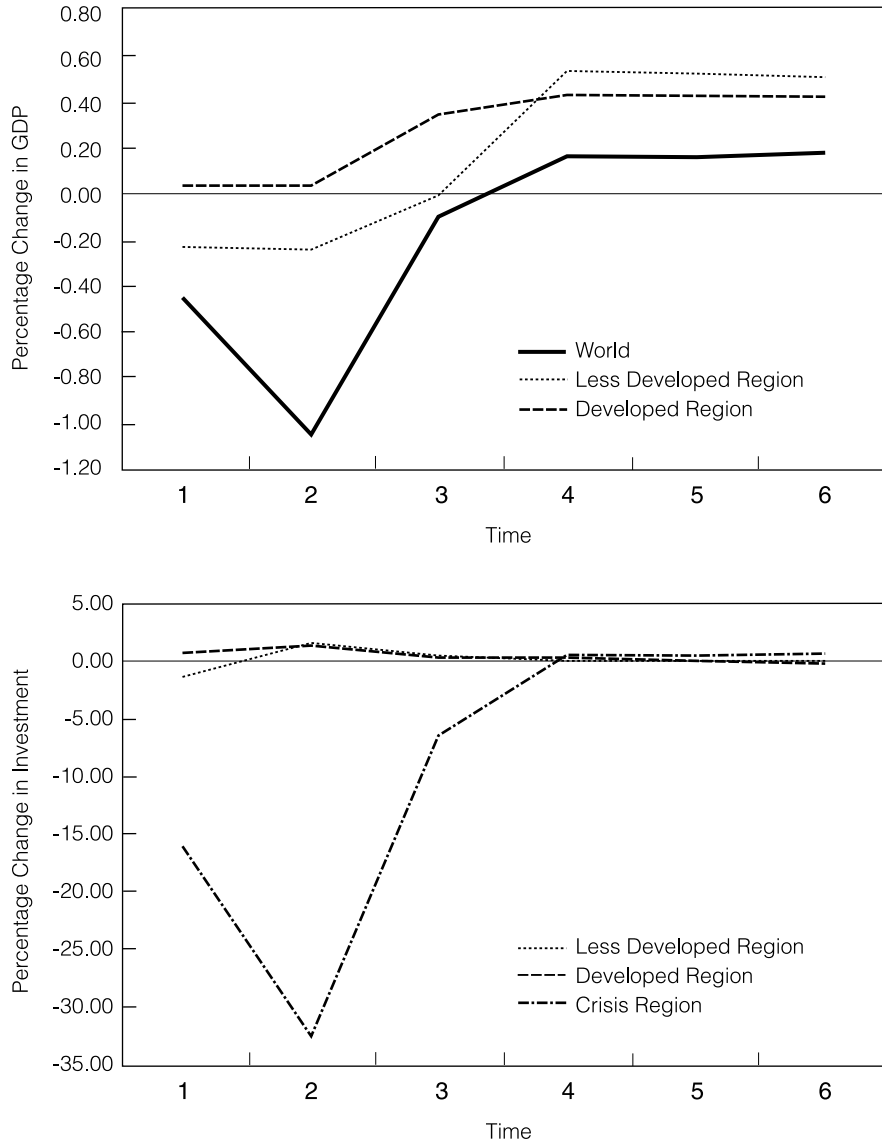
¹⁰ According to IMF ("World Economic Outlook," 1999), the change of growth rates in world output (detrended by a 3.4 percentage average growth rate for world output from 1990 to 1999) are 0.78, -0.914, and -0.114 percent for 1997, 1998, and 1999 respectively. The weighted (by their GDP) change of GDP growth rates for Canada, the United Kingdom, France, Germany, and the United States (detrended by their respective average growth rates from 1990 to 1999) are 0.16, 0.051, and -0.21 percent for 1997, 1998, and 1999 respectively. Although our simulation does not match the exact numbers, it does reproduce the qualitative patterns.

