EAST ASIA'S RESPONSE TO THE CRISIS:
A QUANTITATIVE ANALYSIS

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Paper prepared for:

ASEM Regional Economist's Workshop:

From Recovery to Sustainable Development

Denpasar, Bali, Indonesia

September 15 – 17, 1999

[*] The authors thank the World Bank for financial support. The views expressed in this paper are those of the authors and not necessarily the views of the World Bank or the institutions with which the authors are affiliated.

Summary

Asian countries hit by the economic crisis of the late 90s are recovering. Now is a good time to reappraise the lessons learned, how robust the recovery might be and how vulnerable these economies are to further external shocks and what they might do to improve their prospects and reduce risks. In this paper the crisis in Asia is reconsidered using the insights from an earlier modeling exercise by McKibbin and Martin (1998) but focussing on the nature of the likely recovery process in Asia as well as alternative scenarios that could significantly affect that recovery. Subsequent data and events to the crisis and analysis with the G-Cubed (Asia-Pacific) model suggests that the proximate cause of the crisis was revised expectations about profitability of investments and a subsequent increase in risk premiums for Asian economies.

To explore the policy options and vulnerabilities to further shocks eight simulations with the model are run grouped into three sets: short term policy changes, medium term policy changes and the longer term vulnerability of the region to external shocks — both positive and negative. The short term simulations are a monetary stimulus, a fiscal stimulus and a restoration of confidence eliminating the risk premiums on the financial assets of Asian economies. These simulations show that monetary and fiscal policy have a role to play in the recovery process. They also show that contracting monetary and fiscal policy in the middle of a crisis is not the way to go — unfortunately a lesson learned too late. Reducing risk premiums by restoring confidence is also potentially powerful in assisting the recovery. Good principles of economic governance — both public and private — are some of the measures countries can take to help restore confidence and hence investment in their economy.

The medium term policy experiments are a round of global trade liberalizations as well as unilateral trade liberalization and a program of microeconomic reform that leads to a boost in productivity growth. Trade liberalization leads to extra growth and investment by improving the returns to capital in the country liberalizing its trade. There can be small short-term adjustment costs, especially in a country like Korea that has a highly protected agricultural sector but the dominant effect is one of overall long term gain. Real GDP can be up to 4 per cent higher than otherwise what it might be in countries like Thailand and Indonesia and, with the possibility of foreign capital inflow, real consumption (a good proxy for welfare) can be

much greater — over 10 per cent above baseline in 2010 for Thailand, Indonesia and Malaysia. Furthermore, most of the gains come from a country's own liberalization so there is no need to wait for a full WTO round of trade talks to achieve the bulk of benefits available. Microeconomic reform that boosts productivity growth is another policy that offers significant potential to boost investment, growth and welfare. Exactly which reforms and what extra productivity growth will flow as a result is beyond the scope of the paper and requires further detailed analysis.

The third set of simulations tests the longer term vulnerabilities to a sharemarket sell-off in the US leading to downturn in that country, another slump in the Japanese economy and a boost in growth in China. Factors outside the control of the Asian crisis economies — both adverse factors like a US downturn and a Japanese slump as well as a boost to Chinese growth have little influence on crisis hit Asian economies. Although a downturn in the US sharemarket, for example, leads to a downturn in the US economy and a drop in imports which has an adverse effect on Asian exports, there are offsetting effects from capital flows. Higher expected returns to capital in Asian economies leads to extra investment which boosts growth, more than offsetting the loss in exports. The implicit assumption here is that a downturn in the US economy caused by a stockmarket shakeout does not cause investors to reappraise risks and returns in other economies as well. If that did happen the consequences would be far more adverse.

The lesson from these simulations is that Asian economies need not be adversely hit by unfavourable external developments and they can take steps to reduce their own vulnerability to external shocks by judicious policies at home that encourage productivity growth and policies to properly appraise, manage and minimize risk. Now that the worst of the crisis has passed the temptation to not proceed with further reform would be a mistake. Good macroeconomic management, good governance, microeconomic reform and trade liberalization all have a significant role to play in Asia's recovery and return to long term robust growth.

1. Introduction

The East Asian economic crisis that began the Thailand in 1997 has led to profound changes in East Asian economies. These changes involved major recessions in crisis-affected countries and large changes to macroeconomic variables such as the current account, real consumption and investment, interest rates and the exchange rate. As a consequence there have been large adjustments to the crisis as well as large changes in policies — both macroeconomic and microeconomic. It now looks like most economies are recovering in what appears to a 'V' shaped recovery some two years after the onset of the recession.

In light of the experience with the economic crisis, it is timely to re-examine and re-interpret events in Asia and analyse the appropriate policy response. Several questions are raised:

- What have we learnt about the causes of the crisis with new data and the passage of time?
- What lies behind the current recovery and what is the role of confidence?
- What might be the respective roles of monetary and fiscal policy in the recovery?
- What contribution could microeconomic reform and tariff reform make to the recovery?
- How important is the rebuilding of confidence in the regional economies as reflected in the reduction of risk premia on investments?
- How vulnerable are East Asian economies to further shocks such as a collapse of the US stockmarket, or a further slump in Japan? and
- What are the policy insights we derive from this analysis?

In this study we re-examine the Asian crisis in light of recent data using a quantitative framework that can shed light on the relative importance of key 'drivers' that led to the crisis in the first place. The framework is the G-Cubed (Asia Pacific) model — a multi-country inter-

temporal general equilibrium model with rich detail on East Asian economies and key financial macroeconomic variables of interest. The model is based on the G-Cubed model developed in McKibbin and Wilcoxen (1998) and has been used previously to analyse the Asian economic crisis (e.g. McKibbin (1998), McKibbin and Martin (1998), Coyle et al (1998) and Stoeckel, at al (1998)). These earlier papers using this model contained conditional predictions for the crisis countries as well as countries outside Asia that have been broadly consistent with subsequent experience. We first update the simulation of the Asia Crisis following McKibbin and Martin (1998), modeling the crisis as a rise in the risk premium on assets of the crisis economies and a negative productivity shock representing the banking crises in these economies. This is not meant to be a precise forecast but is intended to give some insight into the likely profile of recovery in the crisis economies from 1999 through 2005. This new baseline incorporating the crisis is then used to consider alternative scenarios around this endogenous recovery path. The first three scenarios are related to short term issues for the recovery process. These are the impact of fiscal and monetary expansion in each economy as well as the impact of a rapid return in confidence captured by a sharp fall in the risk premium in 1999. Examination of these short-term issues are then followed by simulations of a medium term nature. These medium term issues consider the impact of enhanced productivity growth due to structural reforms induced by the crisis and the role of trade reforms in both the context of considerable unilateral tariff reductions within the crisis economies as well as the impact of a wider coverage of trader liberalization through a new Millenium Round of global trade liberalization. Finally the paper considers a third set of issues - the robustness of recovery in the crisis economies to events outside these economies such as a sharp fall in equity markets in the United States, a significant decline in economic growth in Japan, and finally a strong surge in economic growth in China.

The context of this paper is important. While the paper is written as a 'stand alone' piece of research, the paper is but one input into a larger project under the auspices of the World Bank. It does not purport to represent a review of other quantitative modelling of the East Asian crisis or of the broader literature. The focus of this paper is on the insights from using a particular quantitative framework about the East Asian crisis, its recovery and how robust that might be.

It is also a companion paper to the earlier analysis by McKibbin and Martin (1998) to which the reader is referred for greater elaboration of a number of points contained in this paper.

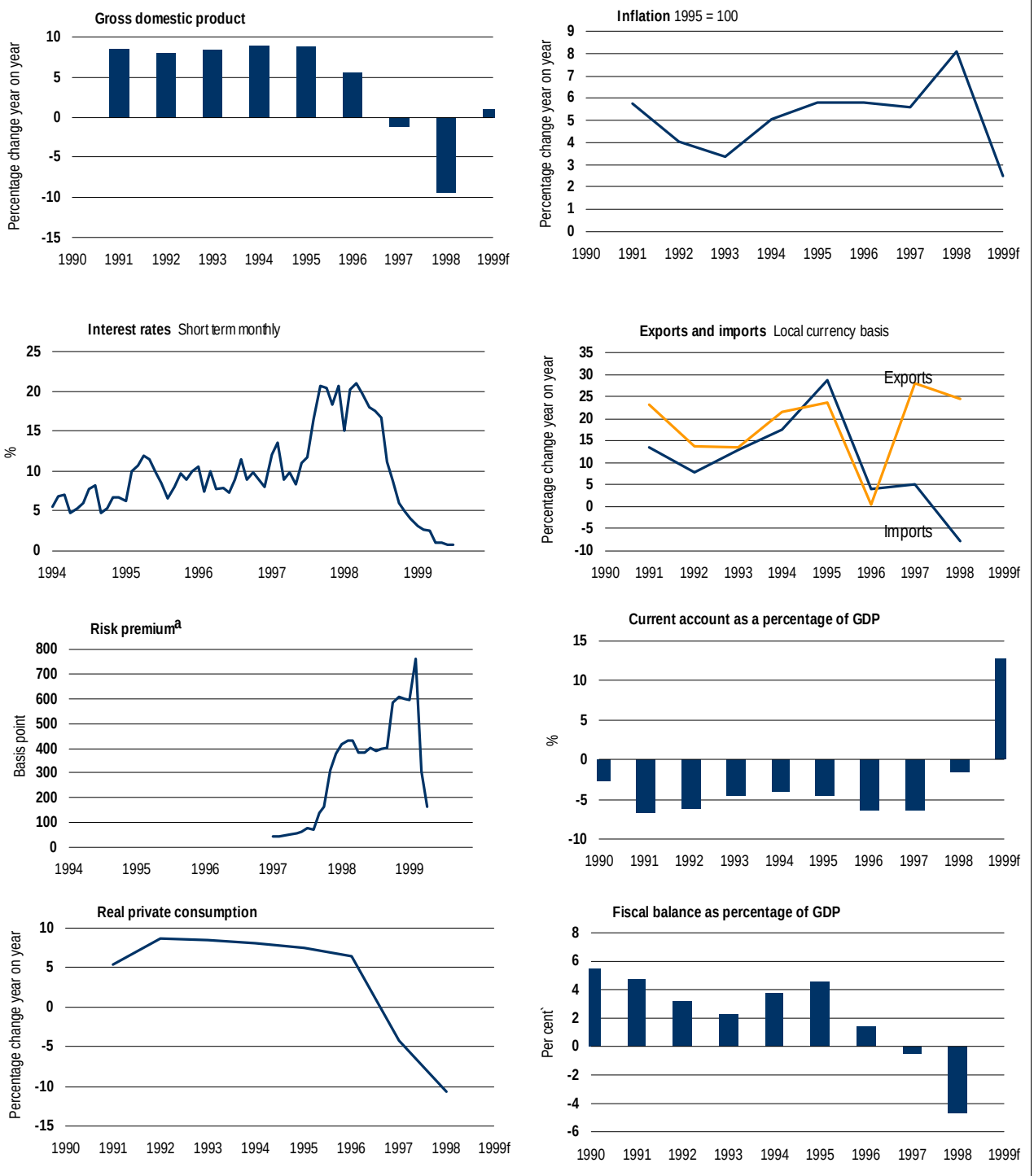
2. What happened and why

East Asia's crisis hit economies — Thailand, Malaysia, Indonesia, Korea and the Philippines — are all showing signs of recovery. All economies displayed a severe recession in 1998, a large drop in real consumption and investment, a spike in inflation in 1998, a rise in short term interest rates that year, a rise in the risk premium on assets (peaking at the end of 1998), a large devaluation of the local currency against the US dollar and rising exports and falling imports (expressed in local currency). Each economy saw a large turnaround in its current account — from large deficit in 1996 to large surplus in 1998. Typical of the pattern of these macroeconomic variables is the experience of Thailand shown in Figure 1. While there are differences in the detail among the crisis hit economies, the pattern of broad macroeconomic variables is very similar. All economies plunged into economic crisis within a few months of each other so, as Krugman (1999) notes they must have had something in common.

