The Asia Financial Crisis and Global Adjustment: Implications for U.S. Agriculture[1]

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Abstract

This study investigates the likely impact of the recent Asia financial crisis on global economic adjustment and its implication for U.S. agriculture using a multi-country, multi-sector dynamic intertemporal general equilibrium model with endogenously modeled financial markets. The simulation results show that the crisis in Asia not only reduces U.S. exports but also reduces interest rates and the cost of energy and other intermediate inputs of production, stimulating U.S. domestic economic activity in interest-sensitive sectors, driving up demand for agriculture products. However, this stimulus of domestic demand may or may not offset the negative impact of declining exports, depending on the relative reliance of each sector on domestic versus Asian markets. Sectors relying heavily on domestic markets such as processed food will expand production, while export-oriented sectors such as food grains are negatively affected.

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1. Introduction

The dependence of U.S. agriculture on the world economy has changed significantly during the past three decades. U.S. agriculture has become more closely integrated in the world economy through a variety of channels. Export markets are increasingly important for U.S. producers. The proportion of U.S. farm products exported more than doubled during the past three decades in response to greater liberalization of markets and U.S. comparative advantage in land-extensive and capital-intensive agriculture, and now accounts for about 20 percent of U.S. total agricultural production, at least double the export share for other U.S. industries on average.[1] Furthermore, American agriculture now depends to a much greater extent than before on purchased inputs and borrowed capital, the costs of which are determined by supply and demand conditions in an interdependent U.S. and global economy. The combination of a flexible exchange rate system and a well integrated international capital market means changes in exchange rates and interest rates become more important determinants of agricultural production and trade performance today than 20 years ago. In the meantime, the growing share of income of rural household from non-farm employment reduces the relative importance of farming as primary source of income in many industrial countries and off-farm employment now accounts for more than two thirds of total farm household income in the United States. As a result, agricultural commodity prices and the income of American farmers have become increasingly sensitive to the economic environment outside agriculture.

Given these changed economic conditions, unexpected economic disturbances in the global economy such as the recent Asia financial crisis will undoubtably have a significant impact on U.S. agriculture and farm income. However, most attention in the U.S. farm community has focused on the merchandise trade impact of the crisis--declining exports, rising imports and a deteriorating agriculture trade surplus. This is

understandable given the importance of the Asian market to the U.S. agriculture and food sector--about 40 percent of U.S. agriculture and food exports go to Asia. Less attention has been given to the far-reaching global adjustments caused by the crisis in Asia and its implications for U.S. agriculture. There are at least two crucial missing ingredients from this narrow trade perspective: ***one***, the crisis has shifted capital flows from affected Asian countries towards industrial countries, especially the United States, reducing real interest rates and lowering capital costs in those economies, which tends to boost interest-sensitive activities such as durable good demand (particularly housing) and business investment, thus stimulating domestic demand for agricultural products; and, ***two***, the economic slowdown in Asia reduces global demand for consumer products as well as intermediate inputs such as energy and other basic raw materials for which those affected Asian countries accounted for a significant share of global demand. In the meantime, the dramatic depreciation of southeast Asia currencies reduces the U.S. dollar prices of commodities such as timber, rice, natural rubber, and vegetable oil for which the Asian economies in crisis are important world suppliers. This tends to reduce inflation and lower the cost of agricultural production in the United States and other industrial countries. Ignoring these phenomena misses key parts of the global adjustment story, and therefore, can not correctly evaluate the overall impact of the Asia crisis on U.S. food and agricultural industries.

This paper analyzes the global adjustment process induced by the Asian financial crisis and its implications for U.S. agriculture using a multi-country, multi-sector dynamic intertemporal general equilibrium model with endogenously modeled financial markets -- the G-Cubed (Agriculture) model . The simulation results illustrate that the crisis in Asia not only reduces U.S. agricultural exports but also reduces global real interest rates and the cost of energy and other intermediate inputs of production, and through these channels, stimulate U.S. domestic demand for agricultural products. However, the stimulus to domestic demand may or may not offset the negative impacts of a decline in exports, depending on the relative reliance of each sector on domestic demand *versus* dependence on Asian markets.

The rest of the paper is organized as follows. The basic features of the model are outlined in **Section**

2, **Section 3** summarizes how a base line projection of the model is generated and the design of two simulations: ***one*** simulation in which the crisis is contained in Korea and Southeast Asia, where the problem is now most acute; and a ***second*** in which the crisis deepens in Japan, China, and Taiwan in the same way as it has in Korea and Southeast Asia. **Section 4** presents results of the two simulations. Conclusions are given in **Section 5.**

2. Structure of the G-Cubed (Agriculture) Model

The G-Cubed (Agriculture) model is an extension of the G-Cubed multi-country model[2] with a particular focus on agriculture. Like the G-Cubed model, this extended model incorporates forward looking behavior and intertemporal budget constraints on firms, households, governments and nations (the latter through accumulations of foreign debt), and also contains substantial regional dis-aggregation and sectoral detail. These features give the model the capacity to evaluate economic shocks which may have their largest effects on small segments of the economy such as the agricultural sectors. By integrating sectoral detail with a coherent macroeconomic structure the model can be used to evaluate the global adjustment induced by economic shocks and their implications on world agricultural markets, thus providing a bridge between computable general equilibrium models and macroeconomic models through integrating the more desirable features of both approaches in the context of agriculture.

The key features of G-Cubed (Agriculture) model are summarized in Table 1. The country and sectoral breakdown of the model are summarized in Table 2. In contrast to the original G-Cubed model, the G-Cubed (Agriculture) model consists of twelve economic regions: the United States, Canada, Japan, Australia, European Union (12 member countries), Mexico, Korea, the rest of the OECD, Taiwan, ASEAN, China, and rest of the world (ROW). Each country/region consists of twelve sectors of production plus a sector that creates capital goods for firms and a sector that produces capital goods for households. There is one energy sector, four primary agricultural sectors (food grains, feed grains, non-grain crops, and livestock products), mining, fishing and forestry products and four manufacturing sectors (processed food, durable

manufacturing, textile & apparel, other non-durable manufacturing) and services.

(**Insert tables 1 and 2 here**)

Each region in the model consists of several economic agents: a representative household, a government, and a representative firm in each of the production sectors listed above. These agents interact in a range of markets: final goods, intermediate goods, factors of production, money markets, bond markets, foreign exchange markets and equity markets. The assumptions about how agents behave follow the original G-Cubed model. Each agent combines two types of behavior: intertemporally optimizing behavior and liquidity constrained behavior (or "rule of thumb" behavior). The relative weighting between the two types of behavior is based on empirical evidence and the approach taken in the MSG2 model (McKibbin and Sachs, 1991). In the long run with no shocks, both types of behavior are the same but in the short run the rule of thumb behavior ignores changes in expected future income or profit streams which intertemporal optimizing behavior takes into account.

We now summarize the economic behavior of the major agents in the model as well as highlighting the role of financial markets. The reader should refer to Appendix A for the detailed algebraic expressions of the model as well as the derivations in McKibbin and Wilcoxen (1995).

a. Firms

Each of the production sectors is represented by a single firm which chooses its variable inputs and its level of investment in order to maximize its stock market value subject to a multiple-input production function and a vector of prices it takes as exogenous. For each sector, output is produced with inputs of capital, labor, land, energy and intermediate inputs from all other sectors. Land is only used in the four agricultural sectors. Intermediate goods are, in turn, aggregates of imported and domestic commodities which are imperfect substitutes. We assume that all agents in the economy have identical preferences over foreign and domestic varieties of each particular commodity. We represent these preferences by defining twelve composite commodities that are aggregated from imported and domestic goods (the Armington

assumption). For example, food grain purchased by agents in the model are a composite of imported and domestic grains. By constraining all agents in the model to have the same preferences over the origin of goods we require that, for example, the agricultural and service sectors have the identical preferences over domestic oil and oil imported from the middle east.[3] This accords with the input-output data we use and allows a very convenient nesting of production, investment and consumption decisions. The structure of production and demand in the model are showed as Figure 1.

In each sector the capital stock changes according to the rate of fixed capital formation less depreciation. One of the key assumptions in the model is that physical capital is costly to adjust and is sector specific in the short run. Following the cost of adjustment models of Lucas (1967), Treadway (1969) and Uzawa (1969) we assume that the investment process is subject to rising marginal costs of installation.

The goal of each firm is to choose inputs to maximize intertemporal net-of-tax profits subject to its technology and capital accumulation constraints. The solution to this intertemporal optimization problem yields the conditions that variable inputs are hired to the point where the marginal productivity of these factors equals their prices relative to the output price. Based on those conditions we write the model in terms of cost functions and derive various component demand functions by Shephard's lemma. The price of the output at each level of the tier structure is also the unit cost function depending on the prices of variable inputs and the quantities of available fixed factors such as capital.

The rate of gross investment in each sector is a function of "Tobin's q" for that sector, where q is the increment to the value of the firm from an additional unit of investment. Following Hayashi (1979), we modify the investment function to improve its empirical properties by writing gross investment as a function not only of q, but also of the firm's current cash flow.

We assume that investment goods are supplied by a firm facing an optimization problem similar to those of the twelve industries described above. Like other industries, the investment sector demands labor and capital services as well as intermediate inputs. The investment column in the input-output table is used to

parameterize the investment sector's cost function. Similar to other sectors, there is a shadow price associated with investment in the investment goods sector. Production structure of the investment good is similar to Figure 1.

