

Modelling the Crisis in Asia

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This paper gives an overview of studies that have attempted to model the crisis in Asia. Although no model-based research predicted the crisis, modelling results have given useful insights into the cause of the crisis as well as the sectoral and macroeconomic adjustment to be expected following the crisis. Some alternative policy responses have also been simulated; these throw light on how to respond to the Asian crisis within and outside Asia.

Introduction

The crisis in Asia has presented challenges across a broad spectrum. Apart from the severe problems facing individuals and governments in the affected countries, as Garnaut (1998) has noted, the crisis has also presented a challenge to economic thought. This challenge is clearest for the theoretical and empirical knowledge embodied in multi-country economic models. One may ask whether these models have been of any use in explaining the crisis and subsequent adjustments. Have the economic theories and mathematical representations of these theories been shown to be totally inadequate in the face of such a dramatic event as the Asian crisis? The purpose of this article is to provide answers to this question by surveying the studies of the Asian crisis that have been undertaken using multi-country economic models. Although only simplified representations of complex economic systems, the models have provided a number of insights into the crisis and its impact on the rest of the world economy.

Existing model-based studies can be divided into three categories: modelling studies that predicted the crisis; studies that have used

multi-country models to explain the crisis *ex-post*; and studies that have examined the adjustment process in response to the crisis in individual crisis countries as well as globally.

There would seem to be no modelling studies that predicted the crisis in Asia *ex ante*. A study by McKibbin and Martin (1998), which is a background paper for the recently published World Bank study on *East Asia: The Road to Recovery*, attempted to evaluate alternative explanations of the causes of the crisis by using a multi-country economic model to identify shocks. Revisions to expectations about growth prospects, shifts in risk perceptions and expectations about policy responses are shown in that paper to go a long way to giving consistent explanations of the extent of the exchange rate changes and asset price collapses experienced in the crisis countries. All the other studies fall into the final category of exploring the nature of the adjustment both within crisis economies and outside, following after the initial crisis.

Very few of these models deal explicitly with international capital flows and even fewer deal with dynamic adjustments between equilibria. Yet these aspects of the Asian crisis are crucial for

understanding the adjustment process. Some recent newly-developed dynamic intertemporal general equilibrium models have this characteristic and therefore dominate the studies to date. These intertemporal models, based on what I have called the G-Cubed model, were used to examine: the impact of changes in risk perceptions and productivity collapses on Asian economies and the transmission of the shock to the rest of the world, through both international trade and international capital movements (McKibbin 1998a; McKibbin 1998b); and the impact on local and world agricultural markets (Coyle et al. 1998; Stoeckel et al. 1998). Two studies using computable general equilibrium models, by Noland et al. (1998) and Kawasaki (1998), looked at the impact of the crisis on the composition of international trade flows and economic structures within and outside Asia. Finally, a study at the OECD (1997), using the INTERLINK multi-country econometric model explored the links between Asia and the OECD economies, primarily with a focus on the impact of the crisis on OECD economies outside Asia.

Insights on Causes of the Crisis

There are now a number of excellent overviews of the crisis and a vigorous debate on the causes (see Corsetti et al. 1998, Krugman 1998, McLeod and Garnaut 1998, and Radelet and Sachs 1998) but the various arguments are more imaginative than subject to rigorous empirical evaluation. This is not the fault of the authors; it is very difficult to test the alternative propositions except within a general equilibrium framework.

To my knowledge, no studies using economic models predicted the crisis in Asia before the fact. Using economic models for forecasting (as distinct from policy analysis) usually involves a high degree of interaction between modellers and other experts. Some models were perhaps showing problems in the crisis economies but any such results would probably have been dismissed as obvious model errors and adjusted away, for the conventional wisdom in early 1997 was that Asian growth would continue.