The starting point for the chain of events — to borrow from Corden (1999) and Krugman (1999) — was the changed expectations of future profitability of investments that led private investors (mostly foreign banks with short term loans) to want to pull their money out of these countries at the same time. The impact of this revision to expectations is illustrated in simulations using this model in McKibbin and Martin (1998). Just what led to this change in expectations about the profitability of investments is an important point that we return to later.

Foreign investors withdrawing funds at the same time, in particular wanting US dollars, led to the currency devaluations across East Asian economies and the banking crisis that followed in each economy to differing degrees of severity. Interest rates were increased to support the local currency that only added to the investment decline. With the banks now unable to lend and companies with unhedged foreign loans now unable to service or repay those debts, domestic investment collapsed. With the economies unwinding, workers were laid off, consumption fell and recession was the result. The sharply higher price of imports stemming from the large

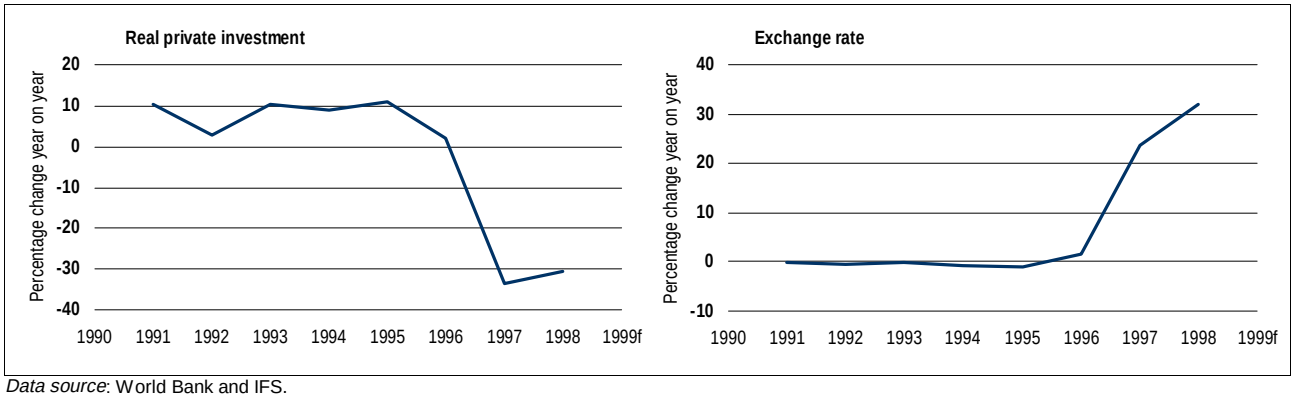
Figure 1: **Thailand: key statistics**



[a] Secondary market spread.
Data source: World Bank and IFS.

continued

Figure 1: Thailand: key statistics continued



Data source: World Bank and IFS.

devaluations combined with lower domestic spending caused imports to fall. Exports from the crisis economies eventually rose given the devaluations that occurred (they rose sharply in real domestic units but not so much in $US because of a sharp decline in the terms of trade). With capital inflow drying up and turning to outflow, major turnarounds in current accounts occurred, going from deficit to surplus in the space of a couple of years.

The changes in current accounts as a percentage of GDP for crisis hit economies were very large. These are shown in table 1. The turnaround for Thailand's current account between 1996 and 1998 was of the order of 20 percentage points of GDP — a major change.

Table 1: **Current account as a percentage of GDP** per cent

	1996	*1998*	*Percentage point difference*
Indonesia	-4.3	4.6	8.9
Korea	-4.4	12.6	17.0
Malaysia	-6.3	9.0	15.3
Philippines	-4.5	1.1	5.6
Thailand	-7.9	12.4	20.3

Source: World Bank, IMF, Business Monitor International, OECD Economic Outlook, December 1999, Paris.

3. The start of the chain events

Important to modelling the East Asian crisis and analysing future policy options and assessing different vulnerabilities to external shocks, is an appreciation of the causes of the crisis and how to represent these in the model. The onset of the crisis was due to changed expectations of

future profitability of investments, initially in Thailand then Indonesia, Malaysia, the Philippines and Korea, but what caused these changed expectations?

The backdrop to the crisis was strong growth in the Asian economies in the decade prior to the onset of financial crisis. This strong growth was based on good fundamentals — liberalization of trade, 'catch up' technology to the West and relatively good macroeconomic policy (Stoeckel, et al. 1998). So strong was this growth that the Asian economies were given the label 'miracle' economies. The high rates of return on investment led to high capital inflow and large current account deficits.

A problem over this period of high growth, high capital inflow and rising asset prices — especially real estate — was the lack of institutional reform and development of the financial system. As the IMF (1998, p.1) describes it, the period prior to crisis was one of weak financial systems and, related to this, absence of good risk management systems.

> A combination of inadequate financial sector supervision, poor assessment and management of financial risk, and the maintenance of relatively fixed exchange rates led banks and corporations to borrow large amounts of international capital, much of it short-term, denominated in foreign currency, and unhedged. As time went on, this inflow of foreign capital tended to be used to finance poorer-quality investments.

But while there seems agreement on the lack of financial institutional development in Asian economies prior to the crisis, difference interpretations are placed on the actual cause of onset of the crisis. Radelet and Sachs (1998) for example place heavy weight on the role of financial panic and subsequent policy mismanagement. Krugman (1998) however describes the cause as one of 'moral hazard' — the explicit or implicit guarantees by government of bank capital and some large private sector projects led to excessive lending but with little of the risk being borne by private owners. The speculative bubble had to burst sooner or later. Goldstein (1998) also places great weight on the over-extension of credit to Asian economies, making them vulnerable to a shift in credit and cyclical conditions.

However, subsequent analysis by McKibbin and Martin (1998) show that in Thailand, the ratio of the price of capital to its return began to decline a full year and a half before the exchange rate devaluation of July 1997. The falling returns to investment are also calculated in Corsetti et al (1998). The most likely reason for this decline was a decline in the efficiency of investment. As McKibbin and Martin (1998) show however, the fall in the ratio of the price of capital to its return in Thailand and Korea occurred before the onset of the crisis in Thailand. A sharp re-evaluation of growth prospects was shown in that paper to be capable of causing a substantial fall of asset values including a large exchange rate depreciation. The story in McKibbin and Martin (1998) is that this started the crisis as the primary shock and lead to revisions of risk assessments of some economies, which was the key secondary shock.

Earlier simulations of the Asian crisis with the G-Cubed (Asia Pacific) model such as in McKibbin (1998) represented a key aspect of the crisis as a rise in the differential between Asian and equivalent US assets — that is, a rise in the risk premia on Asian investments. The impact of emergence of a risk premium in country (i) is most readily seen using the uncovered interest parity condition:

$$r_t^i = r_t^u + E_t \Delta e_t + \gamma_t^i$$

where r_t^i is the rate of return on government securities in country i: r_t^u the interest rate on comparable securities in the United States (or some other reference country); $E_t \Delta e_t$ is the expected depreciation of the nominal exchange rate in time t: and γ_t^i is the risk premium reflecting the market's perceptions of the risk differential associated with the securities issued by country i's government.

Clearly, when the economy reaches an equilibrium in which expected depreciation of its currency is zero, its interest rate will be higher than the equivalent US interest rate by the risk premium associated with its securities. This risk premium could capture a range of factors such as sovereign risk or even restrictions (expected or actual) on international capital flows. During the transition path from the initial shock to the final equilibrium, the domestic interest rate and the risk premium will together determine the expected path of the exchange rate. If $r_t^u + \gamma_t^i$ exceeds the domestic interest rate, then the exchange rate will undergo an anticipated

appreciation over time (McKibbin and Martin 1998). If the risk premium increases sharply then in order to appreciate over time, the current instantaneous exchange rate may have to depreciate significantly.

However, McKibbin and Martin show these rising risk premia to be but one of the secondary shocks once the crisis began. The other main secondary shocks varied across countries but included expectations about government policy reactions as well as the onset of a banking crisis represented by a decline in productivity due to the lack of credit from the banking system.

The primary cause of the crisis in the context of replicability with an empirically based economic model was argued by McKibbin and Martin (1998) as a fundamental reassessment in the growth of productivity and the profitability of investment in the region. This reassessment set off a sequence of events: a sharp fall in asset prices including sharp depreciations of regional currencies, rising risk premia on financial assets which caused further currency weakness, and subsequent impacts on macro variables mentioned earlier such as the decline in investment and consumption, and turnaround in current accounts. Their analysis convincingly argues that terms of trade shocks were not really a factor (although it was partly an issue in Korea), neither were fixed exchange rates — although these fixed rates did exacerbate the subsequent adjustment process.

Neither does it seem that contagion arose through direct trade or capital account linkages. The reason is that direct contagion effects are both negative (adverse trade shocks) as well as positive (lower interest rates than otherwise) and the net effect is small. This is why countries outside Asia such as Australia and the United States were actually stimulated by the crisis. Contagion was seen to occur indirectly through events in Thailand causing a reappraisal of returns to investments in other countries. In other words, rising risk premia as a secondary effect in Thailand caused risk premia also to rise in other Asian economies that had experienced large capital inflows and where the quality of investments might make them vulnerable to a turnaround. Overall the modeling results supported the side of the debate associated with the arguments of Radelet and Sachs (1998). The results also suggested that if

the crisis was not of fundamental structural collapse but a change in risk assessment then there would be expected to be a rapid turnaround in the crisis economies in the event of a return in confidence.

4. Modeling the Asia Crisis

As in McKibbin and Martin (1998) this paper uses the G-Cubed (Asia Pacific) model. Before proceeding with the new simulation results it is worth summarizing the key features of this model.

a. The G-Cubed (Asia Pacific) model

A description of the G-Cubed (Asia Pacific) multi-country model is in Appendix A. The model is based on the G-Cubed model developed in McKibbin and Wilcoxen (1998). This framework is particularly suited to analysis of the Asia crisis because the model integrates both the financial and goods markets of economies. In particular, expectations about future returns to economic activities underlie current asset values are explicitly treated in the model. In practice these expectations are fundamental to the Asia crisis and recovery.

Real and financial markets are integrated temporally and inter-temporally with explicit arbitrage linking rates of return on assets. Within an economy, the expected return to each type of asset (i.e. bonds of all maturities, equity for each sector etc.) are arbitraged, taking into account the cost of adjusting physical capital stock and allowing for exogenous risk premia. 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. Thus a sharp revision in expectations about future returns to capital can lead to instantaneous falls in the value of capital but not necessarily any instantaneous change in the quantity of physical capital in place. Thus a return in confidence can quickly lead to a return in production capacity as long as the ownership of assets is also resolved quickly. In the model this issue which is at the basis of bankruptcy problems is not dealt with explicitly.

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. Changes in an

economy, which, say, increase the rate of return on capital, causes a capital inflow which must be offset by deterioration in the trade balance. This occurs through change in real exchange rates causing trade patterns to change. These international capital flows are assumed to be composed of portfolio investment, direct investment and other capital flows. 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 global net flows of private capital are constrained to zero.

Another important feature of the model for the analysis of this paper is the imposition of inter-temporal budget constraints so that households firms and governments and countries cannot lend or borrow forever without undertaking the required resource transfers necessary to service outstanding liabilities. Large foreign debt and concerns about the ability of different Asian countries to service those debts has been one concern flowing from the Asian crisis. Also, government budgets must balance in present value terms so a deficit today means an appropriate surplus at some future time.