Figure 3 GDP Changes in Crisis Hit Economy

insignificant compared with the depreciation in crisis economies. Since exchange rate depreciation tends to spur exports by making them less expensive, we find that exports in developing economies decrease, but at a slower rate than in developed economies. Conversely, imports for both developed economies and other developing economies increased, with the rate of increase being higher for developed economies. These numbers from our simulation are broadly consistent with the actual ones. Among the five developed economies discussed earlier (Canada, the United Kingdom, France, Germany, and the United States), all of them experienced substantial increase in their imports (year by year) between 1997 and 1999. Only the United Kingdom and the United States had large drops in their exports. The other countries experienced an increase in their exports; however, the increase in their exports was outpaced by a corresponding increase in their imports. For the five crisis economies (Korea, Malaysia, the Philippines, Thailand, and Indonesia), all except Malaysia experienced a substantial decline in imports in 1997 and 1998. And, except for Korea and Indonesia in 1998, all experienced a large increase in their exports.

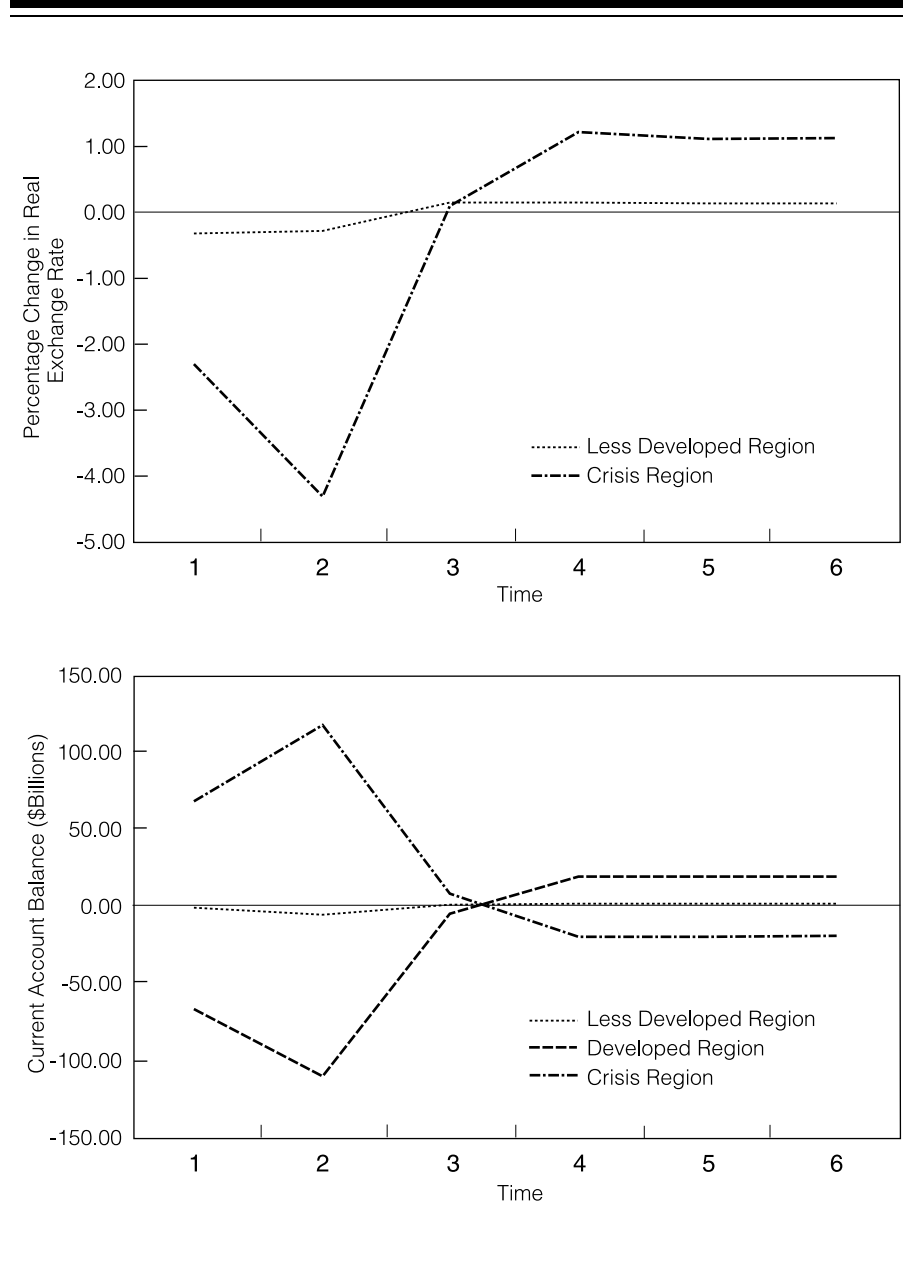
The decrease in exports and increase in imports in developed economies produced a trade balance deficit that was financed by large capital inflow into these economies. This inflow, when transformed into an increase in capital stock, raises the production potential, hence GDP, of developed economies. The developing economies, however, do not benefit from such capital inflows