The failure of models to predict the crisis should not be seen as evidence that models cannot help in understanding the causes of the crisis. Economic models consist of a large number of assumptions built into a large number of equations. If the assumptions fed into the model are wrong or new information hits a market before a model can be rerun, then the forecasts generated by the model are likely to be wrong. The value of these models is not so much in their ability to forecast as in enabling us to understand how outcomes change as a result of changing model inputs.

One study that used an economic model to try to understand likely causes of the crisis is a recent paper by McKibbin and Martin (1998). It looks back at data in the key crisis economies of Thailand, Korea and Indonesia and uses these data to see if the model can generate the scales of adjustment in asset markets, in particular stock markets and foreign exchange rates, as well as the sharp declines in economic activity, that actually occurred. The paper first looks for evidence of traditional causes of crisis in emerging economies such as terms of trade shocks, world interest rate shocks or the fact that the crisis countries had exchange rates tied in various ways to the U.S. dollar. Although each perhaps played some role, none of these explanations seemed large enough to explain the magnitude of the crisis. The authors then looked at the stock market data for Thailand which indicated a significant fall in share prices through 1996 and into 1997. Translating these into a revision of expectations about future growth prospects in Thailand, they used this as input into simulations of the G-Cubed Asia-Pacific Multi-country Model. The result was a revision in expected growth in 1997 of 0.5% per year for five years (with a permanent reduction in the level of GDP after that) which led to a 20% depreciation of the Thai baht, a collapse in real investment of 10% in the year of the revision and a collapse of private consumption of 40% in the first year. The consumption collapse was primarily due to a large capital loss associated with a sharp rise in U.S. dollar denominated foreign debt and the collapse in the value of physical capital. These wealth

effects were exacerbated in the short run by the Keynesian multiplier. Similar revisions to growth expectations were also shown to cause problems for Korea and Indonesia and to other economies in the region. The explanation for Korea is plausible because it is consistent with falling stock markets in Korea before the crisis. It is less plausible as an explanation for Indonesia because there were no indications of a fall in financial prices until after crisis emerged. Despite the severity of the shock in Thailand, the spillovers through trade and capital flows throughout the region were relatively small. The model results suggest that there was little direct transmission of the shock, especially the large exchange rate depreciation, through trade and capital flows.

An alternative set of simulations followed the approach of modelling risk premia as in McKibbin (1998a), but using the actual data on risk spreads that emerged in the crisis economies. It was shown that, if the average jump in risk premiums on the assets of these economies between July 1997 and December 1997 was assumed to be permanent, very large changes in real exchange rates and real consumption and investment could be generated. For example, the risk premium on Indonesian assets rose from around 110 basis points in July 1997 to nearly 650 basis points by February 1998. This rise of 540 basis points was very large. Using the average increase in Indonesia of 240 basis points the model generates a nominal exchange rate depreciation of 30%, a fall in private consumption of over 20% and a sharp contraction in investment of 28%. Thus the model results suggest that the initial collapse in Indonesia could be explained as a re-evaluation of risk associated with the problems in Thailand rather than any deep structural problem in Indonesia as the trigger of the crisis. This does not mean that the crisis was not aggravated by domestic problems in Indonesia, but as a trigger risk re-evaluation could be very important. Additional growth pessimism after the crisis began further impaired confidence in the Indonesian economy.

Another source of shocks that are considered is the impact of the actual and expected monetary

responses in the crisis countries. Both Thailand and Korea reacted with tightening of policy whereas Indonesia had a dramatic monetary expansion in late 1997. If a monetary loosening was expected in crisis countries, then the actual tightening that was administered would have larger real negative output consequences. The impact of a monetary loosening of the extent experienced in Indonesia according to the model was to dramatically further devalue the rupiah. From this study, it appears that revisions of growth prospects, changes in risk perceptions and policy responses in the individual countries in the G-Cubed (Asia-Pacific) model can explain the qualitative and quantitative events that unfolded in the actual economies.