Expectations are yet another feature of the model affecting results. Because agents are forward looking in their behavior, it matters considerably whether policy changes are anticipated or not and even whether policies are credible. Anticipation of a future increase in the money supply, for example, will lead to an immediate depreciation of the exchange rate. As McKibbin and Martin (1998) note, the depreciation leads to a rise in the price level and in wages, which, can lead to a downturn in the economy if the monetary shock does not eventuate.

The model is solved for a full rational expectations equilibrium at an annual frequency initially from 1996 to 2070. However the algorithm allows us to change the information set of agents over time. Thus we can generate a solution in which the expectations from 1996, although rational at that point in time, are not equal to the average outcome over time if the information set is changed in the interim period. In a tracking exercise through time in which actual information sets are clearly changing, having this option is necessary for the usefulness of any large applied model with rational expectations.

b. Simulation methodology

This section updates the approach of McKibbin and Martin (1998) in which key shocks are used to approximate the Asia crisis using the G-Cubed (Asia Pacific) model. The focus is on the crisis economies of Indonesia, Korea, Malaysia, the Philippines and Thailand.

There are a number of problems with using a model such as the G-Cubed model to replicate an historical episode. First, the timing of the model and of the crisis in Asia is a little awkward because the crisis actually began to emerge in mid 1997 in Thailand and then spread to other economies over the latter part of 1997. To represent this timing with any precision in an annual model is difficult. We assume for ease of exposition that the crisis begins at the start of 1998. Secondly we have a problem because the solution of the model in 1998 depends critically on the expectations of agents in 1998 of the years from 1999 onwards. Even if we had reliable data for 1999, this would not necessarily help in the replication of 1998 because it is likely that there were significant changes in information sets throughout the crisis period and there is no reason that the ex-post realization of events necessarily matched the ex-ante expectation. Indeed many commentators in 1998 were talking of a global recession and decades of slow growth in Asia. We take an agnostic approach to this issue and base our projections on a set of plausible assumptions outlined in the following paragraphs.

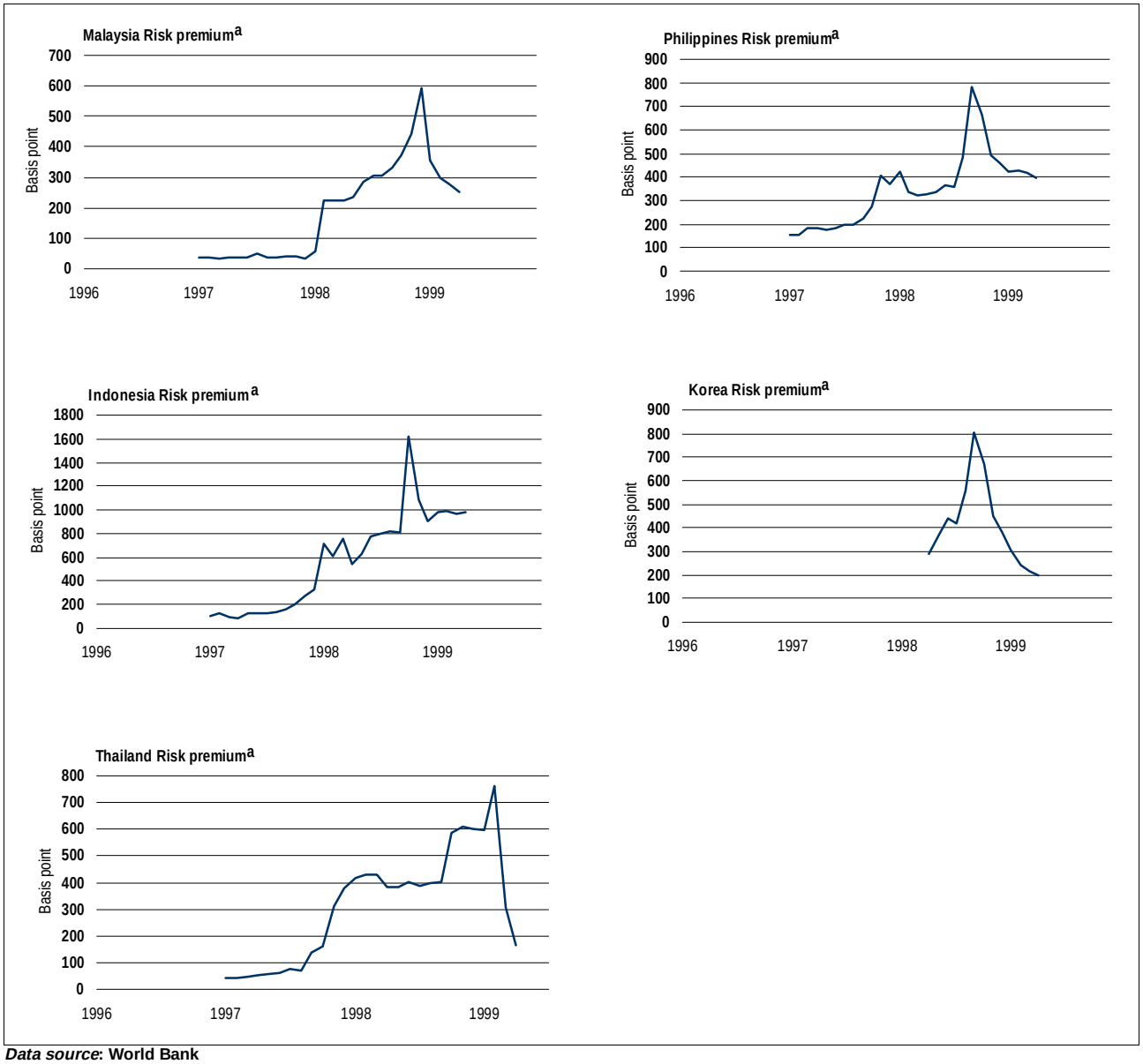
The model is first solved from 1996 to 2070 under the assumption of no crisis in order to generate a model baseline based on a range of assumptions. These assumptions include assumptions about population growth by country (based on World Bank projections) and sectoral productivity growth by country by sector (based on a technology catch-up model) as well as assumptions about tariff rates, tax rates, and a range of other fiscal and monetary policy settings. 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 (apart from a lump sum tax on households that varies to satisfy the intertemporal budget constraint facing the government) and government spending constant 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 in 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.

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). This is 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 these should be equal to the observed values for the initial year. The next step of baseline generation is then 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 stable manifold of the model in which all variables are moving on a stable path towards a steady state in the long distant future.

We then "roll the model forward" to 1998 and change the information set of all agents by introducing a number of shocks, that were assumed to be unanticipated in 1996. These shocks are designed to replicate the key aspects of the crisis in Asia. As in McKibbin and Martin (1998) these consist of a change in the risk premium on each country's assets, and a short term sharp change in productivity growth. In McKibbin and Martin (1998) the model generated both a large collapse of consumption and a large surge in real exports. In fact the observed response of exports has been less than produced by the model (which are in domestic units - not $US) and the consumption collapse generated by the model was much larger than appears in the most recent data. To get a better replication of the crisis we further adjust the model by raising autonomous consumption temporarily from 1998. This leads to a closer fit with measured consumption in 1998 as well as tracking the export response much better. Again it is important to stress that this procedure is being used to capture the broad stylized characteristics of the crisis and to give a basis for expectations about the future profile of these economies from 1999 onwards.

Figure 2 **Changing risk premia**



***Data source*: World Bank**

As shown in McKibbin and Martin (1998), the key shock in generating the asset price outcomes and investment response is the jump in risk premia. We base the shocks to the risk premia in each country on the actual data shown in figure 2. Even this is not straightforward because, not only does the 1998 value of the risk premium matter for the 1998 outcomes, but also expectations of future risk premia matter. To proceed, we impose the actual 1998 value and from 1999 onwards assume a value that decays over time at a rate sufficient to generate the extent of exchange rate collapse experienced on average during 1998. Clearly a large

number of assumptions are possible and each would generate a different result. The importance of time profile of the risk premium is explored in McKibbin (1998) and some indication is also given in the next section where we explore the consequences of a rapid fall in the risk premium from 1999.

The actual shocks imposed in the model from 1998 are contained in table 2. This shows the shocks as percent deviation from baseline. A detailed decomposition of the consequences of these shocks can be found in McKibbin and Martin (1998). Note that these shocks are conditioning the information set in 1998 and may not actually be relevant for the actual evolution of the economies after 1999, when some alternative outcomes may be realized, as shown below under the alternative scenarios. The results to be presented can therefore be interpreted as the expected adjustment given the initial conditions and the exogenous inputs.

Table 2: Shocks – deviation from baseline

			1998	*1999*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*
Indonesia										
	Productivity	%	-9.0	-7.2	-5.8	-4.6	-3.7	-2.9	-2.4	-1.9
	Risk	%	14.0	11.2	9.0	7.2	5.7	4.6	3.7	2.9
	Consumption	%GDP	15.0	10.5	7.4	5.1	3.6	2.5	1.8	1.2
Malaysia										
	Productivity	%	-8.0	-6.4	-5.1	-4.1	-3.3	-2.6	-2.1	-1.7
	Risk	%	6.0	4.8	3.8	3.1	2.5	2.0	1.6	1.3
	Consumption	%GDP	8.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Philippines										
	Productivity	%	-3.0	-1.5	-0.8	-0.4	-0.2	-0.1	0.0	0.0
	Risk	%	6.0	4.8	3.8	3.1	2.5	2.0	1.6	1.3
	Consumption	%GDP	5.0	3.5	2.5	1.7	1.2	0.8	0.6	0.4
Thailand										
	Productivity	%	-7.0	-3.5	-1.8	-0.9	-0.4	-0.2	-0.1	-0.1
	Risk	%	7.0	6.3	5.7	5.1	4.6	4.1	3.7	3.3
	Consumption	%GDP	15.0	10.5	7.4	5.1	3.6	2.5	1.8	1.2
Korea										
	Productivity	%	-6.0	-3.0	-1.5	-0.8	-0.4	-0.2	-0.1	0.0
	Risk	%	7.0	5.6	4.5	3.6	2.9	2.3	1.8	1.5
	Consumption	%GDP	4.0	2.8	2.0	1.4	1.0	0.7	0.5	0.3

There are many results generated by the model. Rather than produce extensive results for what is essentially a benchmarking exercise, the reader is referred to McKibbin and Martin (1998) for the adjustment of a wide range of variables. Because the current paper is concerned with

the growth prospects in Asia, we focus on the path of real GDP, real private consumption and real private investment from 1998 to 2005 as a result of the shocks imposed. This gives an indication of the likely recovery path in Asia under the assumption that the shocks imposed on the model are a reasonable representation of the crisis. Even if the reader does not believe the results of this exercise it is independent from the alternative scenarios presented in the next section.

The results for these key variables are contained in table 3. Note that the results from the model that are usually expressed as deviation from baseline (as are the shocks in table 2), are converted into growth rates over time for Table 3. This is done for comparison with the actual data presented elsewhere in this paper. Later the simulation results are presented as percent deviation from the Asia crisis scenario.