(Insert figure 1 here)

b. Households

Households consume goods and services in every period and also demand labor and capital services. Household capital services consist of the service flows of consumer durables plus residential housing. Households receive income by providing labor services to firms and the government, and from holding financial assets. In addition, they may also receive transfers from their government.

We assume household behavior can be modeled by a representative agent in each country who maximizes an intertemporal utility function subject to the constraint that the present value of consumption be equal to the present value of after tax labor income (human wealth) plus initial financial assets. Human wealth in real terms is defined as the expected present value of a future stream of after tax labor income. Financial wealth is the sum of real money balances, real government bonds in the hands of the public, net holdings of claims against foreign residents, and the value of capital in each sector.

The solution to this maximization problem is the familiar result that aggregate consumption is equal to a constant proportion of private wealth, where private wealth is defined as financial wealth plus human wealth.

Based on the evidence cited by Campbell and Mankiw (1987) and Hayashi (1982) we assume that only a portion of total consumption is determined by these intertemporally-optimizing consumers who calculate expected future income streams, and the remainder is determined by after tax current income. This can be interpreted as liquidity constrained behavior or a permanent income model in which household expectations regarding income are backward-looking. It implies that total consumption is a weighted average of the forward looking consumption and backward-looking consumption.

The household consumption problem can be thought of as a sequence of decisions. Households first decide on total consumption for each period as described above, then the total expenditure is allocated across goods and services based on preferences and relative prices. We assume that the household's preferences can be represented by a two level nested constant elasticity of substitution utility function.[4] At the top tier of the utility function total consumption is allocated across energy, a basket of non-energy goods (i.e. materials) including agricultural products, as well as labor and capital services. Household capital services consist of the service flows of consumer durables plus residential housing. At the second tier, spending on non-energy goods is further disaggregated into demands for individual commodities. The allocation of total consumption expenditure across goods and services is assumed to be separable from the intertemporal allocation.

The supply of household capital services is determined by consumers themselves who invest in household durables and housing to generate a desired flow of services according to a production function using household capital stock accumulated by previous investment. The household is assumed to maximize utility from the flow of services of durable stock by choosing an investment stream subject to quadratic costs of adjustment. As for the firm decision on optimal investment, the result is an investment function depending on the shadow price of capital.

c. Government

We take each region's real government spending on goods and services as exogenous and assume that it is allocated among final goods, capital and labor services in fixed proportions, which we set to 1992 values. Total government outlays include purchases of goods and services plus interest payments on government debt, investment tax credits and transfers to households. Government revenue comes from corporate and personal income taxes, sales taxes, and by issuing government bonds.

We assume that agents will not hold government bonds unless they expect the bonds to be paid off eventually. Therefore, the government is subject to an intertemporal budget constraint that the present value

of spending is restricted by the present value of future tax collections from all sources less the initial stock of existing government debt.

The implication of such a constraint is that a government running a budget deficit today must run an appropriate budget surplus at some point of time in the future. Otherwise, the government would be unable to pay interest on the debt and agents will not be willing to hold it. To ensure that the intertemporal budget constraint holds at all points in time we assume that the government levies a lump sum tax in each period equal to the value of interest payments on the outstanding debt.[5] In effect, therefore, any increase in government debt is financed by consoles, and future taxes are raised enough to accommodate the increased interest costs. Thus, any increase in the debt will be matched by an equal present value increase in future budget surpluses. Other fiscal closure rules are possible, such as requiring the ratio of government debt to GDP to be unchanged in the long run. These closures have interesting implications but are beyond the scope of this paper.

d. Financial Markets and the Balance of Payments

A key feature of the G-Cubed class of models is the integration of financial markets with the real side of global economy. There are a variety of assets available within each region including domestic money, government bonds, equity and foreign debt. Each asset represents a claim over a real activity. Money is required for transactions and therefore represents a claim over purchasing power. Government bonds are a claim over the future tax collections of governments. Equity is a claim over the future dividend stream of firms. Foreign debt is a claim over the future export receipts of the debtor countries. The prices of financial assets therefore contain information about the expected future real outcomes in the economy and are used by agents in undertaking real economic activities such as investment and consumption decisions.

The twelve regions in the model are linked by flows of goods and assets. Flows of goods are determined by the import demands of households, firms and governments. These demands can be summarized in a set of bilateral trade matrices, which give the flows of each good between exporting and

importing countries. There is one 12 by 12 trade matrix for each of the twelve goods.

Trade imbalances are financed by flows of assets between regions. We assume asset markets are perfectly integrated across all regions except with the rest of the world. With free mobility of capital, expected returns on loans denominated currencies of various regions must be equalized period to period according to a set of interest arbitrage relations. While we allow for exogenous risk premium in the calibration of the model, there is no allowance for endogenous risk premia on the assets of alternative currencies when shocking the model.

Determining initial net asset positions and hence base-case international capital flows is non-trivial. We assume that capital flows are composed of portfolio investment, direct investment and other capital flows. These alternative forms of capital flows are perfectly substitutable *ex ante*, adjusting to the expected rates of return across economies and across sectors. Within an economy, the expected return to each type of assets (i.e. bonds of all maturities, equity for each sector etc) are arbitraged, taking into account the costs of adjusting physical capital stock and allowing for exogenous risk primum. Because physical capital is costly to adjust, any inflow of financial capital that is invested in physical capital (i.e. direct investment) will also be costly to shift once it is in place. The decision to invest in physical assets is based on expected rates of return. However, if there is an unanticipated shock then *ex-post* returns could vary significantly. Total net capital flows for each economy in which there are open capital markets are equal to the current account position of that country. The sum of global net flows of capital are constrained to zero.

We treat the rest of the world differently to the regions which have full internal structures. We assume that the rest of the world is subject to an exogenous balance of payments constraint determined by the exogenous amount the world is willing to lend to this region.

e. Labor Markets

We assume that labor is perfectly mobile among sectors within each region but is immobile between regions. Thus, within each region nominal wages will be equal across sectors. The nominal wage is

assumed to adjust according to labor market institutions in different countries. In the United States, for example, wages adjust slowly according to an overlapping contracts model where nominal wages are set based on current and expected inflation and on economy-wide labor demand relative to labor supply. In the long run labor supply is given by the exogenous rate of population growth, but in the short run the hours worked can fluctuate depending on the demand for labor. For a given nominal wage, the sectoral demand for labor will determine short run employment in each industry and thus economy wide unemployment will be the difference between the overall supply and the sum of sectoral demand for labor.

G-Cubed (Agriculture) is still in the process of development but it is already a large model. In its current form it contains over 9,000 equations and 175 intertemporal costate variables. Nonetheless, it can be solved using software developed for a personal computer outlined in McKibbin and Wilcoxen (1995). A detailed algebraic description of the model and a complete list of variables and equations can be found in McKibbin and Wang (1998).

3. Base Line Generation and Simulation Design

One of the important features of the Asia financial crisis is a jump in the perceived risk of investing in those economies. Therefore, we follow the approach in McKibbin (1998) in our analysis modeling the crisis as a loss in confidence in each of the affected countries. Before presenting how this is done we first outline how the baseline projections are generated without shocks to risk. The model is first solved from 1996 to 2070 to generate a model baseline based on a range of assumptions[6]. These assumptions include population growth by country (based on World Bank projections) and sectoral productivity growth by country and by sector (based on a technology catch-up model developed by Bagnoli, McKibbin, and Wilcoxen, 1996) as well as assumptions about tariff rates, tax rates, and a range of other fiscal and monetary policy variables. Monetary policy is assumed to be targeting a stock of nominal money balances in each economy. Fiscal policy is defined as a set of fixed tax rates (except a lump sum tax on households that varies to satisfy the intertemporal budget constraint facing the government) and government spending as a

constant share relative to simulated GDP. The issue of projecting the future using a dynamic intertemporal general equilibrium model such as the G-Cubed model, is discussed in detail by Bagnoli *et al* (1996). This initial projection step is important for simulations because it builds in underlying structural change in the global economy which is endogenous to the exogenous assumption about differential productivity growth.

$$r_t^i = r_t^U + {}_t e_{t+1}^i - e_t^i + x_t^i \qquad (1)$$

Given all of the exogenous assumptions and initial conditions the full rational expectations solution of the model is found using a numerical technique outlined in Appendix C of McKibbin and Sachs (1991). Without additional intervention, this initial model solution will not generate the actual outcomes for the first year of simulation (in the current example 1996) because a range of forward looking variables such as human wealth, exchange rates, stock markets etc. will be conditioned on the future path of the world economy and there is no reason they should be equal to the observed values for the initial year. The next step in the baseline generation is to calculate a vector of constants for all equations in the model, including arbitrage equations, such that the solution of the model in the base year (1996) is exactly equal to the observed data in that year. It is important to stress that in no way are we assuming that 1996 is a steady-state solution of the model. It clearly cannot be. What we are imposing is that the 1996 database is on the unique stable path of the model in which all variables are moving towards a steady state in the distant future.

To see more precisely what the technique does and how a re-evaluation of risk is modeled, consider the uncovered real interest parity assumption relating the returns to government debt in each country, that is used in the model. This is shown in equation (1).

Here the real interest rate *(r)* on one year government bonds in country *i* in period *t* is equal to the interest rate in the United States (r^U) in period *t,* plus the expected rate of depreciation in the bilateral real exchange

rate between country *i* and the United States $({}_te_{t+1}-e_t)$, where e_t is the log of the real exchange rate in period *t* and ${}_te_{t+1}$ is the expectation, formed in period *t*, about the exchange rate to prevail in period *t+1*. In addition we assume that there is a risk premium ξ^i which if positive means that country *i* interest rates on government debt (in real terms) are above the interest rates on comparable U.S. government debt expressed in the same currency. In principle, this risk premium varies over time.