Figure 4a The Impact of the Crisis on World Economy



and investment falls initially and only rises slightly after that. With a negative change, or appreciation, in its real exchange rate, its GDP falls slightly. Given that developed economies account for about 70 percent of world GDP and

Figure 4b The Impact of the Crisis on World Economy



that the crisis does not affect them much, the world GDP only falls by 0.47 percent in the first year of the simulation, even though the crisis economies and developing economies register GDP falls of 3 and 0.23 percent.

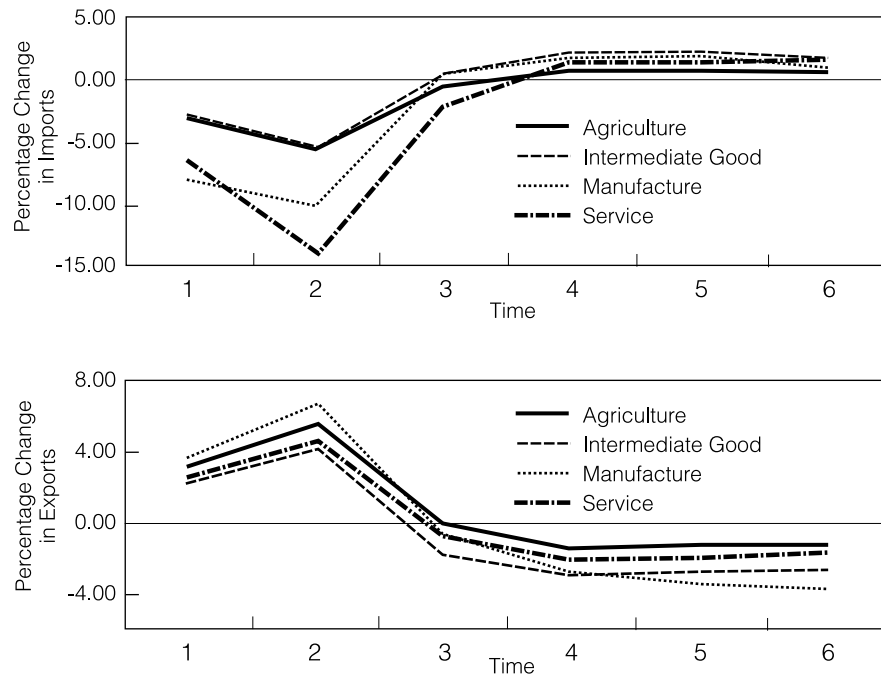
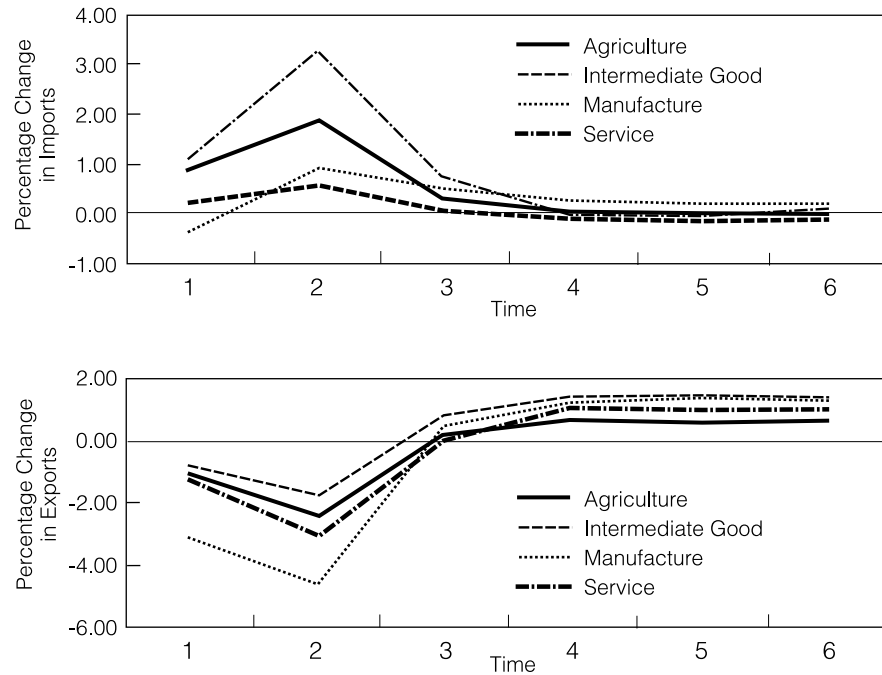
Figure 5a Sectoral Effects of the Crisis: Crisis Hit Economy