Table 3: Projected Real GDP, Consumption and Investment Growth 1998 to 2005

Real GDP Growth 1998 to 2005								
	1998	1999	2000	2001	2002	2003	2004	2005
Indonesia	-12.69	2.67	6.25	6.20	5.96	5.89	5.92	5.96
Malaysia	-4.33	4.26	6.64	6.10	4.69	4.26	4.31	4.44
Philippines	-0.44	3.65	6.83	6.60	5.86	5.38	5.17	5.11
Thailand	-8.48	4.93	8.62	6.87	5.41	4.68	4.39	4.32
Korea	-6.60	4.86	11.02	9.64	7.33	5.87	5.25	5.11
Real Consumption Growth 1998 to 2005								
	1998	1999	2000	2001	2002	2003	2004	2005
Indonesia	-14.35	-10.15	3.87	9.57	11.77	12.26	11.93	11.22
Malaysia	-15.78	6.11	15.23	16.53	12.50	11.20	10.77	10.21
Philippines	-3.76	5.18	10.49	9.96	8.61	7.64	7.06	6.67
Thailand	-6.33	-5.63	8.90	9.05	8.28	8.04	8.06	8.05
Korea	-13.21	7.22	17.35	14.86	11.04	8.57	7.35	6.80
Real Investment Growth 1998 to 2005								
	1998	1999	2000	2001	2002	2003	2004	2005
Indonesia	-51.53	30.73	35.75	19.97	12.00	8.13	6.12	5.00
Malaysia	-22.78	16.18	13.47	9.28	6.62	5.15	4.31	3.76
Philippines	-19.88	12.45	14.96	11.09	7.81	5.89	4.92	4.44
Thailand	-31.94	12.44	18.32	12.37	8.23	6.02	4.87	4.26
Korea	-18.47	7.10	17.20	13.20	8.59	5.88	4.68	4.30

Source: Simulation of the G-Cubed (Asia-Pacific model)

These results are highly conditional on the assumptions that the risk and productivity shocks decay over time. They demonstrate that given the underlying structure of the economies before

the crisis, and the shock primarily being one of risk premia, the recovery is quite rapid. Although the levels of variables before the crisis take a number of years to be reached again, the growth rates turn around quickly. Thus this modeling of the crisis is closer to the Radelet and Sachs (1998) view that the crisis is a loss of confidence rather than deep structural flaws. Note, however, that a loss of confidence can be related to deep structural flaws in an economy — a point we return to later.

5. Some Alternative Scenarios that could change the Projections

In section 3 we used the types of shocks used in McKibbin and Martin (1998) to explore the nature of the adjustment process over time. Here we run the model from 1999 under various shocks designed to yield insights about the emphasis on different policies and the vulnerability of the recovery of the East Asian economy to further external shocks. The simulations with the G-Cubed (Asia Pacific) model are divided into three groups:

Short term

- Monetary Stimulus
- Fiscal Stimulus
- Restoring confidence and eliminating risk premia on financial assets.

Medium Term

- Productivity boost from further microeconomic reforms.
- Removal of tariff protection.

External Risks and Opportunities

- Large fall in US equity prices
- Sharp contraction in the Japanese economy
- Rapid growth in China

The short term issues largely relate to domestic developments such as monetary and fiscal policy and changes in risk premia. These are also embodied in the assumptions in the Asia

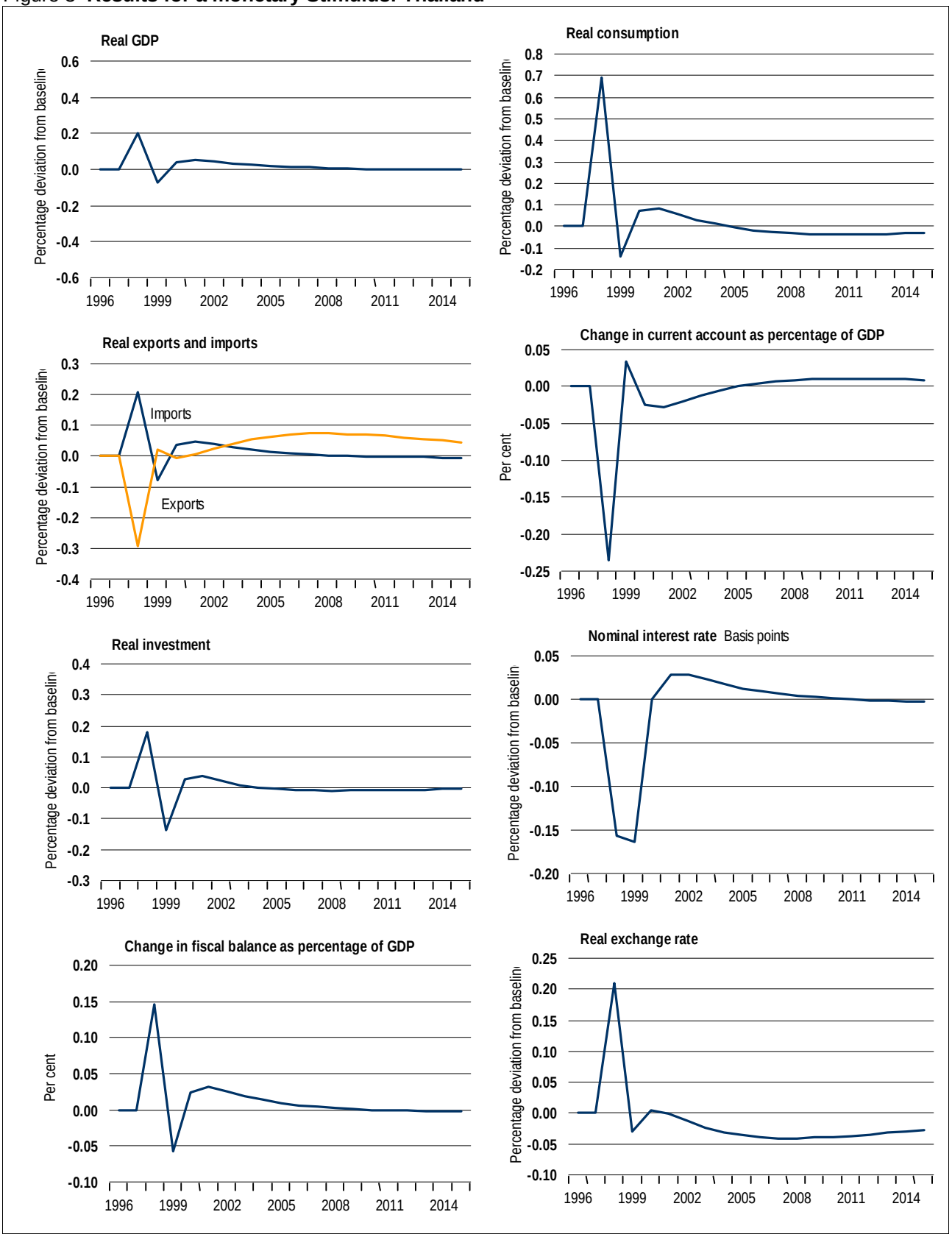
crisis baseline, but here are disentangled for the reader to understand the key mechanisms and insights provided by the model.

In the following sections all results are presented as deviation from the Asia crisis scenario in either percents, percent of GDP, or percentage points as indicated. We also present a subset of results for each shock because of the shear volume of results that are available for each country. Most results for each country are qualitatively similar although there are quantitative difference. We present two sets of figures for each scenario. One is for a representative country to show the mechanisms at work. We present results for the paths of GDP, consumption, investment, exports, imports, current account, fiscal balance, short term real interest rates and the bilateral real exchange rate relative to the United States. We then present a second panel of results for just real GDP and private investment for the other four crisis countries to highlight the differences among countries.

a) Monetary Stimulus

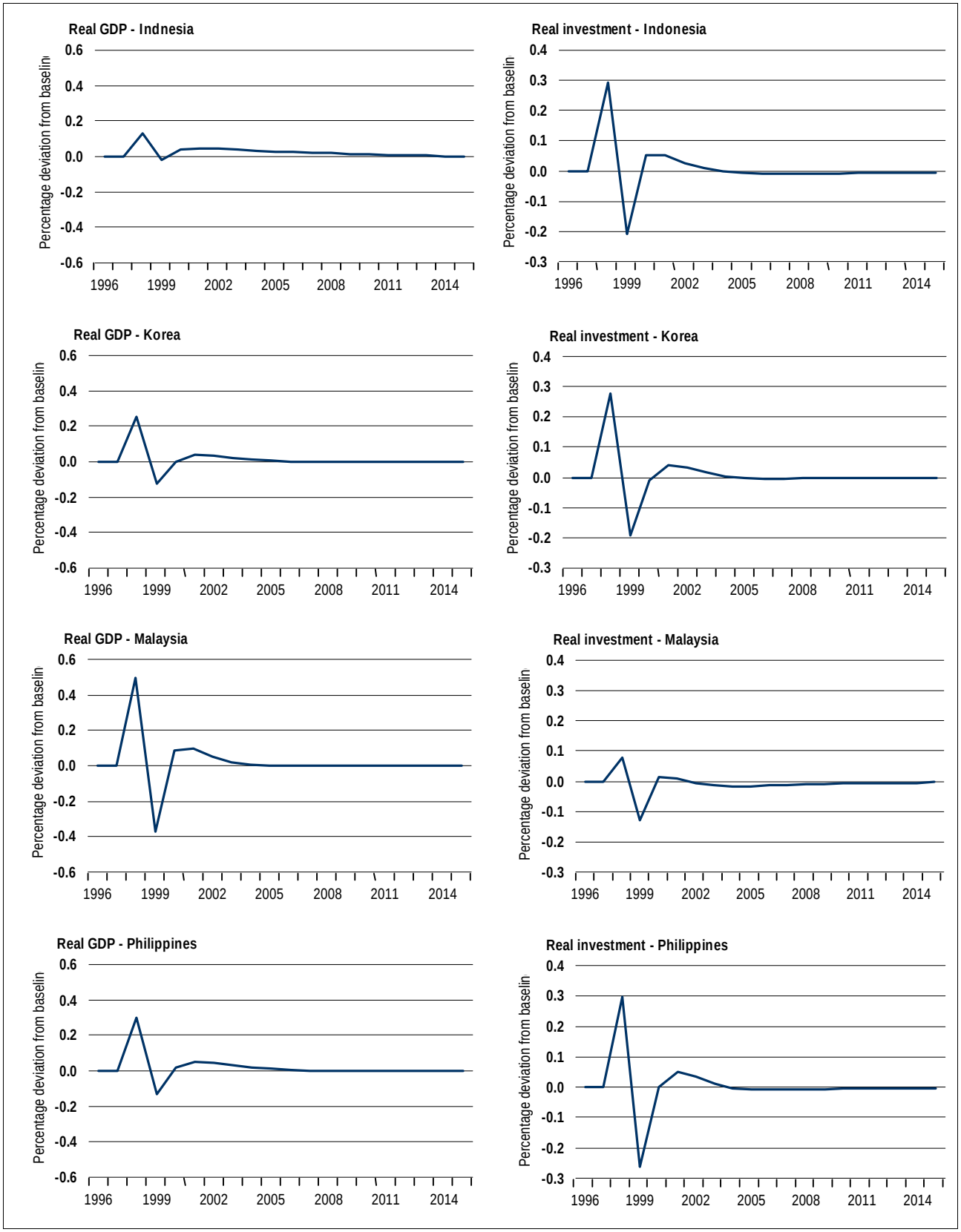
The first set of issues is whether monetary policy is stimulative. Results for a relaxation in monetary policy in Thailand commencing in 1999 are shown in figure 3. The monetary injection is a rise in the money supply of 1% in 1999. In all these economies we assumed that the money supply is targeted. The *real* exchange rate appreciates for Thailand even though the *nominal* exchange rate depreciates because the domestic price level jumps in the first year of the policy. The temporarily lower real and nominal interest rates stimulate private investment and consumption and the real exchange rate appreciation worsens net exports. With a stimulus to private investment there is a capital inflow and the current account expressed as a percentage of GDP falls below baseline in the year of the stimulus. Thus real GDP is temporarily stimulated although the real effects of the monetary expansion are quickly reversed as prices and wages rise to neutralize the additional money.