The term ξ^i captures a range of issues including sovereign risk, impediments to financial flows from government regulations, the degree of departure from rational expectations in actual data as well as a range of other factors. It measures the amount that the domestic interest rates must exceed the foreign (U.S. in our model) interest rate, adjusting for the expected change in exchange rate, in order to equilibrate expected returns in asset markets. Therefore, an increase in the risk premium on the domestic currency results in a depreciation of the currency.

Equation 1 can also be interpreted differently. Solving for e_t it can be shown that:

$$e_t^i = \int_t^T (r_s^U - r_s^i + x_s^i)ds + {}_te_T^i \qquad (2)$$

The real exchange rate in any period *t* is the sum of future expected interest rate differentials as well as the expected future risk premium on assets denominated in the home currency plus the equilibrium (period *T*) value of the real exchange rate.

In the baseline we calculate a constant value for ξ such that the exchange rate *(e)* converted into nominal terms using the appropriate price deflators in 1996 is equal to the observed nominal exchange rate. In practice this calculation can be done using actual data outside the model as long as some measure of the expected change in the exchange rate can be found. In this paper the model is used to calculate the expected change in the real exchange rate. It is also important to stress that although the arbitrage relationship outlined above focuses on the bond rate differentials, recall that within each economy all financial assets (bonds,

money, equity, etc.) are being arbitraged and therefore there is a wedge across these assets. In addition changing the wedge between bond rates will also affect the relative returns of a range of domestic and foreign assets that are being arbitraged to the yield on government bonds.

In simulation, certain paths of the expected future risk premium need to be selected. In the first scenario we conduct in this paper the rise in the risk premium is assumed to last for three years in each of the ASEAN economies and Korea before returning to the baseline. The values of the risk shock are selected such that the model generated changes in nominal exchange rates are equal to the observed changes in nominal exchange rates in those affected economies as January, 1998. In the second scenario, the jump of risk premium is assumed to be more widespread. In addition to ASEAN and Korea the rise in risk affects Japan, China and Taiwan. Japan and China are the two largest economies in the region, with Japan now accounting for 50 percent of U.S. agricultural exports to Asia[7]. In the event that international efforts to contain the current crisis fail and Japan, China, and Taiwan are drawn into it to the same extent as Korea and Southeast Asia, the global economy and U.S. agriculture may face more significant adjustments.

In addition to the rise in risk, it is assumed that there is an across the board decline in productivity in countries experiencing the risk shock in order to capture the impact of the financial crisis on domestic production. The time profile of the shocks are given in Table 3.

(**Insert table 3 here**)

4. Simulation Results

The results of major macro variables for both scenarios are shown in Tables 4a through 4c. The upper panel of each table contain the results for the simulation in which the crisis is contained in the ASEAN economies and Korea. The lower panel of each table contains the results for a wider crisis which spreads to China and Hong Kong, Taiwan and Japan. For presentation purposes in these tables, regions in the model are grouped into two groups: the directly affected (from the narrow crisis) as well as neighboring Asia countries, and major industrial countries.[8] All results are expressed as percent deviation from baseline except where

noted.

Table 4b contains macro-economic impacts of the crisis on the affected countries: ASEAN and Korea as well as neighboring Asian countries. The rise in risk and fall in productivity leads to an outflow of financial capital from the crisis countries. This outflow of capital depreciates the nominal and real exchange rates by around 60 and 30 percent respectively through 1998 in both ASEAN and Korea. The real exchange rates recover over time reflecting the assumed restoration of confidence in each economy. The outflow of capital also leads to a sharp rise in real interest rates in the crisis economies and a general deflation of asset prices. The rise in real interest rates, sharp decline in total wealth and reduction in current and expected future incomes leads to a sharp drop in domestic demand. Consumption falls by about 35 percent in ASEAN and Korea through 1999. Investment also falls by about 40 percent in ASEAN and 25 percent in South Korea in 1998. This sharp contraction in economic activity also results from large capital losses experienced by these economies. In particular the fixity of physical capital implies a significant reduction in capital use given the large increase in the cost of capital in the crisis economies.

Despite the large contraction in domestic demand, gross domestic product (GDP) is not quite so badly hit because of the adjustment in exports. The sharp depreciation in the nominal and real exchange rates increases the external demand for local products, both from countries unaffected by the crisis and those modestly affected. This export surge (note that the change in exports in shown in real terms and not in $US) is consistent with the change in the balance of payments reflecting a capital outflow. The change in the trade balance associated with this capital outflow can be achieved either by a rise in exports or a fall in imports. The model projects that this adjustment occurs through a large rise in exports. In 1998 it appears that the actual adjustment was not occurring through exports but rather through a sharp drop in imports. This largely reflected the collapse of the domestic and international financing of international trade. Given recovery in some of the economies, apart from Indonesia, it is expected that the model projections may be closer to being realized in the coming year.

The impact on ASEAN and Korea is large. However, the impact on the world as a whole is quite small because of the small size of the affected economies. The reduction of economic activity (primarily consumption and investment) in those affected countries are only a small share of the world total (panel 2 of table 4a), therefore, the crisis overall only causes global GDP and GNP growth rates to slowdown slightly, by only about 0.3-0.4 percent (panel 3 of table 4a). However, there are important adjustments in the global economy in response to the crisis in Asia. First, there is a sharp redirection of international financial capital flows and a gradual relocation of production capital towards industrial countries. In the earlier 1990s, there were huge financial capital flows towards emerging markets from capital abundant industrial countries looking for higher returns. The average capital inflow into emerging markets during 1990-96 was $148 billion annually. Developing countries in Asia attracted more than half of this inflow, with a peak of $102 billion in 1996 (IMF, 1998). As risk increase considerably in the crisis countries, investors lose confidence causing financial capital to move from emerging markets in seeking "safe haven" in industrial countries, especially the United States.[9] The redirection of financial capital toward developed countries reduces real interest rates in almost of the industrial countries except Japan, therefore stimulating total investment and private consumption (Tables 4b and 4c) in those countries. Total investment rises by more than 3 percent in most of the unaffected economies. The net impact on those economies depends on whether the negative demand shock from reduction in exports is more or less important than the positive demand shock from higher investment spending due to lower real interest rates. Since GDP is a measure of value added by domestically located factors of production, the relocation of physical capital resulting from higher investment may increase aggregate production hence GDP growth rate in those unaffected economies. Despite this capital relocation effect, residents in countries receiving capital will earn a lower rate of return from their capital than they would have earned in the previously high return Asian economies.

(**Insert tables 4a-4c here**)

Second, there is a realignment of each economy's international competitiveness through adjustments

in each country's Real Effective Exchange Rate (REER). The dramatic depreciation of the currency crisis alters multilateral trade weighted exchange rates and international competitiveness both in Asia and around the globe. However, the depreciation in real effective terms is much smaller than in nominal terms (25 percent verses 60 percent) because competitiveness gains from currency depreciation are partially offset by higher domestic inflation in these affected countries. (About 20 percent according to the simulation results). It is interesting to note that the appreciation in real effective terms for the United States and Australia are higher than other OECD countries because of their more significant trade ties (and therefore high weights in the index) with these affected Asian countries. The real effective appreciation for Taiwan, China and Hong Kong is even higher, reflecting the competitive pressure on these economies because their products compete more directly with these affected Asian countries in third markets, especially in developed markets. However, the magnitude of real appreciation is quite modest, less than 9 percent, consistent with recent estimates by et. al (1998).

Third, there are substantial adjustments of external positions by almost all economies in the world, especially for those countries in crisis and countries that have important trade and financial links with those crisis economies. As discussed earlier, the sharp declines in private capital inflows and dramatic increase of interest payment for outstanding debt will require substantial adjustments of external positions by those affected Asia countries. With the improvements in competitiveness associated with the declines in currency values, the crisis countries reduce their demand for imports and expand exports. This forced improvements in their external position, with shift production resources shifting towards the export sector to generate trade surpluses necessary to serve their international debt. While industrial countries, except Japan, are expected to have worsening trade balances. EU and Canada reduce their trade surplus by 0.3 and 1 percent of GDP respectively, while the U.S. trade deficit increases by about 0.2 percent of GDP. The worsening trade balance in industrial countries for several years is necessary for recovery in the Asian crisis economies and reflects the redistribution of global demand through international trade. This occurs through adjustment in real

exchange rates.

Finally, global supply and demand conditions are changed significantly for many important primary commodities. For example, Asian developing countries accounted for about two-thirds of the increased world consumption of petroleum products in 1992-1996, and Korea and ASEAN-4 accounted for about one-half of this increase. The share of these countries in world consumption rose from 5 percent to 6.5 percent during this period (IMF, 1998). The currency crisis reduces construction activities in the affected economies, induces higher energy import costs in terms of national currencies, implies less available credit to finance imports, and causes a sharp reduction in energy demand. As shown by the simulation results, total energy demand falls by more than 40 percent in both Korea and ASEAN countries (table 4b), thus reducing the price of energy worldwide.

In all, despite a fall in exports by most countries, the declines in real interest rate and lower world prices of energy and other intermediate inputs have an offsetting and stimulative effect on economic growth outside those countries in crisis.