Consequences of the Crisis

The consequences of the crisis have to be examined at two levels. The first relates to the impact on the crisis countries themselves, the second to the spillovers to the rest of the world — primarily the industrialized economies. At this stage it is difficult to evaluate the overall performance of the models because events are still unfolding, but we do have some studies and can evaluate their insights over the coming year or so.

Impact on Crisis Countries

In McKibbin (1998a) the impact on crisis countries of a change in risk perceptions was shown to have large financial and real consequences. This paper imputed the change in risk premiums required to generate the change in exchange rates in the crisis countries up to December 1997, and explored the consequences of whether the risk shock was permanent or temporary. The more permanent the risk shock, the smaller the change in risk required to cause the same initial exchange rate depreciation. The adjustment in the real economy over time was shown to be quite different for temporary as opposed to permanent risk shocks. The output loss was found to be larger, the longer the risk premium remained high. An interesting result from McKibbin and Martin

(1998) is that the actual risk premiums used in that paper were of a similar magnitude to the assumed risk premiums in the permanent risk shocks in McKibbin (1998a).

In these simulations, although the asset price changes and the changes in consumption and investment are of orders of magnitude similar to the actual outcomes in late 1997, the GDP losses in the model simulations were much smaller than have now occurred. The explanation for this divergence between the model results and the actual outcomes is that the model generated a large response in net exports from crisis economies which significantly reduced the GDP or production contractions. McKibbin (1998a) pointed out that a domestic financial collapse and/or inability to export owing to financial problems could change the model results. In fact productivity shocks need to be imposed on top of the risk shocks to enable the models to match the actual production outcomes. This effect is considered in McKibbin (1998a), McKibbin and Martin (1998), Noland et al. (1998), Kawasaki (1998) and Coyle et al. (1998).

Noland et al. (1998) focus on the effect on trade flows and economic activity of cumulative exchange rate depreciations in Asian economies. The output contractions are larger than in McKibbin (1998a) primarily because with similar contractions in domestic demand, net exports expand far less than in McKibbin (1998a).

Spillovers to the Rest of the World

Early in the debate, the G-Cubed model was giving results which were counter to popular commentary, both in Australia and in the United States. The model showed that although the international trade effects are negative for countries that export to Asia, the international capital outflow would push down world interest rates and stimulate non-traded sectors of economies that were not also affected by risk reassessment. Thus Australia would slow only slightly in the short run and the United States would actually experience stronger growth as a result of the capital reallocation. A similar result was subsequently found in

the CGE model used by Noland et al. (1998). This effect seems to have been borne out by September 1998, although the problem now emerging is that risk re-evaluation across a range of assets in all countries is occurring. Thus, although the direct impact of the Asian crisis on countries outside Asia has been small, the confidence effects are beginning to have a negative impact.

The small spillover effects from Asia in these studies is in contrast with the OECD analysis (OECD 1997) in which the economic spillover in 1997 for the United States was likely to be a reduction of growth by up to 0.3% and 0.7% by 1998. This result largely ignored the capital flows effects because the model used focused largely on trade linkages between economies. The international capital flow consequences of the Asian crisis is one of the important contributions that multi-country economic models have made to our understanding of the crisis.

Another issue of importance for the global economy is possible changes in current account balances. This is particularly important because of the political responses highlighted in Noland et al. (1998). The fact that capital flowed out of Asia implies that countries receiving that capital would experience current account deficits which would increase political pressures from trade lobby groups. In McKibbin (1998a) there is indeed a large worsening in non-Asian current account balances. The U.S. balance is found to deteriorate by around 1% of GDP and the Australian by 2% of GDP. This reflects the capital inflow into these economies. Noland et al. (1998) found a similar pattern of current account changes, although the overall magnitudes were somewhat smaller than these numbers — closer to 0.6% of GDP for the United States.