Figure 5 documents sectoral export and import changes for each region for the first six years following the crisis. We observe that, for crisis economies, exports rise and imports fall during the first two years in all four sectors. By the third year, exports in all four sectors have reversed their signs and are showing negative percentage changes. Imports in intermediate goods and manufacturing have also reversed their signs and become positive, though it takes longer for imports in agriculture and service to recover. For other developing countries, exports decline in all four sectors in the first two years, then recover starting from the third year. Except for the first year in manufacturing, imports have increased. In developed economies, exports decline in all four sectors, more so in manufacturing and service, in the first two years. This decline in exports is a result of the decreased import demand of crisis economies, a decreased demand that more than offsets the increased import demand coming from other developing economies.

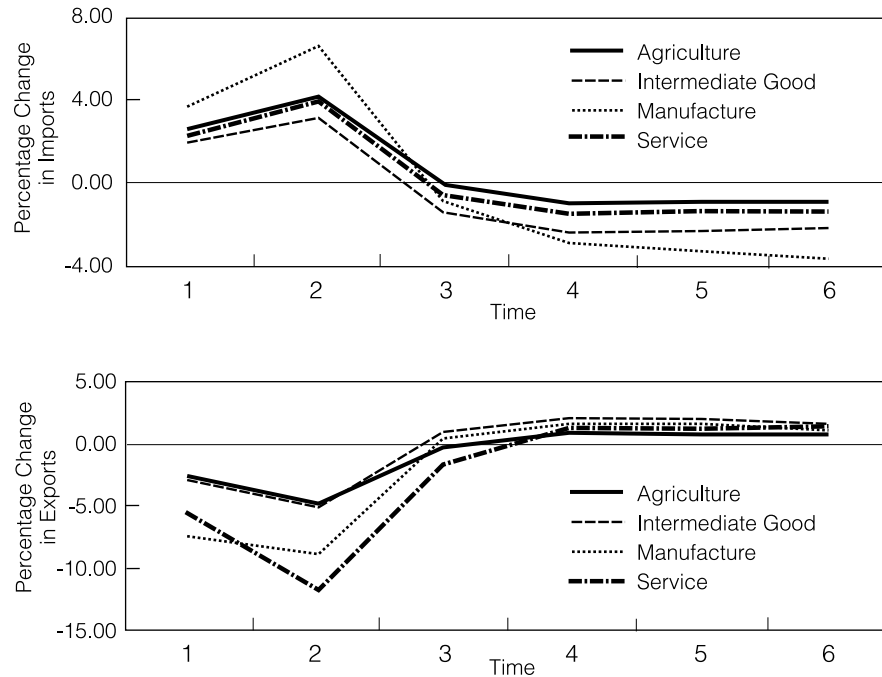
Figure 6 depicts changes in bilateral trade flows between crisis-ridden economies and the other two economies. Following the crisis, the real exchange rate depreciation in crisis-ridden regions causes, by cheapening the

Figure 5b Sectoral Effects of the Crisis: Other Developing Economy

region's exports while rendering its imports dearer, a fall in its imports and rise in its exports. Since one region's imports are another's exports, the developed region's exports of manufactured goods and services suffer a fall both from the reduced import demand of the crisis-ridden region and the competitive effect of that region's increased exports, which displace, or crowd out, the exports of the developed region.