What are the implications of these global adjustments induced by the crisis in Asia for the U.S. economy, especially for its food and agricultural sectors? As showed in table 4c, after a small fall in U.S. GDP in 1998, the relocation of capital increases production in the United States for a number of years. Importantly, the structure of the U.S. economy changes as well. Table 5a shows the fall in demand in Asia reduces U.S. exports across all sectors with agricultural industries falling more than non-agricultural sectors. This effect is due to higher dependence on global and Asian markets of U.S. agricultural products than other products (table 5a, last panel). The impact on exports are relatively similar across all U.S. agriculture sectors, a fall around 6 percent during 1998, except for a large drop in livestock products (a fall more than 9 percent). This fall in exports across the board is offset by a rise in consumption (table 5a, panel 3) and private investment (table 5b, panel 2) in the U.S. economy due to lower consumer prices and real interest rates. Consumption increases in all sectors with non-grain crops, food grain, textiles (table 5a), and consumer

durables such as housing and automobiles (table 5b) increasing the most. The increasing consumption of textiles reflect the cheaper imports from Asian countries due to competitive devaluation. The boom in the consumer durable sector is mainly a result of the lower real interest rate, while the increased demand for agricultural products is mainly the result of substitution of domestic demand for exports. This change in the structure of the U.S. farm sector from exports to domestic demand is clear in the second panel of table 5a, which shows that the effects of the crisis on U.S. agricultural production are quite different by sectors. Output of those sectors with the highest trade exposure--food grains (more than 40 percent of production exported, and 12 percent went to Asia market, table 5a last panel)--declines the most, about 6 percent in 1998. Feed grains and non-grain crops--15 to 25 percent of production exported and less than 10 percent went to Asia -- decline modestly, about 2 percent. And for livestock products and processed food--the least dependent on trade with less than 6 percent of production exported (less than 2 percent export to Asia) -- output increases in response to strong domestic demand stimulated by strong investment spending and lower consumer prices, despite a strong increase in imports due to lower price exports from Asia (imports of processed food increase by 2.5 percent in 1998, table 5a, panel 5). As indicated by the simulation results, the stock of physical capital increases in almost all sectors except non-grain crops and the durable goods sector (panel 3 of table 5b) due to increases in investment (panel 2 of table 5b) , with production capital and consumer durable sectors increasing the most. Increases in investment and the capital stock drive the production expansion in domestic-oriented sectors. This is supported by the induced strong domestic demand for agricultural products, especially processed food.

(**Insert tables 5a and 5b here**)

Thus within the U.S. food and agriculture industry, we see different responses to the Asian crisis. As expected the more exposed the commodity is to export markets, the greater the impact of the Asia crisis. The major additional insight from the model used here is the switch towards domestic demand driven by the changes in international capital flows and lower prices for intermediate inputs induced by the global

adjustments from the Asian crisis.

What do these global adjustments imply for U.S. food and agricultural producers? Obviously, there is a drop in farm revenue because of declining export prices and shrinking export demand from Asia. However, as shown in figures 4, there is an increase of *Tobin's q*, the shadow price of sector specific capital, implying reduced capital cost or increased unit value for investment. It explains the seemingly contradictory results observed in table 5. Production decreases in food grain, feed grain, and non-grain crop sectors, but investment in those sectors goes up. The key reason here is our assumption of agent's expectation in the simulations. With an expectation that the Asian financial crisis is a temporary shock, producers will take advantage of low capital costs to replace/upgrade machinery and equipment in the short run, in order to increase production capacity to fit the anticipated higher demand in the longer run. There are also declining costs of energy and other intermediate inputs in agricultural production because of lower real interest rates, cheaper import prices, and reduced demand for intermediate inputs resulting from the economic slowdown in Asia (figure 2 and 3). The changes in relative input prices induce substitution among production factors, causing changes in the input mix across agricultural sectors as shown in table 5b.

(**insert figures 2-4 here**)

Most of the discussion above has focused on the case where the crisis is contained in ASEAN and Korea. The lower panels of each table also show results for a more widespread crisis in Asia. One noticeable difference between results is the scale of the effects. The more widespread the crisis in Asia, the more exports from non-crisis countries are reduced but also the more capital that flows from crisis countries to non-crisis countries. The quantitative magnitudes of these effects are different across countries. Other important differences show up in the changing structure of the U.S. economy contained in tables 5a and 5b. The relative importance of U.S. agriculture on Chinese and Japanese markets are clear in these results. A wider crisis in Asia is clearly much worse for production of food grains, feed grains and non-grain crops in the United States. Offsetting this in its overall negative impact on the U.S. economy are the lower real interest

rates that accompany a wider crisis. However, the simulation results show clearly that the Asia financial crisis under both scenarios represent a permanent set back for the world economy. Global real GDP declines 0.4 percent in 1998 and 1999 in the contained case, and by 2.9 and 3.6 percent in the wider case (table 4a, panel 3). It is interesting to note that in the contained case, the reduction of total world GDP is smaller than for the affected countries, implying a rise in GDP in the rest of the world. When more Asian countries, especially Japan become more embroiled in the crisis, the decline of world GDP exceeds that for the affected countries, indicating that the rest of the world is no longer able to buffer the negative shock of the crisis when it spreads to other parts of Asia, particularly a large economy like Japan.

5. Conclusions and Directions for Future Research

Both scenarios show that the crisis in Asia will not only reduce U.S. exports but will also reduce global real interest rates and the cost of energy and other intermediate inputs of production within the US economy. Lower capital costs and intermediate prices will stimulate the U.S. domestic economic activity especially in interest-sensitive and energy-intensive sectors. This stimulus to domestic demand may or may not offset the negative impacts of a decline in exports, depending on the relative reliance of each sector on domestic U.S. demand *versus* dependence on Asian markets. The redirection of financial capital flows away from Asia to the United States and other developed markets stimulates investment in the U.S. economy, especially those sectors relying most heavily on the domestic market such as processed food, while export-oriented sectors such as food grains are more negatively affected by the crisis.

The results of this study provide useful insights in understanding the offsetting effects of the Asian crisis on U.S. agriculture. However, since the model we used is only a stylized representation of the U.S. and world economies, the results should not be interpreted as forecasts, but rather as indicative of the potential impacts of the crisis. Because the model is still under development, only one representative household is defined for each region. Therefore, we are not able to make conclusions about the net welfare effects of the Asian financial crisis on U.S. farm households *per se*. This is possible but requires further

research and model development. However, since off-farm income accounts for more than 80 percent of average farm households' income in the United States, the impact of the Asia crisis on U.S. farm welfare may be limited unless the crisis worsens further. Despite the preliminary nature of the model, results presented in this paper suggest the useful role of the model particularly in analyzing the impact of financial adjustments on global and U.S. agriculture.

Future research should be focused on sensitivity tests of key parameters and careful econometric estimation of the key parameters along the lines of the estimation in the original G-Cubed model.

Footnotes:

1.The share calculation used here is based on the ratio of the fob value of U.S. agriculture and food exports ($55 billion in FY '95) to gross farm income ($211 billion in 1995). This share probably overstates the real share because the value-added component of exports is not netted out. According to the GTAP data base, the share of U.S. agriculture production exported was 9 percent in 1995.

2.G-Cubed model was originally developed by McKibbin and Wilcoxen (1992). It combines the dynamic macroeconomic modeling approach taken in the MSG2 model of McKibbin and Sachs (1991) with the disaggregated, econometrically-estimated, intertemporal general equilibrium model of the U.S. economy by Jorgenson and Wilcoxen (1990).

3. This does not require that both sectors purchase the same amount of oil, or even that they purchase oil at all; only that they both feel the same way about the origins of oil they buy.

4.This has the undesirable effect of imposing unitary income elasticities, a restriction usually rejected by data. Moreover, in the preliminary version of the model presented here, the elasticities of substitution have been constrained to be unity. In future work we plan to replace this specification with one derived from the linear expenditure system to allow income elasticities to differ from one.

5. In the model the tax is actually levied on the difference between interest payments on the debt and what interest payments would have been if the debt had remained at its base case level. The remainder, interest payments on the base case debt, is financed by ordinary taxes.

6.A long period is used so that expectations of the future evolution of the world economy is not affected by the end point of the simulation period.

7.See McKibbin (1998) for an exploration of the differences between permanent and temporary changes in the risk premium.

8. The results for Mexico and the Rest of the World are not reported because of space limitations, but are available upon request.

9.Based on recent IMF projection, net capital inflows to the developing countries of Asia are projected at only $1.5 billion in 1998.

Table 1: Summary of Main Features

- Specification of the demand and supply sides of modeled economies in both real and financial markets;
- Household behavior in the short run is a weighted average of neoclassical optimizing behavior and ad-hoc "liquidity constrained" behavior;
- The real side of the model is disaggregated to allow for production and trade of multiple goods and services within and across economies;
- Financial markets are integrated with real side of the economy. Each financial asset represents a claim over real resources: money over purchasing power, bonds over future tax revenues, equity over future dividend stream of a firm, and foreign assets over future exports of the debtor country;
- Imposition of intertemporal budget constraints so that agents and countries cannot forever borrow or lend without undertaking the required resource transfers necessary to service outstanding liabilities;
- Assets markets are linked globally through the international mobility of financial capital;
- Agents arbitrage between different assets within countries and across countries - taking into account the fixity of physical capital stock in each sector in the short run;
- Labor markets may not clear in the short run;
- Full short run and long run macroeconomic closure with macro-dynamics at an annual frequency around a long run Solow/Swan neoclassical growth model.
- Baseline of the model is solved for a full rational expectations equilibrium at an annual frequency from 1993 to 2070.