Figure 3 **Results for a monetary Stimulus: Thailand**



Data source: Simulation of the G-Cubed (Asia Pacific) model.

Figure 4 **Results for a monetary stimulus: real GDP and real investment**



Data source: Simulation of the G-Cubed (Asia Pacific) model

The profile for all countries is shown in figure 4. A similar adjustment process works in each economy. Looser monetary policy under a flexible exchange rate depreciates the exchange rate and stimulates net exports as well as private investment. The medium term growth effects of monetary policy are actually negative before being neutral. Thus only the temporal profile of investment and growth is influenced by monetary policy in this model. Thus a loosening of monetary policy in 1999 in all crisis countries is likely to spur growth in 1999 but unless followed by additional loosening in 2000 is likely to dampen the response of the economies in later years. Any gains in GDP in the short term are exactly offset by losses in future years.

b) Fiscal stimulus

The adjustment of fiscal policy during the crisis has been a hotly debated issue. In response to the initial crisis, fiscal deficits would have been expected to deteriorate sharply due to revenue reductions. In fact many of the crisis countries maintained a tight fiscal stance by cutting spending. This has been argued by many commentators to have exacerbated the extent of the output contraction. To explore the impact of fiscal policy, as well as the potential role of fiscal relaxation during 1999 and beyond, we simulate a permanent fiscal expansion.

There are many fiscal instruments in the model (as there are in practice) and thus a fiscal stimulus is a somewhat ambiguous concept since it matters what instrument of fiscal policy is changed (company tax, household income tax, indirect tax, spending on the output of each sector). It also matters how the fiscal expansion is financed. In this section we assume that a lump sum tax on households is reduced by 1% of GDP forever and this is financed by a permanent fiscal deficit of 1% of GDP. The additional interest costs resulting from permanently higher government debt is financed by a lump sum tax that exactly covers the additional costs.

We focus on a tax cut rather than a spending increase because with a spending increase it matters on which goods the government purchases. Rather than make arbitrary decisions on spending, a tax cut gives us the essential mechanisms important in the adjustment process without an additional round of arbitrary relative price changes caused by the pattern of government spending. The primary difference between the effects of the fiscal stimulus

through tax cuts versus spending increases is on private consumption, which tends to overshoot much more under a tax cut than under an increase in government spending.

Results for Korea are presented in figure 5 and for the other countries in figure 6. A fiscal expansion stimulates GDP directly through increased after tax income stimulating consumption. The multiplier further stimulates consumption despite the rise in expected future tax liabilities resulting from higher debt because of the high discount rate used by consumers. The short run Keynesian stimulus also raises investment temporarily through the accelerator. However investment is crowded out eventually through higher interest rates. The increase in interest rates resulting from additional borrowing by government as well as through stronger demand in the short run also leads to an appreciation of the real and nominal exchange rates. This crowds out net exports. The extent to which GDP rises as a result of the fiscal stimulus depends crucially on this effect. Figure 6 illustrates a difference in GDP responses across countries, which primarily reflect the response of exports and investment.

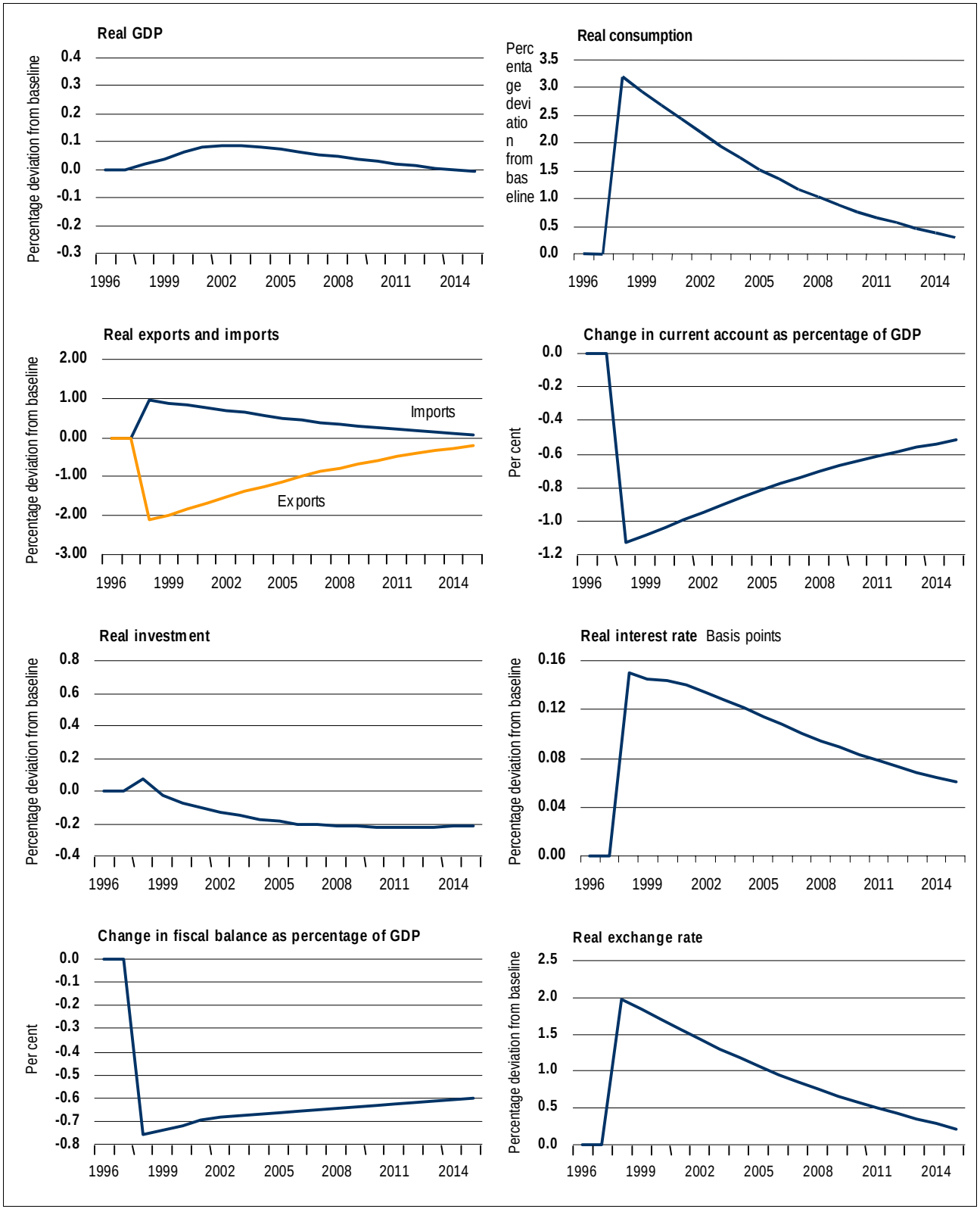
Real GDP for all crisis hit economies except Malaysia rises, however, over time, crowding out tends to reduce GDP. This effect would be more apparent had we simulated a fiscal expansion through a spending increase rather than a tax cut.

These results suggest that a relaxation of fiscal policy in the aftermath of the crisis will stimulate the economy as well as strengthen the exchange rate. Although not shown in these results, a fiscal stimulus combined with a relaxation of monetary policy as in the previous simulation would, in this model, causes a rise in real GDP and offsetting effects on exchange rates and interest rates. It would also lead to a significant capital inflow.

c) Restoring confidence and eliminating risk premia on financial assets

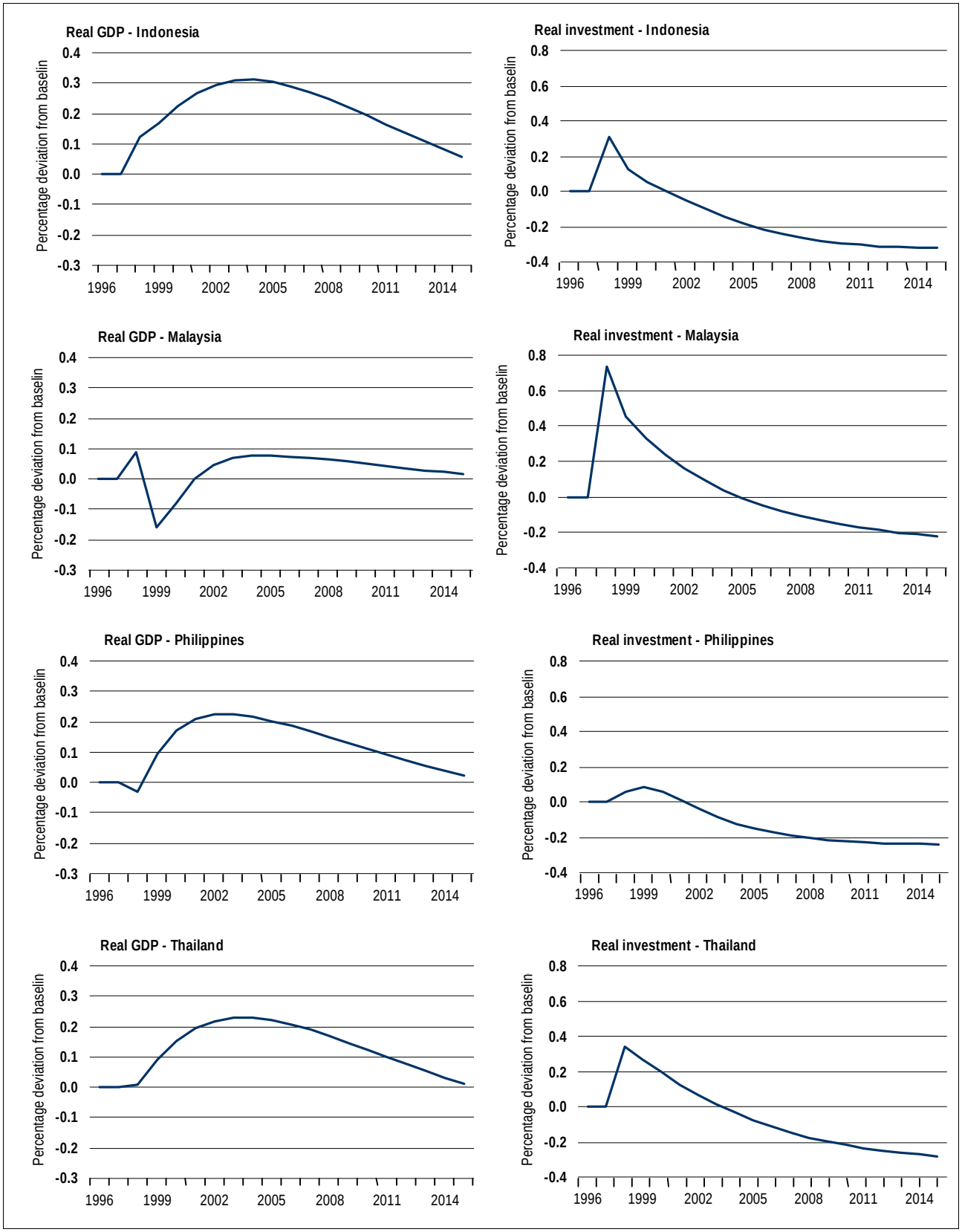
The importance of changing perceptions about the riskiness of investments in East Asia was discussed at length earlier. Changing risk premia for the East Asian economies is seen to be an important factor in explaining the pattern of events and part of the explanation for the sharp change in key macroeconomic variables over the course of the crisis. To generate the new

Figure 5 **Results for Fiscal Stimulus: Korea**



Data source: Simulation of the G-Cubed (Asia Pacific) model.