Alternative Scenarios

In our simulation of the baseline scenario, we attempted to replicate both (1) the development or unfolding of the crisis and (2) the most recent IMF projections. One may argue that these events and projections already take into account policy actions mentioned earlier. Therefore, it is not surprising that, by matching growth rates of crisis countries to these numbers, we saw little or no impact on the world economy and its constituent industrial economies. Put another way, had it not been for the policy considerations, growth rates for crisis economies would have been slower and thus the effects of the crisis on the world and industrial economies larger. For example, concerns were manifest that the crisis

Figure 5c Sectoral Effects of the Crisis: Developed Economy

would, by enhancing investment risk in two ways, divert investment away from emerging markets. First was the risk that the crisis would, through contagion, generate additional crises. Second was the risk that the crisis may, by raising public fear, make potential investors more risk-averse than they were before. Both types of risk would inhibit investment in emerging markets. Consequently, we construct two alternative scenarios to account for possible implications of this risk.

Scenario One

In scenario one, we disturb, or shock, the crisis-ridden region's risk premium so that GDP declines in the region are consistent with the IMF projection back in October 1998 ("World Economic Outlook," International Monetary Fund, October 1998).¹¹ It takes about ten years for the GDP in the crisis-ridden region to completely recover. We find that the pattern of changes in investment, GDP,

¹¹ The decline in GDP for the crisis hit region was projected to be -3.6 , -6.4 , and -4.3 respectively for the first three years.

Figure 6a The Impact of the Crisis on the Bilateral Trade between Crisis Hit Region and Other Regions