Table 2: Overview of the G-Cubed (Agriculture) Model

Regions		*Sectors*
United States	(U)	Energy
Canada	(C)	Mining
Japan	(J)	Forestry and Fish Products
Australia	(A)	Agriculture:
European Union	(E)	Food Grains
Mexico	(M)	Feed Grains
Rest of OECD	(O)	Non-grain Crops
Korea	(K)	Livestock Products
Taiwan	(T)	Manufacturing:
China	(H)	Processed Food
ASEAN	(N)	Durable Manufacturing
Rest of the World	(L)	Textile and Apparel
		Other Non-Durable
		Services

Table 3 - Time Profile for the Simulation Shocks

(Percent change from baseline)

Country	Variable	1998	1999	2000	After 2000
Contained Shocks					
ASEAN	Risk	20	20	10	0
	Productivity	-6	-4	-2	0
Korea	Risk	20	20	10	0
	Productivity	-6	-4	-2	0
Further Spread Shocks					
ASEAN	Risk	20	20	10	0
	Productivity	-6	-4	-2	0
Korea	Risk	20	20	10	0
	Productivity	-6	-4	-2	0
Japan	Risk	20	20	10	0
	Productivity	-6	-4	-2	0
China	Risk	20	20	10	0
	Productivity	-6	-4	-2	0
Taiwan	Risk	20	20	10	0
	Productivity	-6	-4	-2	0

Figure 1 Commodity/Sector Nesting in G-cubed (Agriculture) Model

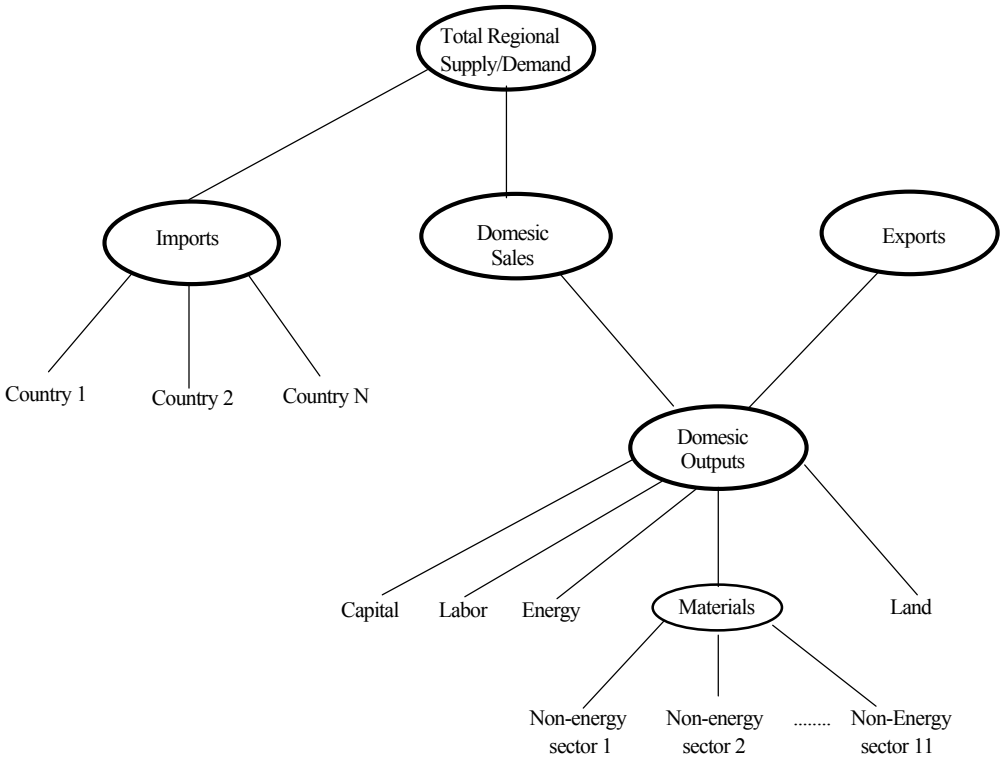


Table 4a The Impact of Asia Financial Crisis on the World: Macro Indicators

(Percent change from baseline)

Regions	Affected countries changes as share of world				World total (after adjust)			
Year	1998	1999	2000	2005	1998	1999	2000	2005
Real GDP	-0.3	-0.5	-0.3	0.0	-0.4	-0.4	-0.2	-0.1
Real GNP	-0.3	-0.5	-0.3	0.0	-0.4	-0.4	-0.2	-0.1
HH Wealth[a]	-1.7	-1.3	-0.6	0.1	-0.7	-0.7	-0.4	0.0
HH current income	-1.1	-1.3	-0.8	0.0	-0.4	-0.5	-0.3	-0.1
Private consumption	-1.0	-1.1	-0.7	0.1	-0.4	-0.5	-0.3	-0.1
Total investment	-1.9	-1.3	-0.4	0.2	0.0	0.0	-0.2	-0.1
Total imports	0.3	-0.1	-0.2	-0.2	-1.4	-1.0	-0.5	0.0
Total exports	2.2	1.4	0.3	-0.4	-0.3	-0.4	-0.3	0.0
Real GDP	-1.9	-2.8	-1.8	0.2	-2.9	-3.6	-2.0	0.2
Real GNP	-1.8	-2.7	-1.7	0.3	-2.2	-2.6	-1.5	0.1
HH Wealth	-4.7	-3.8	-1.4	0.2	-2.0	-2.1	-1.1	0.0
HH current income	-4.7	-5.8	-3.7	0.5	-3.2	-3.8	-2.2	0.1
Private consumption	-4.1	-5.1	-3.1	0.6	-2.9	-3.6	-2.0	0.2
Total investment	-6.4	-4.4	-1.2	0.6	-0.7	-0.9	-0.9	0.0
Total imports	1.0	-0.3	-0.7	-0.3	-3.2	-2.7	-1.3	0.2
Total exports	5.9	3.3	0.7	-0.7	-0.8	-1.2	-0.7	0.1

a. HH wealth includes expected future income plus financial holdings which includes equity, bonds, foreign assets and real money.

Table 4b The Impact of Asia Financial Crisis on Major Affected and Neighboring Asia Countries: Macro Indicators

(Percent change from baseline)

Regions	ASEAN				Korea				Japan				Taiwan				China and Hong Kong			
Year	1998	1999	2000	2005	1998	1999	2000	2005	1998	1999	2000	2005	1998	1999	2000	2005	1998	1999	2000	2005
									Contained Crisis in Asia											
Real GDP	-7.5	-13.0	-10.9	-1.5	-9.2	-14.1	-8.7	0.2	0.3	0.0	0.0	0.0	-0.3	0.0	-0.1	0.0	-0.2	0.3	0.2	0.0
Real GNP	-9.8	-14.2	-10.5	-0.4	-9.9	-14.4	-8.4	0.8	0.4	0.0	0.0	0.0	0.2	0.3	-0.1	-0.1	-0.1	0.3	0.2	0.0
Private consumption	-34.3	-38.4	-25.4	1.6	-32.3	-35.5	-18.7	3.3	0.0	-0.4	-0.3	-0.2	2.8	2.1	0.6	-0.5	2.6	3.0	1.6	-0.4
Total investment	-43.4	-28.3	-8.4	3.7	-26.4	-18.4	-4.4	2.0	-1.6	-0.2	0.2	0.0	4.7	2.3	0.0	-0.4	4.7	2.3	0.0	-0.4
Total imports	4.0	-0.2	-2.8	-2.7	4.5	-1.8	-3.5	-1.5	0.9	0.3	0.2	0.3	-1.5	-0.6	-0.2	0.3	-2.0	-1.1	-0.3	0.4
Total exports	22.5	14.4	3.8	-4.6	21.7	12.9	2.8	-3.2	2.7	1.0	0.4	0.3	-2.4	-1.4	-0.3	0.5	-4.5	-3.0	-1.1	0.7
Balance of trade[a]	18.0	15.7	7.2	-1.6	16.8	15.0	5.9	-1.4	0.4	0.2	0.1	0.0	-1.6	-1.2	-0.3	0.3	-0.9	-0.7	-0.3	0.1
Real interest[b]	8.6	6.3	2.0	-0.1	6.6	6.0	2.9	-0.1	1.1	0.3	0.0	0.0	-1.1	-1.1	-0.6	0.0	-1.0	-0.7	-0.3	0.0
Inflation rate[b]	20.4	18.4	10.8	1.7	19.2	17.3	6.8	1.0	0.3	0.1	0.0	0.0	-0.6	-0.4	0.0	-0.1	-0.6	-0.3	0.0	0.0
Real exchange rate	-29.4	-18.6	-5.4	5.1	-30.0	-17.2	-3.6	4.2	-9.4	-5.1	-2.0	0.2	-1.2	-1.5	-1.0	-0.3	-1.0	-0.6	-0.4	-0.3
Nominal exchange rate	-60.5	-47.9	-23.1	4.1	-59.8	-45.1	-15.8	5.0	-10.1	-5.8	-2.2	0.3	-2.0	-1.1	-0.9	-0.3	-0.2	0.1	-0.1	-0.3
Real effective exch rate	-25.8	-16.7	-4.7	5.3	-23.5	-13.3	-2.3	3.7	-1.3	-0.1	-0.5	-1.0	6.8	3.7	0.8	-1.2	8.9	5.3	1.5	-1.3
									Wider *Crisis in Asia*											
Real GDP	-8.2	-12.7	-10.2	-1.3	-9.1	-13.6	-8.5	0.2	-6.9	-9.4	-6.0	1.7	-7.6	-17.7	-10.9	-1.5	-8.4	-12.9	-7.9	-0.3
Real GNP	-9.7	-13.3	-9.8	-0.5	-9.6	-13.8	-8.3	0.6	-6.4	-9.0	-5.8	1.7	-7.1	-17.2	-10.7	-1.5	-8.7	-12.6	-7.2	0.4
Private consumption	-29.6	-32.8	-22.0	0.7	-27.8	-31.5	-17.3	2.0	-13.1	-16.6	-10.5	2.8	-20.9	-33.1	-18.7	-2.1	-33.3	-39.9	-21.0	2.7
Total investment	-34.4	-23.1	-8.0	2.8	-20.3	-14.7	-4.3	1.5	-13.6	-9.3	-2.5	1.6	-28.7	-23.4	-7.3	1.3	-28.6	-17.3	-3.3	1.7
Total imports	2.2	-1.3	-2.9	-2.1	2.3	-2.8	-3.4	-1.0	5.2	-0.3	-2.1	0.5	1.5	-6.7	-5.0	-1.3	5.9	0.5	-2.2	-2.5
Total exports	16.5	9.7	2.2	-3.3	16.3	9.1	1.9	-2.0	18.7	10.4	2.7	-1.3	12.8	6.9	1.8	-0.7	22.1	12.7	1.8	-4.5
Balance of trade[a]	14.2	12.0	5.7	-1.1	13.7	12.3	5.2	-0.9	4.1	3.2	1.4	-0.5	18.6	24.3	11.1	0.6	6.0	4.5	1.3	-0.6
Real interest[b]	6.4	3.9	0.8	-0.1	5.1	3.9	1.7	-0.1	3.5	2.7	1.1	0.0	6.1	5.7	3.4	-0.1	4.1	0.8	-1.0	0.1
Inflation rate[b]	19.0	17.2	10.1	1.6	18.1	16.5	6.6	0.3	12.1	10.9	4.2	-1.8	19.3	22.6	9.3	2.0	13.9	11.2	3.8	1.0
Real exchange rate	-33.3	-21.3	-6.6	4.3	-33.5	-20.1	-5.4	3.2	-37.6	-22.7	-6.8	2.4	-31.1	-18.8	-5.9	1.8	-38.0	-23.6	-5.8	5.5