Figure 6: **Results for a Fiscal Stimulus - real GDP and real investment**



Data source: Simulation of the G-Cubed (Asia Pacific) model.

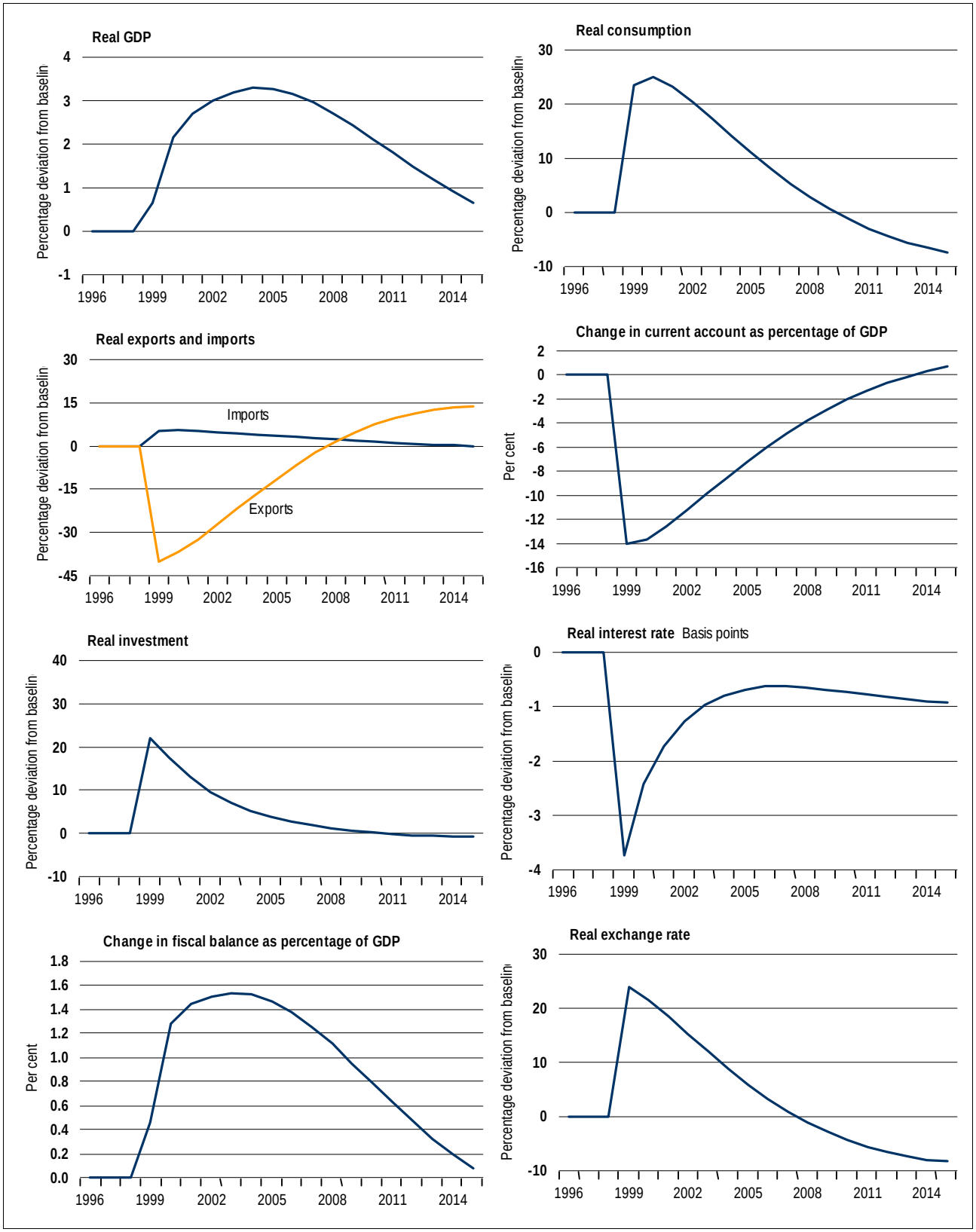
baseline including the Asia crisis, risk premia for each of the five East Asian economies were changed according to actual figures in 1998 shown earlier in figure 2. These risk premia were assumed to decay at a rate sufficient to give an initial change in nominal exchange rates approximately in line with what occurred in 1998 (see table 2). In the simulation of this section, we solve the model from 1999 inheriting the dynamics from 1998 under the old information set with persistently higher risk premia, but now assume that the risk premia in all crisis countries returns to the levels that existed in 1996, before the crisis erupted.

Again, the pattern of results across countries is similar and here we report a full set of graphs for key macro variables for Thailand in figure 7. The changes to real GDP and real investment for the other four East Asian economies are reported in figure 8. Remember that these results are the percent deviation from what otherwise would have been the case in the Asia crisis baseline. These are not the same units as the growth rates shown for the Asia crisis baseline.

Once the risk premia drops the expected rate of return on capital increases significantly. The price of all assets including the stock market also shoots up as the risk premia fall. The rising return on capital and rising asset prices causes a major capital inflow amounting to 14 per cent of GDP in the case of Thailand as shown in figure 7. This capital inflow results in additional real investment, which rises by 20 per cent above baseline in 1999. Investment eventually goes back to zero deviation from baseline because, in the long run, the risk premia are the same as those used in the Asia crisis baseline which were also assumed to disappear, although much more gradually than in this simulation.

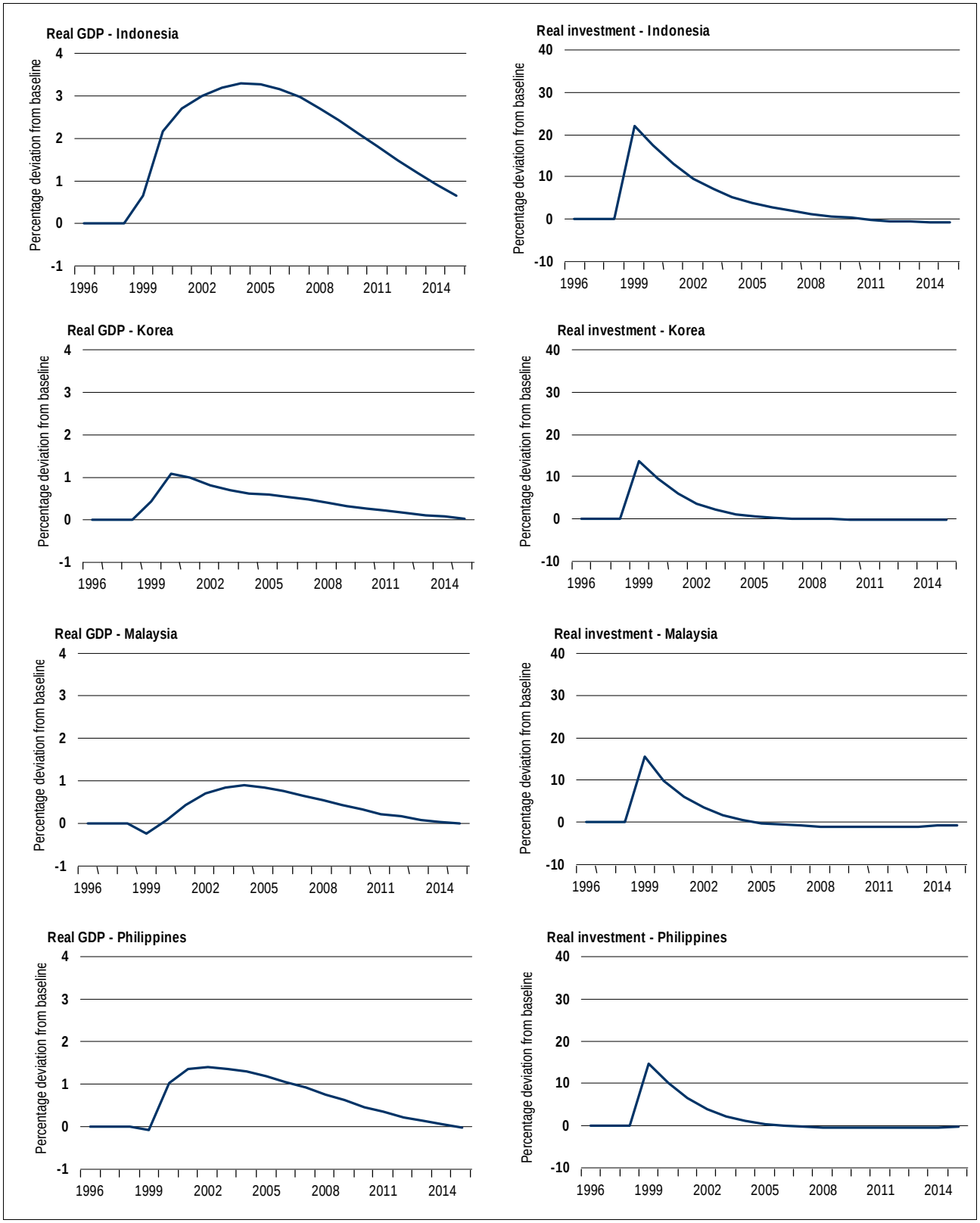
There is also a large increase in real consumption — up to 25 per cent above baseline for Thailand by 2000 as consumption plans are brought forward. The real interest rate falls as shown in Figure 7, because previously there was a risk premium driving a wedge between local interest rates and world interest rates. With a reduction in the risk premium the domestic interest rate also falls.

Figure 7 **Restoring of risk premia to pre-crisis levels: Thailand**



Data source: Simulation of the G-Cubed (Asia Pacific) model

Figure 8 **Changes in real GDP and investment from restoring risk premia to risk crisis levels**



***Data source*:** Simulation of the G-Cubed (Asia Pacific) model

The capital inflow causes the real exchange rate to appreciate some 24 per cent above baseline in 1999. To mirror the deterioration in the current account, there is a decline in the trade balance. The appreciation of the exchange rate caused exports to initially fall before increasing over time. The appreciation and stronger growth also causes imports to rise. With higher real investment there is an increase in real GDP, which in the case of Thailand rises to over 3 per cent above baseline by 2005. Higher real activity leads to rising taxation revenues and the change in fiscal balance pattern follows that of the change in real GDP.

Overall the results for the crisis economies show that a return of confidence, as embodied in a reduction in risk premia, leads to a more rapid return to economic growth. The degree to which this would occur in reality depends importantly on the institutional structures in these economies. Both the ownership of capital, as well as its value will in practice determine how quickly production capacity can be brought back into operation. The model by its construction is optimistic on this since the problem of bankruptcy workouts etc are ignored.

d) Productivity boost from further microeconomic reforms

The Asian crisis has focused governments on the need for better economic governance of their economies including the need for significant microeconomic reform. For those economies like Korea, Thailand, Philippines and Indonesia with informal IMF programs, substantial microeconomic reform has been built into the loan conditions. The recent bounce-back in economic recovery in these Asian economies has in fact led some people, for example Krugman (1999), to worry that the pace of economic reform may in fact slow. A comprehensive survey of the economic governance reforms required in the five crisis hit Asian economies, many of which are catered for in the various IMF, World Bank and Asian Development Bank programs, can be found in CIE (1998).