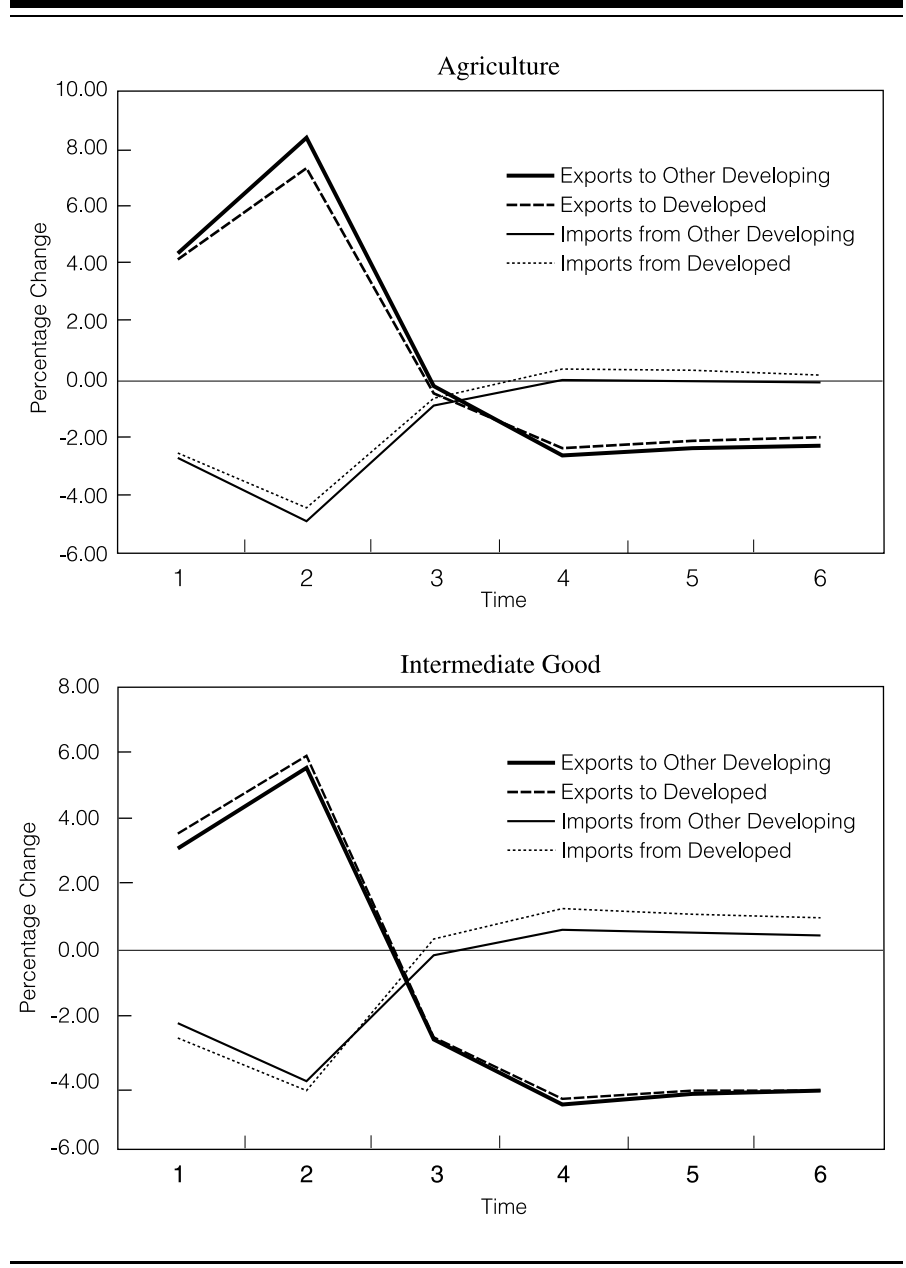
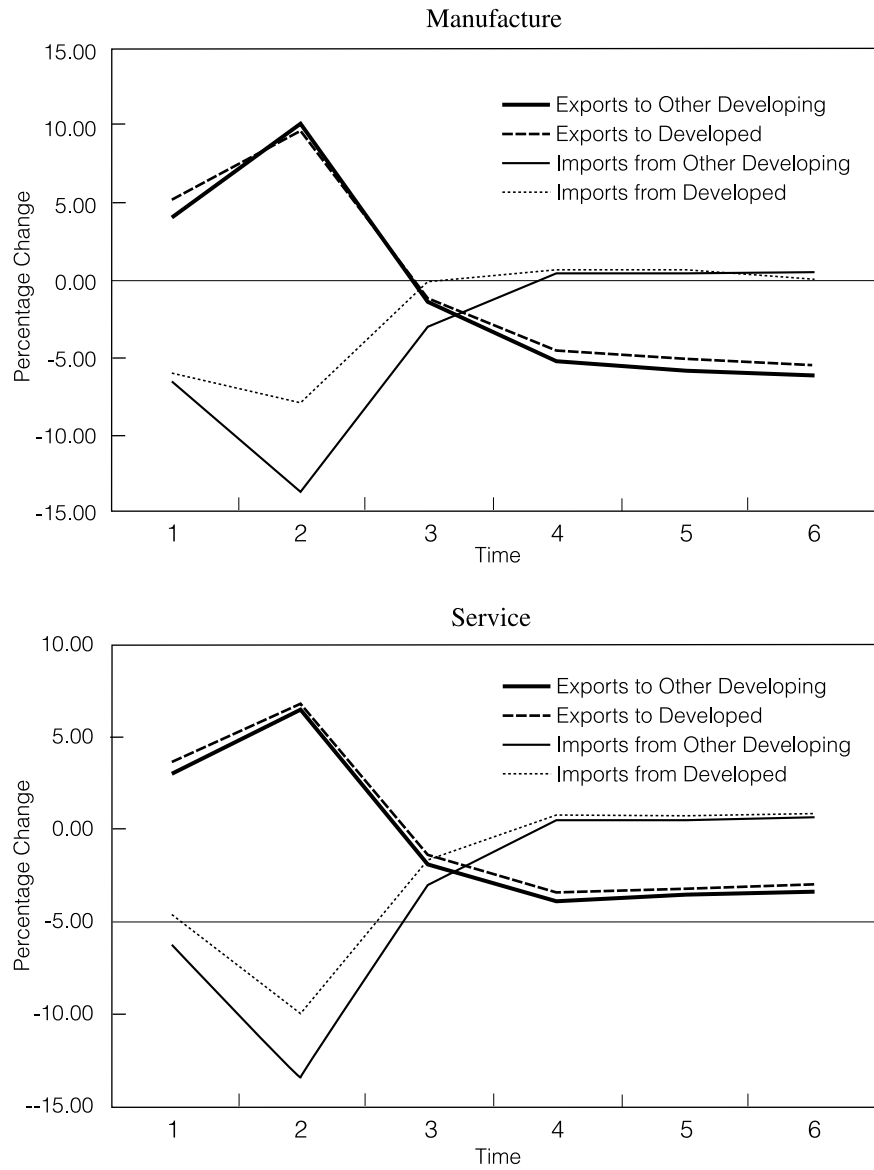