Nominal exchange rate	-62.2	-48.6	-23.2	3.2	-61.6	-46.9	-17.5	3.8	-53.8	-38.1	-13.6	4.9	-58.7	-53.0	-21.8	-0.7	-64.3	-48.2	-16.4	5.8
Real effective exch rate	-13.8	-9.4	-3.0	3.3	-13.4	-7.7	-1.6	1.8	-22.0	-12.8	-3.8	0.9	-10.3	-6.0	-1.9	0.3	-16.7	-10.5	-1.6	4.2

Table 4c The Impact of Asia Financial Crisis on Major Industrial Countries: Macro Indicators

(Percent change from baseline)

Regions	United States				Canada				EU12				Australia				Other OECD			
Year	1998	1999	2000	2005	1998	1999	2000	2005	1998	1999	2000	2005	1998	1999	2000	2005	1998	1999	2000	2005
									Contained Crisis in Asia											
Real GDP	-0.1	0.1	0.1	-0.1	-0.2	0.2	0.1	-0.1	-0.2	0.1	0.2	-0.1	0.0	0.2	0.1	-0.1	-0.2	0.2	0.2	-0.1
Real GNP	-0.1	0.1	0.1	-0.1	-0.1	0.2	0.1	-0.2	-0.3	0.0	0.1	-0.1	0.0	0.3	0.1	-0.2	-0.3	0.1	0.1	-0.2
Private consumption	0.6	0.7	0.5	-0.1	1.2	1.3	0.6	-0.4	0.6	0.8	0.6	-0.2	1.3	1.4	0.6	-0.4	0.8	1.0	0.6	-0.4
Total investment	3.2	1.6	0.1	-0.4	3.2	1.9	0.2	-0.3	3.4	2.0	0.4	-0.3	3.5	2.1	0.2	-0.3	3.7	2.4	0.4	-0.5
Total imports	-2.6	-1.5	-0.5	0.2	-0.8	-0.4	-0.1	0.1	-2.5	-1.3	-0.4	0.3	-1.3	-0.5	-0.1	0.2	-1.3	-0.7	-0.2	0.1
Total exports	-6.3	-4.0	-1.5	0.4	-3.0	-1.9	-0.6	0.4	-3.4	-2.1	-0.7	0.4	-4.3	-3.0	-1.2	0.4	-3.4	-2.1	-0.8	0.4
Balance of trade[a]	-0.2	-0.2	-0.1	0.0	-1.0	-0.7	-0.2	0.2	-0.3	-0.3	-0.3	0.1	-0.7	-0.6	-0.3	0.1	-0.6	-0.5	-0.2	0.1
Real interest[b]	-0.6	-0.5	-0.2	0.0	-0.9	-0.7	-0.3	0.0	-1.0	-0.9	-0.5	0.0	-0.8	-0.8	-0.4	0.0	-1.0	-0.9	-0.5	0.0
Inflation rate[b]	-0.4	-0.3	-0.1	0.1	-0.6	-0.5	0.1	0.1	-0.4	-0.5	-0.2	0.0	-0.6	-0.5	0.5	0.1	-0.8	-0.7	-0.2	0.2
Real exchange rate					-0.8	-0.6	-0.4	-0.2	-1.2	-0.8	-0.4	-0.1	-0.9	-0.7	-0.5	-0.3	-1.0	-0.6	-0.3	-0.1
Nominal exchange rate					-0.5	-0.3	-0.4	-0.3	-1.2	-0.7	-0.2	0.0	-0.5	-0.5	-0.6	-0.4	-0.7	-0.3	-0.1	-0.3
Real effective exch rate	7.8	4.6	1.6	-0.6	0.9	0.4	0.0	-0.4	7.1	4.1	1.2	-0.9	5.6	3.2	0.8	-0.9	1.2	0.8	0.3	-0.2
									Wider Crisis in Asia											
Real GDP	-0.4	0.2	0.3	-0.1	-0.5	0.2	0.3	-0.2	-0.5	0.1	0.4	-0.1	-0.1	0.4	0.2	-0.3	-0.5	0.4	0.5	-0.3
Real GNP	-0.3	0.4	0.4	-0.1	-0.3	0.3	0.2	-0.4	-0.7	-0.1	0.2	-0.3	0.0	0.6	0.2	-0.5	-0.9	-0.1	0.1	-0.4
Private consumption	1.5	2.0	1.4	-0.2	2.8	2.9	1.5	-1.1	1.5	1.8	1.4	-0.7	3.3	3.5	1.7	-1.0	1.9	2.3	1.6	-0.8
Total investment	8.7	4.8	0.1	-0.9	8.9	5.4	0.3	-1.0	8.8	5.4	0.7	-0.9	10.2	6.4	0.7	-0.9	10.2	7.1	1.3	-1.1
Total imports	-6.8	-4.2	-1.4	0.3	-2.3	-1.2	-0.2	0.6	-6.1	-3.4	-0.6	1.0	-2.7	-1.2	-0.2	0.5	-3.1	-1.6	-0.4	0.3
Total exports	-16.5	-11.3	-4.2	0.8	-7.8	-5.2	-1.5	1.5	-8.6	-5.6	-1.7	1.3	-12.2	-9.5	-3.7	1.6	-8.7	-5.6	-1.8	1.0
Balance of trade[a]	-0.5	-0.4	-0.2	0.0	-2.5	-1.8	-0.6	0.4	-0.9	-0.8	-0.4	0.1	-2.2	-1.9	-0.8	0.2	-1.8	-1.3	-0.4	0.2
Real interest[b]	-1.6	-1.4	-0.6	0.1	-2.2	-2.4	-1.2	-0.0	-2.4	-2.6	-1.4	0.1	-2.1	-2.8	-1.7	0.1	-2.2	-2.5	-1.5	0.1
Inflation rate[b]	-0.9	-0.9	-0.2	0.1	-1.4	-1.2	-0.4	0.2	-1.0	-1.2	-0.6	0.1	-1.5	-1.3	-0.2	0.3	-1.8	-1.8	-0.7	0.4
Real exchange rate					-3.1	-2.4	-1.5	-1.0	-3.4	-2.6	-1.5	-0.8	-3.5	-3.0	-1.7	-0.9	-2.8	-2.2	-1.1	-0.6
Nominal exchange rate					-2.6	-2.0	-1.4	-1.3	-3.7	-2.5	-1.1	-0.8	-2.7	-2.4	-1.7	-1.2	-2.3	-1.5	-0.7	-0.9

Real effective exch rate	23.2	14.6	4.8	-1.2	2.3	0.8	-0.5	-1.4	20.2	11.8	2.5	-3.3	13.3	7.5	1.6	-2.1	3.9	2.3	0.8	-0.3

a. Percent of GDP change from baseline
b. percent point change

Table 5a The Impact of Asia Financial Crisis and Global Adjustment on Structure of US Economy

(Percent change from baseline)