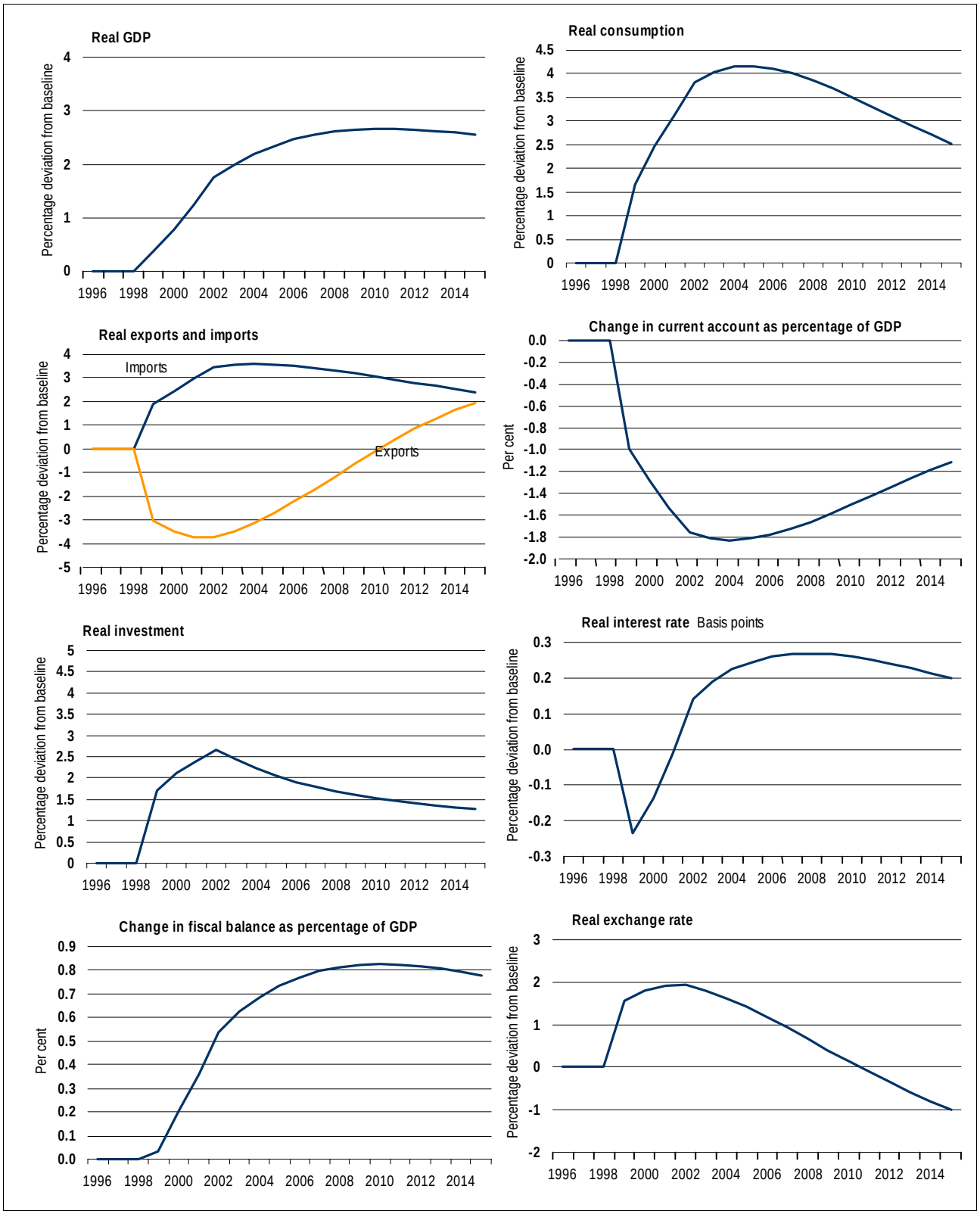
Whether or not crisis hit Asian economies now go slow on microeconomic reform, given the apparent recovery, will largely depend on political circumstances and leadership in each economy. There is no way of objectively estimating just how much productivity boost may occur. So here we assume there is a growth of 1 per cent a year in productivity for four years up to the year 2002 starting from 1999. The experiment under this simulation is a growth of 1

per cent in labour augmenting technological change. We use labour augmenting technological change as there is some endogenous capital productivity rise, given the large decline in capital utilization as a result of the crisis. Typical of the pattern of results for each country are the graphs of macro variables shown in figure 9 for Indonesia. The increase in productivity raises the rate of return on capital, so capital flows into the economy attracted by improved prospects both in the present as well as in the future. This implies that the current account deteriorates through the familiar mechanism that the real exchange rate appreciates causing a reduction in exports and a rise in imports. With the anticipation of productivity, real investment receives a boost rising to 2.5 per cent above baseline in 2003. The combination of forward looking consumers and backward looking consumers who spend current income, leads to a large increase in real consumption — up to 4 per cent above baseline in 2005. Note that there is some overshooting of consumption due to the nature of the assumed expectations by households. With higher real consumption and real investment, real GDP rises up to 2.5 per cent above baseline by 2010. The capital inflow leads to an appreciation of the real exchange rate relative to the US dollar. This real appreciation leads a lower real price of imports which, when combined with extra consumer spending, leads to a large rise in imports. Exports however fall initially to make way for the capital inflow necessitated by the increase in investment.

As GDP rises and the tax revenue improves, the fiscal balance moves into surplus. Real interest rates fall below baseline in 1999 but then start to increase above zero as the expectation of a real exchange rate depreciation becomes apparent after 2002.

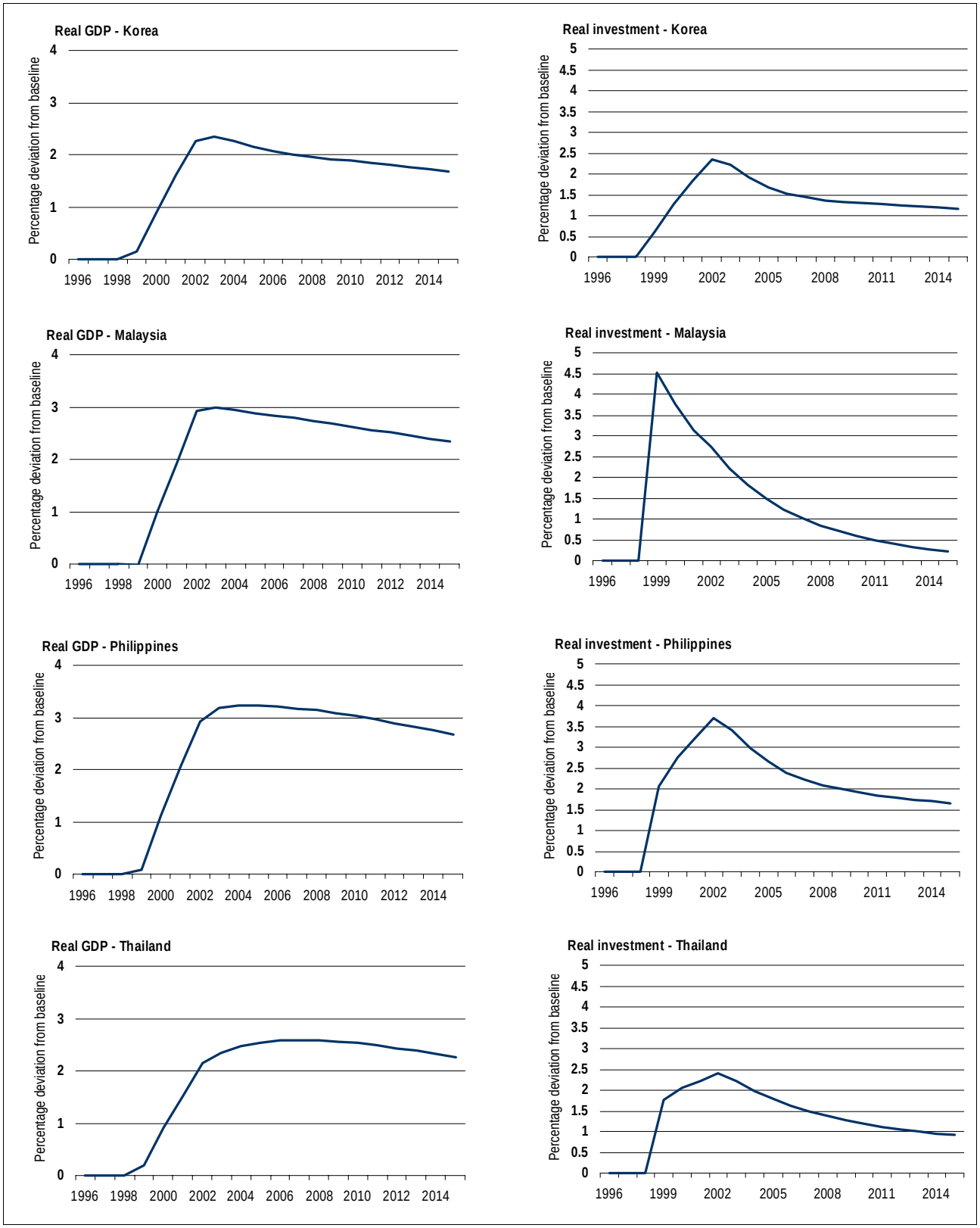
Comparing the changes in GDP and real investment across the other crisis hit Asian economies shows much the same pattern of events (see figure 10). In each case the productivity boost increases the return on capital in each economy and leads to an investment boost, which leads to a further rise in real GDP.

Figure 9: **Productivity boost from further microeconomic reforms: Indonesia**



Data source: Simulation of the G-Cubed (Asia Pacific) model.

Figure 10 **Changes in real GDP and real investment from more microeconomic reform**



Data source: Simulation of the G-Cubed (Asia Pacific) model.

Overall the productivity boost from economic reform assists the recovery process in each economy primarily through its impact on the expected return to capital. The numbers used in these simulations are somewhat arbitrary but nonetheless indicative of the adjustment process to be expected on top of the natural recovery process as well as the other potential shocks in these economies.

e) Removal of tariff protection

Related to the issue of microeconomic reform in crisis affected Asian economies, is the issue of further tariff reform and what it means for economic performance in the crisis economies. There are two aspects to this tariff reform. One is the reform by Asian economies themselves in reducing their own border protection. The other is the broader issue of global tariff reform, despite the failure to launch a new WTO round of trade liberalization at the November/-December WTO Ministerial in Seattle in December, 1999. Attempts are underway to ultimately lead to another round of trade talks. Different outcomes can occur depending on whether a country unilaterally reduces its own border protection or whether this liberalization occurs as part of a broader WTO round of tariff cuts.

The fast growing Asian economies of a decade ago achieved part of their growth through an opening up of trade and investment to global markets. Significant trade liberalization of many economies occurred. However, many of these economies like Indonesia, Korea and Thailand started from a high base of protection. Also, since the onset of the crisis there has been some backsliding in tariff reform and some protection of key industries has occurred to shield them from the full impact of the crisis. Post-Uruguay tariffs by region and sector assumed for the G-Cubed (Asia Pacific) model are given in table 4. Clearly there are substantial opportunities for further cuts to tariffs and it is interesting to see what extra gain might occur as a result of such reform.