Implications for Policy Responses

McKibbin and Martin (1998) used the G-Cubed model to explore possible policy responses, both within crisis economies as well as in the OECD. The authors found that a mix of fiscal expansion and monetary expansion within the crisis economies would tend to be neutral on the exchange

rate of these economies, but significantly support domestic demand. This policy mix is in contrast to the actual policy response of tight fiscal policy and tight monetary policy which was clearly aimed at holding a rapidly falling exchange rate. The modelling results suggest that the exchange rate fall would be rapid but would bottom quickly and thereafter be responsive to the outcomes in the real economy. With high real interest rates, the real economy is squeezed and the real exchange rate is low, consistent with these policy settings. To be fair to proponents of the tight policy school, the debate about credibility in policy responses is difficult to deal with in these models because it is usually assumed that the policy change imposed is credible to all concerned. In practice, it is unclear how credible a policy will be.

As for policy response outside Asia, McKibbin and Martin (1998) show that a temporary fiscal expansion in Japan is actually more expansionary for Japan and the crisis countries than a permanent one. The reason is the role of asset markets. Any fiscal policy change in such a model requires funding. If countries borrow to pay for fiscal spending, the more they borrow, the higher real interest rates and the stronger the exchange rate response. Both higher real interest rates and a stronger currency tend to crowd out demand through lower private investment and weaker net exports. A temporary fiscal stimulus thus raises demand in Japan with less crowding out than a permanent one because future funding problems are less serious and the asset price effect is therefore relatively small. This is in contrast to popular calls for a permanent rather than a temporary fiscal stimulus in Japan. What it does not take into account is the role of credibility. Proponents of the permanent fiscal stimulus argument presumably believe that vague credibility effects will dominate the fundamentals which drive the model results. This is an important open issue.

Noland et al. (1998) also consider policy issues but focus on the expected policy response in the United States from a change in the current account predicted by their model rather than on policies to address the crisis. The authors predict

a rise in trade tensions between the United States and Asia, with serious implications for future trade relations between Asia and the United States (and Europe).

Conclusions and Lessons

A number of lessons emerge from the modelling work summarized in this article. First, it is not difficult for the models (either intertemporal general equilibrium models or CGE models) to generate, on a variety of plausible assumptions, effects on the scale that have been observed. Not that the models could have predicted the crisis beforehand or will necessarily be able to pick the next crisis, for the types of input needed are very subjective. Risk re-evaluation, in particular, appears to be a crucial part of the story of the Asian crisis, but modellers, and economists in general, know very little about endogenous risk determination.

Second, both the actual experience of the Asian crisis and the intertemporal general equilibrium models that deal with finance illustrate that developments in financial markets can have serious consequences for the rest of the economy. This occurs because these models allow for adjustment costs but within reasonably well functioning markets, with some real world stickiness in wage setting institutions and overshooting of asset prices. This implies that models such as CGE models which ignore financial parts of the economy and dynamic adjustment issues as well as short-run Keynesian-style rigidities may be misleading for some scenarios. These models can be successfully and skilfully adjusted to deal with this issue (as has been done, for example in both Noland et al. 1998 and Kawasaki 1998). But an added degree of exogenous adjustment to the model is required.

If the models can be believed, a large negative shock to confidence and a weak financial sector, rather than deep fundamental flaws across the crisis economies, can explain much of the onset of crisis. Subsequent adjustments have exposed a range of structural problems within each of these economies (as well as within the international

monetary system as a whole). A restoration of confidence, restoring the financial systems, and dealing with the heavy debt burdens overhanging real economic activities are crucial to restoring growth in these economies. In addition, and perhaps as part of this process, an expansionary monetary and fiscal response, rather than a contractionary policy response in the crisis economies, should speed up the adjustment.

Just as the oil price shocks of the 1970s showed the weaknesses of economy-wide economic

models at that time, shocks in the 1980s and 1990s have shown just how useful the newer generation of multi-country models have been in aiding our understanding of a complex and increasingly interdependent world economy. The Asian crisis has been a major test of ideology as well as human endurance. It will also undoubtedly be the source of further improvements in the development of the multi-country models that policy makers will inevitably need in their toolkits for understanding the global economy.

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