	Production				Consumption				Exports				Imports				Exports/ production		Imports/ absorption	
	1998	1999	2000	2005	1998	1999	2000	2005	1998	1999	2000	2005	1998	1999	2000	2005	Total	Asia	Total	Asia
Contained Crisis in Asia																				
Food grains	-5.98	-4.04	-1.55	0.49	2.60	1.27	1.25	-1.16	-6.54	-4.63	-1.98	0.51	0.00	-3.57	0.00	0.00	40.27	12.24	4.68	1.00
Feed grains	-2.02	-1.16	-0.35	0.05	0.00	3.85	0.00	0.00	-6.68	-4.57	-1.92	0.32	-4.35	0.00	0.00	0.00	16.32	6.98	0.94	0.00
Non-grain crops	-2.12	-1.08	-0.28	0.07	3.09	2.27	1.06	-0.39	-5.30	-3.30	-1.27	0.40	0.58	0.33	0.12	-0.06	22.30	9.15	17.24	2.30
Livestock products	-0.20	0.14	0.23	-0.05	1.01	1.10	0.69	-0.16	-9.36	-6.72	-2.75	0.69	0.58	0.57	0.32	0.08	3.37	1.80	2.53	0.05
Processed food	0.31	0.51	0.44	-0.04	1.29	1.22	0.73	-0.18	-5.71	-3.80	-1.44	0.50	2.51	1.61	0.37	-0.59	5.92	1.78	4.85	0.83
Ag. Total	-0.33	0.06	0.22	-0.02	1.36	1.27	0.75	-0.19	-6.25	-4.18	-1.67	0.47	0.89	0.55	0.18	-0.14	7.72	2.94	4.88	0.63
Non. Ag Total	0.06	0.21	0.13	-0.07	0.72	0.93	0.63	-0.16	-4.99	-3.19	-1.20	0.32	2.85	1.71	0.51	-0.26	5.45	1.37	6.32	2.20
Total	0.03	0.20	0.14	-0.07	0.78	0.97	0.64	-0.17	-5.18	-3.34	-1.27	0.34	2.56	1.53	0.46	-0.24	5.60	1.47	6.23	2.10
Wider Crisis in Asia																				
Food grains	-15.7	-11.5	-4.5	1.0	6.5	5.1	3.7	-1.2	-17.3	-13.2	-5.5	1.2	-11.1	-10.7	-3.6	3.3	40.27	12.24	4.68	1.00
Feed grains	-8.0	-6.1	-2.4	0.4	3.8	3.8	0.0	0.0	-27.1	-22.9	-10.3	1.4	-8.7	-4.3	0.0	4.2	16.32	6.98	0.94	0.00
Non-grain crops	-4.7	-2.6	-0.7	-0.0	6.2	5.1	2.6	-0.7	-12.0	-8.2	-3.2	0.6	0.8	0.5	0.2	-0.0	22.30	9.15	17.24	2.30
Livestock products	-0.5	0.5	0.7	-0.0	2.9	3.3	2.1	-0.3	-25.3	-19.2	-8.1	1.8	2.2	2.0	1.2	0.3	3.37	1.80	2.53	0.05
Processed food	0.6	1.3	1.2	-0.0	3.1	3.3	2.1	-0.2	-15.7	-11.5	-4.5	1.0	4.6	3.4	1.3	-0.4	5.92	1.78	4.85	0.83
Ag. Total	-1.0	0.0	0.5	0.0	3.3	3.4	2.1	-0.3	-17.1	-12.8	-5.3	1.0	1.5	1.1	0.5	-0.1	7.72	2.94	4.88	0.63
Non. Ag Total	0.2	0.6	0.4	-0.2	1.9	2.6	1.8	-0.3	-12.8	-8.8	-3.3	0.5	8.2	5.1	1.5	-0.5	5.45	1.37	6.32	2.20
Total	0.1	0.5	0.4	-0.2	2.0	2.7	1.8	-0.3	-13.4	-9.4	-3.6	0.6	7.2	4.5	1.3	-0.5	5.60	1.47	6.23	2.10

Table 5b The Impact of Asia Financial Crisis and Global Adjustment on Input Structure of US Economy

(Percent change from baseline)

	Investment				Capital Stock				Labor				Energy				Material			
	1998	1999	2000	2005	1998	1999	2000	2005	1998	1999	2000	2005	1998	1999	2000	2005	1998	1999	2000	2005
Contained Crisis in Asia																				
Food grains	6.4	3.9	1.2	0.1	0.0	0.2	0.3	0.1	-6.4	-3.8	-1.8	0.0	-6.3	-4.6	-1.5	1.3	-5.6	-3.7	-1.5	0.4
Feed grains	3.7	1.5	-0.3	0.0	0.0	0.1	0.1	0.0	-2.6	-1.4	-0.5	0.0	-2.5	-0.8	0.0	0.0	-1.9	-1.1	-0.3	0.0
Non-grain crops	0.5	-0.9	-1.4	0.1	0.0	0.0	0.0	-0.1	-3.3	-1.6	-0.5	0.0	-2.3	-1.5	-0.7	0.0	-2.6	-1.2	-0.3	0.1
Livestock products	1.5	0.9	0.2	0.4	0.0	0.1	0.1	0.0	-0.9	-0.2	0.1	0.0	-0.3	0.0	0.0	0.0	-0.1	0.2	0.2	-0.1
Processed food	5.5	8.1	5.3	0.2	0.0	0.2	0.4	0.2	-0.5	0.1	0.3	0.0	0.0	0.4	0.4	0.0	0.7	0.8	0.5	-0.1
Ag. Total	**2.8**	**1.9**	**0.6**	**0.1**	0.0	0.1	0.2	0.1	-1.3	-0.4	0.0	0.0	-0.9	-0.3	0.0	0.1	-0.1	0.2	0.3	-0.1
Non. Ag Total	1.8	1.5	0.6	0.2	0.0	0.1	0.2	0.0	-0.2	0.1	0.1	0.0	0.1	0.2	0.1	0.0	0.4	0.4	0.1	-0.1
Production capital	**9.6**	**-1.7**	**-5.9**	**0.6**	0.0	0.7	0.5	-0.3	1.8	0.8	-0.2	-0.2	2.2	0.9	-0.2	-0.1	2.8	1.4	0.0	-0.3
Consumer durable	**2.7**	**1.0**	**-0.4**	**-0.2**	0.0	0.3	0.4	0.0												
Total	3.2	1.6	0.1	-0.4	0.0	0.2	0.2	0.0	-0.2	0.1	0.1	-0.1	0.1	0.2	0.1	0.0	0.8	0.6	0.1	-0.1
Wider Crisis in Asia																				
Food grains	16.4	10.8	3.1	-0.6	0.0	0.5	0.8	0.3	-16.7	-11.8	-5.0	1.1	-15.9	-12.3	-4.5	1.3	-14.7	-10.8	-4.3	0.9
Feed grains	11.4	6.7	0.3	0.3	0.0	0.3	0.4	0.1	-9.3	-6.9	-2.8	0.3	-9.1	-6.5	-2.3	0.0	-7.6	-6.0	-2.4	0.3
Non-grain crops	-1.9	-4.2	-5.1	0.0	0.0	-0.1	-0.2	-0.5	-7.5	-4.0	-1.0	0.1	-6.3	-3.8	-1.5	0.6	-5.6	-3.0	-0.6	0.1
Livestock products	4.1	2.6	0.6	-0.3	0.0	0.2	0.3	0.1	-2.4	-0.7	0.3	-0.1	-1.1	-0.3	0.3	0.0	-0.3	0.6	0.8	0.0
Processed food	13.2	21.6	15.0	-5.6	0.0	0.4	1.0	0.6	-1.4	0.3	0.8	-0.2	-0.2	0.7	0.9	0.0	1.5	1.9	1.4	-0.2
Ag. Total	**7.3**	**5.3**	**1.6**	**-0.6**	0.0	0.3	0.5	0.1	-3.5	-1.4	0.0	-0.1	-2.9	-1.5	-0.2	0.1	-0.5	0.4	0.7	-0.1
Non. Ag Total	5.2	4.3	1.7	-0.8	0.0	0.3	0.5	0.1	-0.6	0.3	0.3	-0.2	0.1	0.3	0.3	0.0	1.1	1.1	0.4	-0.2
Production capital	**26.4**	**-4.0**	**-16.7**	**2.1**	0.0	1.9	1.4	-0.9	4.9	2.3	-0.6	-0.5	5.7	2.5	-0.5	-0.4	7.7	4.1	0.0	-0.7
Consumer durable	**7.3**	**3.0**	**-1.1**	**-0.5**	0.0	0.9	1.1	-0.1												
Total	8.7	4.8	0.1	-0.9	0.0	0.4	0.6	0.1	-0.5	0.3	0.3	-0.2	0.1	0.3	0.3	0.0	2.4	1.7	0.4	-0.3

Figure 2

Changes in Average Wage, Real Interest Rate and Price of Energy Inputs in the United States