Figure 6b The Impact of the Crisis on the Bilateral Trade between Crisis Hit Region and Other Regions



current account, exports, imports, and the real exchange rate are the same as baseline simulation results, but the magnitude is bigger. The world GDP drops 0.64 percent the first year, 1.32 percent the second year, and 0.31 percent the third year. GDP in the other developing region declines for two consecutive years (−0.30 and −0.29 percent), while GDP in the developed region increases slightly in the first year (0.01 percent), decreases for the next year, and begins to recover in the third year (−0.002 and 0.035 percent, respectively). Capital flows going from the crisis-ridden region to the other developing region and the developed region are more severe. In particular, countries in the developed region show large capital account deficits.

Scenario Two

In scenario two, we consider the policy reforms undertaken by crisis economies during the period. In particular, we eliminate the government's investment subsidy and remove the ceiling interest rate in the manufacturing sector. Of course, without an explicit banking sector, the model cannot capture all effects of a change in the government's investment policy, especially the effects of government intervention in the banking system. Note, however, that even though the model lacks an explicit banking system, it maintains an effective financial capital market economy in a theoretically consistent framework.

It is obvious that the investment-subsidy policy distorts firms' investment decisions and thus leads to overinvestment in manufacturing and possibly underinvestment in other sectors, such as services. It follows that removing such policy distortions would lower manufacturing investment and increase investment allocated in the other sectors. Eliminating the investment subsidy to manufacturing also affects the trade structure of the crisis-prone region as investors now require a higher premium to hold assets of manufacturing firms. In the crisis-ridden region, GDP also worsens for the first few years compared with its counterpart in the baseline scenario.¹² For countries in the developed region, GDP again was not affected much—the growth rate was 0.01 percent for the first year, −0.08 percent for the second year, and 0.32 percent for the third year—although its current account deficits declined further. Moreover, the simulated investment policy reform conducted by the crisis-ridden region generates relatively modest aggregate effects in the short and medium run. The main reason is that the expected gains from the investment policy reform take the form of enhancement to economic efficiency, i.e., gains in productivity growth. Our model cannot capture such endogenous gain, however, as it is based on neoclassical growth theory in which productivity growth is exogenous. In actual policy setting, one may encounter many other forms of distortions in

¹² For the crisis hit economies, GDP declined 3.6, 6.8, and 3.3 percent for the first three years, and 2.5 percent for the fifth year.

industrial policies, in banking systems, or in capital markets of crisis-ridden economies. We would expect once countries implemented such essential reforms, adjustments in their economies as well as in the entire world would be much larger than they are in our simulations.

In summary, our simulation analysis indicates that the crisis reduced GDP in developing economies, but raised GDP in developed economies. Furthermore, the crisis had a larger effect on developing than on developed economies. Capital flows from crisis economies to non-crisis economies, developing and developed, caused capital account deficits in both regions, more so in the developed region.

5. CONCLUDING COMMENTS

The preceding paragraphs have investigated the impact of the East Asian Crisis on the world economy with the aid of an intertemporal general equilibrium model. Admittedly our model is incomplete; it contains no monetary or financial sectors. Still, despite the absence of a full-fledged model of real-financial linked theoretical apparatus, we were able to estimate the real effects of the crisis by examining its consequences on investment demand. Our simulation results, conducted under three reasonable scenarios, revealed that the crisis had by far the largest negative impact on other developing economies. The impact on industrial economies, on the other hand, is generally small and even positive initially. Our analysis suggests that the fear of a “global slump” was not well founded. The corollary is that policy actions associated with the “recovery” of the world economy may not have mattered at all, since there was no global slump from which to recover.

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