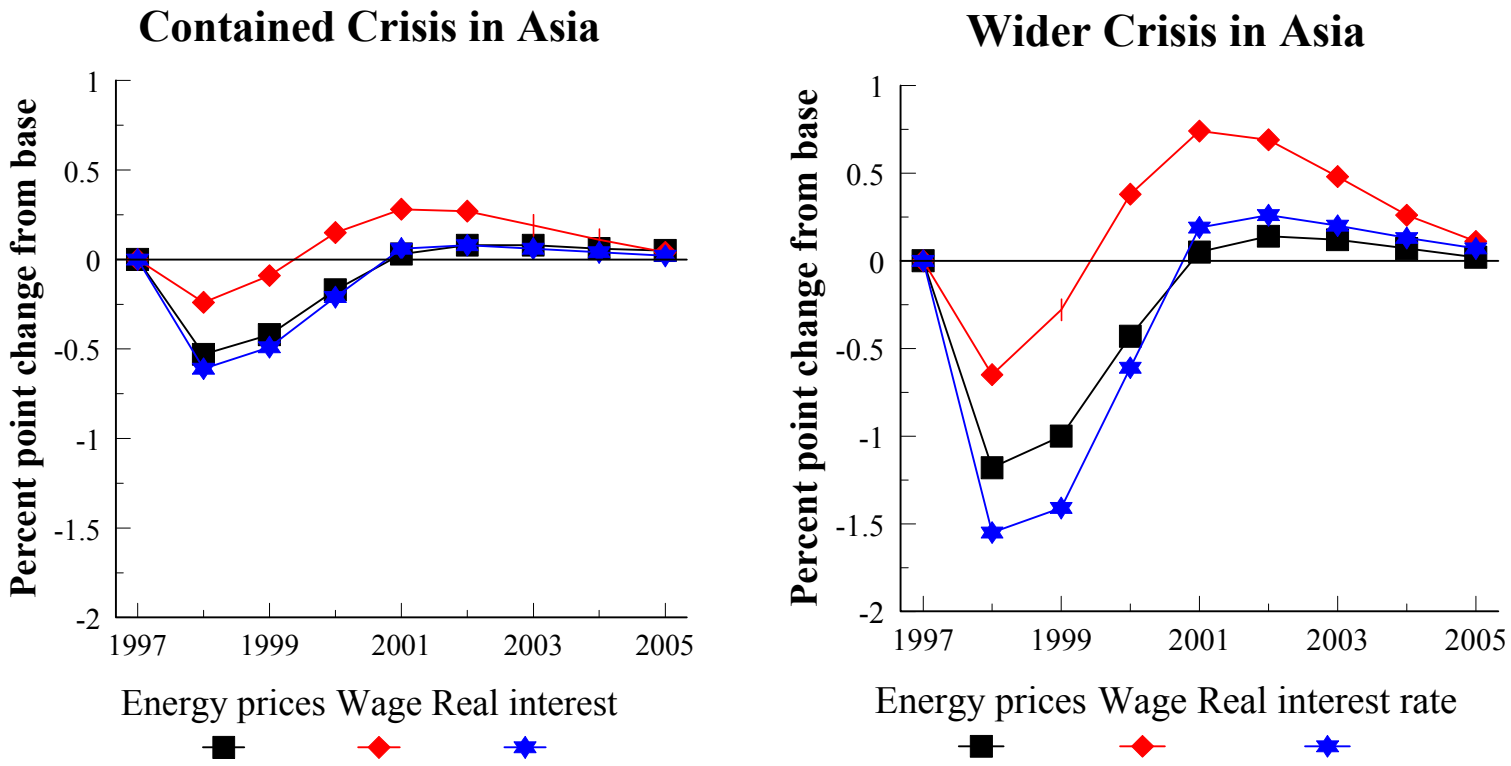


Figure 3

Changes in Prices of Material Inputs in U.S. Farm Sector

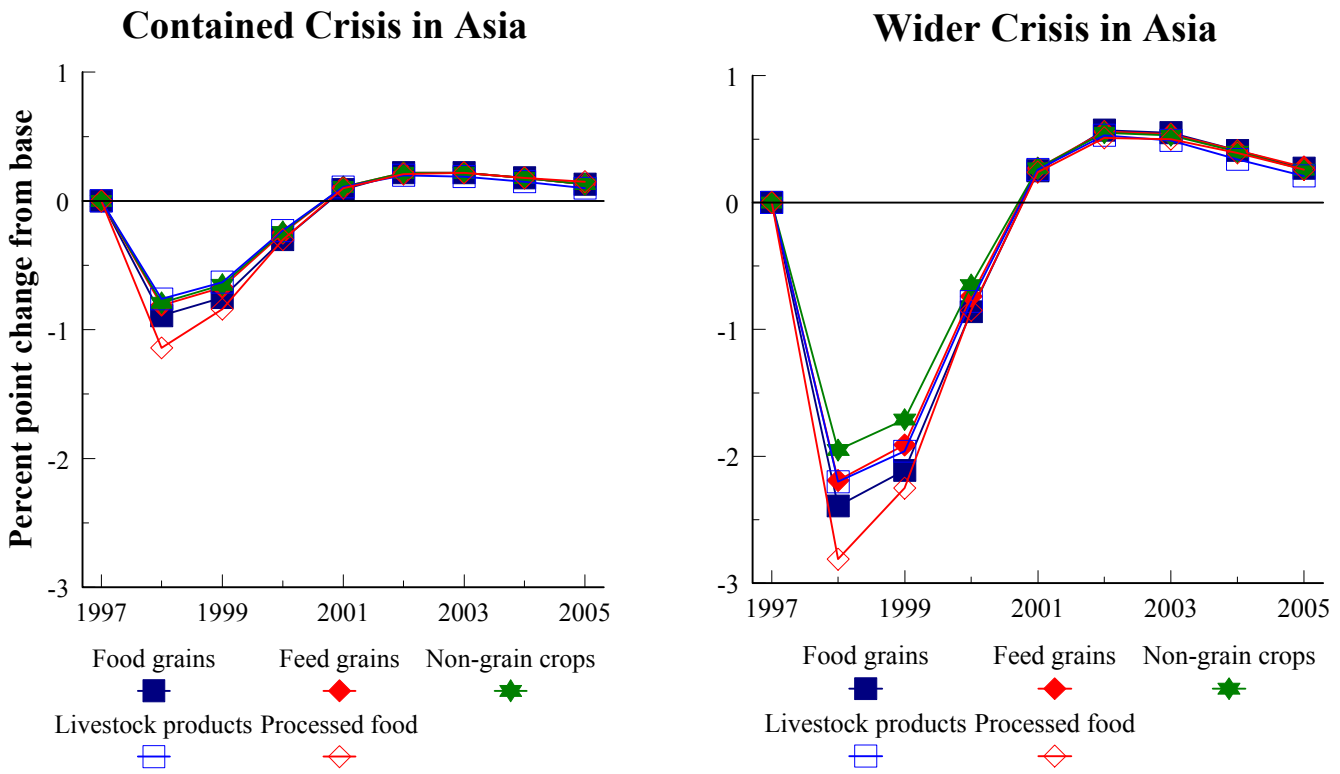
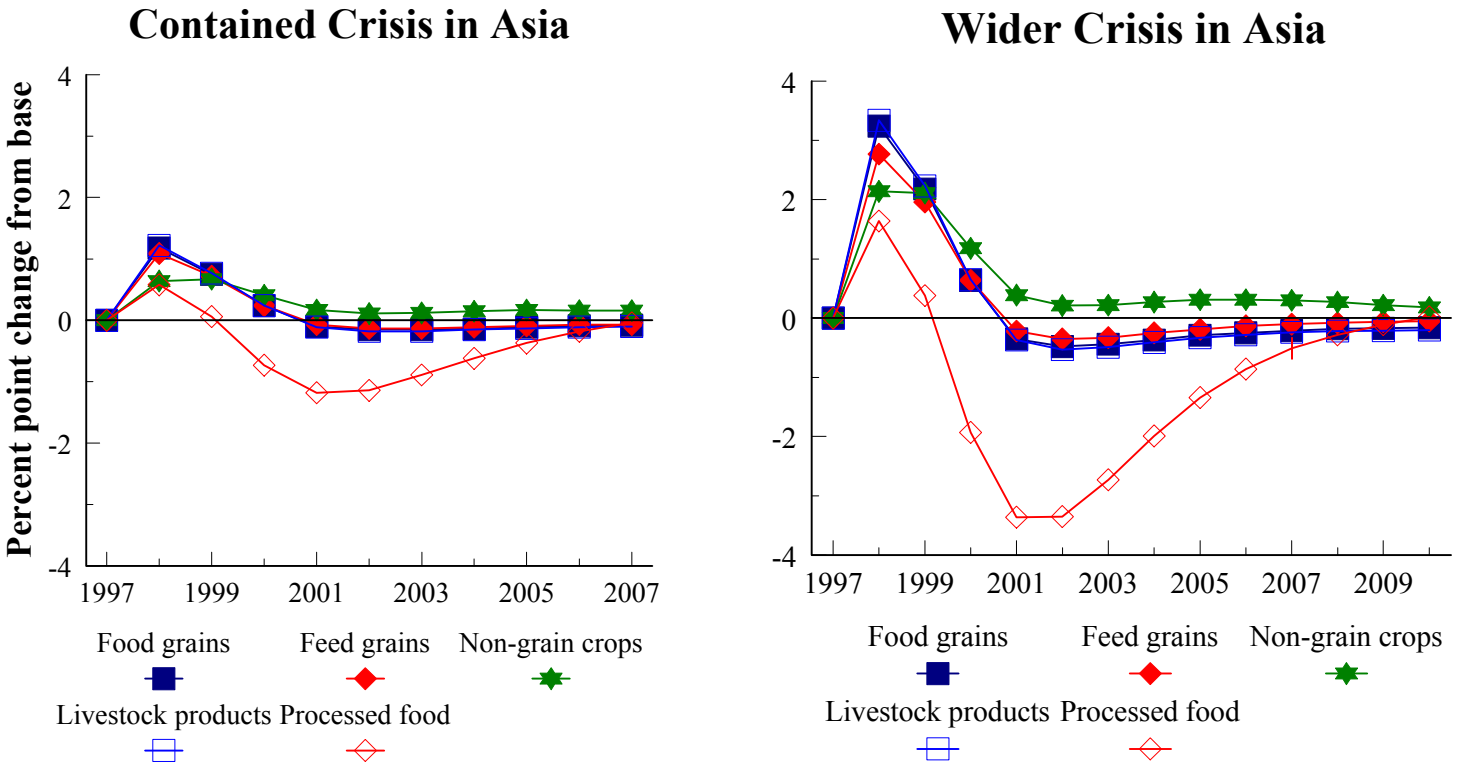


Figure 4

Changes in Shadow Prices of Capital Stock in U.S. Agriculture



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