The tariff rates used in the model have been derived from the GTAP Version 4 database (McDougall et al 1998) as well as estimates by the CIE of tariff equivalents for the services sector. Measures of protection for services industries are notoriously hard to come by since

Table 4 Post-Uruguay Round tariffs by region and sector G-Cubed (Asia-Pacific) model aggregation

Region	*Energy*	*Mining*	*Agriculture and food processing*	*Durable manufacturing*	*Non-durable manufacturing*	*Services (Percentage cost reduction achievable)*
	%	%	%	%	%	%
United States	0.1	0.1	0.3	3.5	1.1	1.4
Japan	0.0	0.0	90.5	6.4	0.5	1.5
Australia	0.5	0.4	0.6	5.2	8.5	1.6
New Zealand	0.0	0.4	0.1	2.9	4.2	1.7
OECD Europe & Canada	1.2	0.1	5.4	8.9	3.5	1.4
ndonesia	3.3	1.5	5.9	8.8	9.4	2.0
orea	1.1	1.7	23.2	11.9	7.5	1.7
alaysia	2.4	1.3	5.6	12.9	5.6	1.9
hilippines	0.0	1.9	22.4	22.0	17.1	2.1
hailand	0.3	1.2	15.7	21.4	21.6	2.2
Singapore	0.0	0.0	6.5	4.6	0.1	2.2
China	8.7	3.2	14.6	32.7	36.1	2.2
Chinese Taipei	6.8	0.9	21.1	13.6	7.2	1.7
Hong Kong	0.0	0.0	0.0	0.0	0.0	2.5
India	13.8	3.2	15.9	46.9	41.8	2.1
OPEC (ex. Indonesia)	7.4	12.0	10.0	12.3	12.0	2.2
Eastern Europe	4.4	9.0	4.5	10.1	9.7	1.9
Other	9.4	5.3	8.3	14.5	15.0	2.1

Source: CIE estimates from GTAP 4 database and World Bank.

most services industries are basically non-tradeable and 'protection' is by means other than tariffs. The starting point used was to take the *relativities* (rather than the absolute and somewhat arbitrary values) of the tariff equivalents for services computed by Bernard Hoekman at the World Bank (see Brown et al, 1995). These tariff equivalents are for services from the sectoral coverage ratio under the GATS (general agreements on trade services). Using these estimates as a starting point only, the relativities between countries were then calibrated so that the gain to Australia's services sector reform was equivalent to 2 per cent of GDP — a reasonable estimate of the gains from reform of the services sector as measured by detailed work undertaken by the Productivity Commission (Productivity Commission, 1995). The 'tariffs' for the services sector are then expressed as the percentage cost reduction that could be achievable from further removal of protective arrangements in the sector as shown in table 4. It can be seen that Indonesia, Korea, Malaysia, the Philippines and Thailand are among the still highly protected economies in the agriculture, food processing, durable manufacturing, non-durable manufacturing and services sectors. It is assumed that trade liberalization is started in 2000 and finished in 2010. Liberalization occurs across-the-board.

For the WTO liberalization, reductions occur across-the-board in all sectors for all countries over the same timeframe.

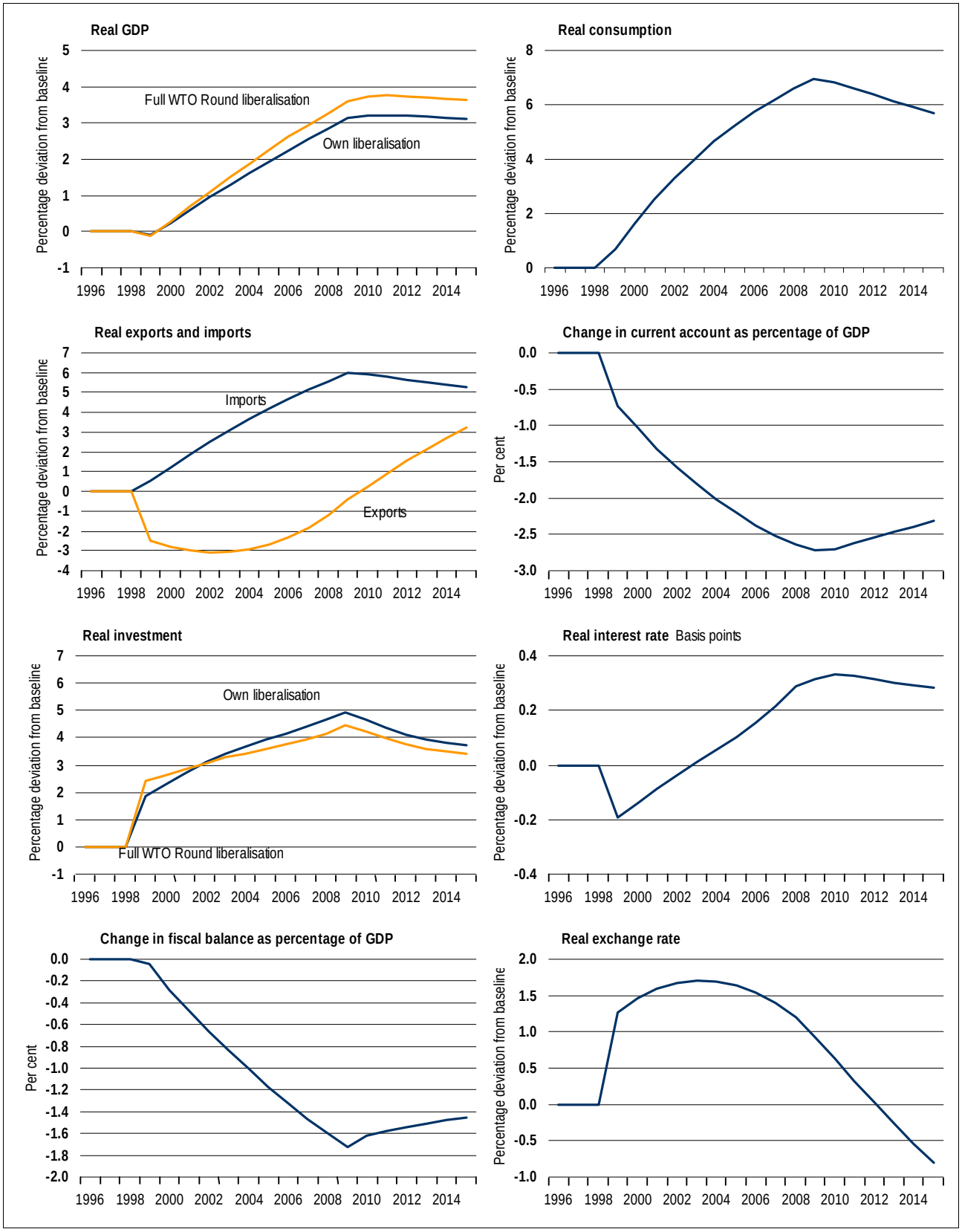
To illustrate the difference between liberalization in the crisis economies versus multilateral liberalization we plot both sets of results on each chart. The effects on all East Asian economies is similar so results for the Philippines only are shown in figure 11. Results for real GDP and real investment for the other East Asian economies are shown in figure 12.

Cutting tariffs has the effect of increasing the return on capital in different sectors depending on the capital intensity of the sector involved and the extent of tariff reduction. The result is that for the economy as a whole, there is an increase in real investment which is 2 per cent above baseline in 1999 for the Philippines. Part of this additional investment is financed by foreign capital and therefore this capital inflow causes a deterioration in the current account. With the removal of protection, consumers partly anticipate the gains and real consumption rises. Rising real consumption and an appreciation of the real exchange which lowers the price of imports causes imports to rise by 6 per cent above baseline by 2010. Exports initially fall to cause a deterioration in the trade balance sufficient to mirror the increase in current account deficit. By 2004, exports start to increase and, although not shown in the graph in figure 11, eventually rise above imports to cause the trade balance to move towards surplus in order to service the foreign capital inflow.

The extra investment and consumption leads to a rise in real GDP which generates extra tax revenue. However, there is a loss of tariff revenue so there is a net decline in the fiscal balance.

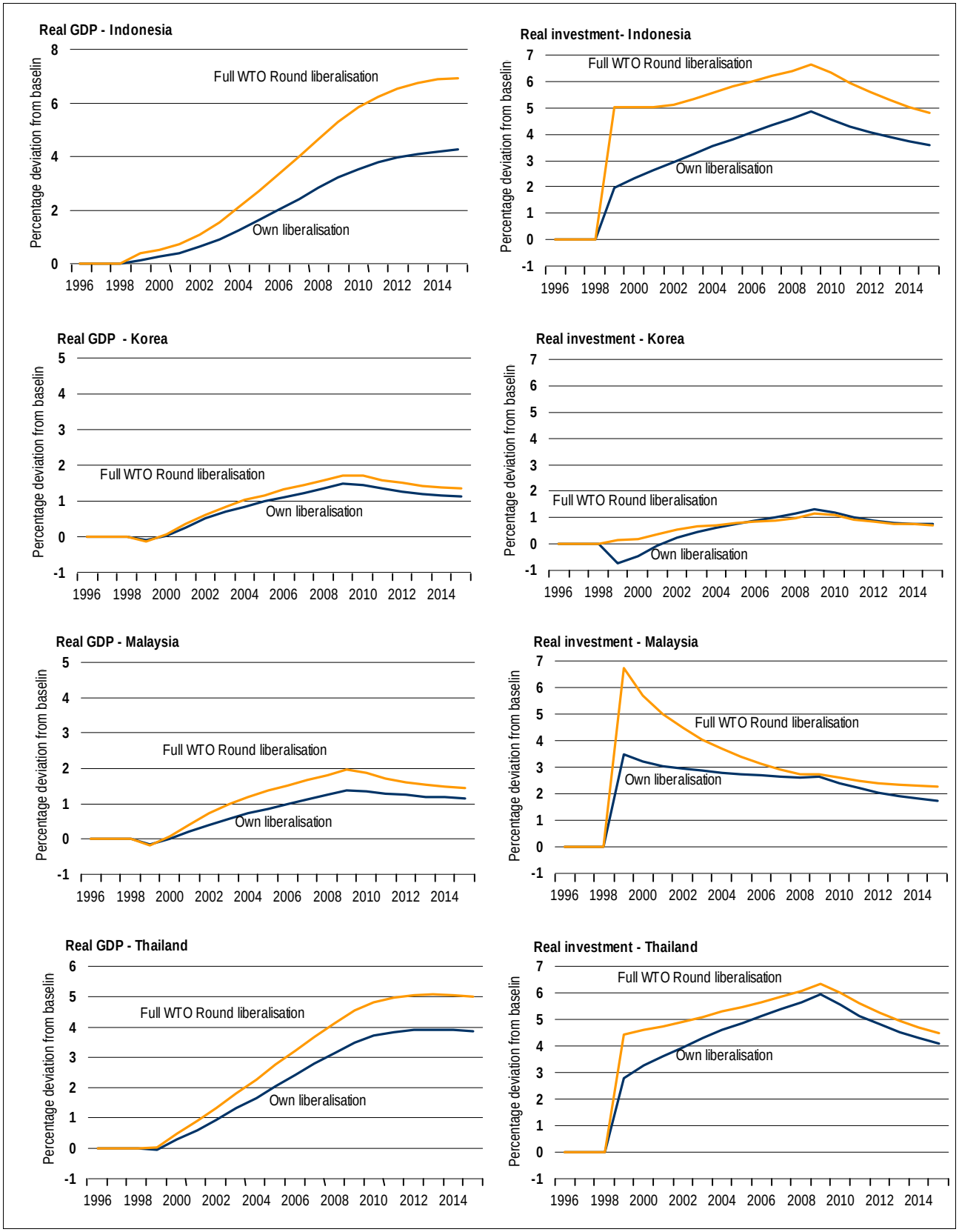
The graph of real GDP in figure 11 shows the difference between GDP with full WTO liberalization and GDP when just the Philippines liberalizes unilaterally. The first point to note is that most of the gain from liberalization comes from the Philippines removing its own protective measures. Real GDP would be over 3 per cent above baseline by 2010 with unilateral reform. Foreign liberalization adds to this gain from more efficient resource allocation.

Figure 11 **Trade liberalization: Philippines**



Data source: Simulation of the G-Cubed (Asia Pacific) model.

Figure 12 **Changes in GDP and investment from trade reform**



Data source: Simulation of the G-Cubed (Asia Pacific) model.

A similar result occurs for other East Asian economies except for one difference. In Korea, there is a slight decline in investment initially and in fact, a capital outflow in 1999 before a capital inflow occurs. The reason is that Korea has relatively high protection for agriculture and food processing. The decline in protection for these sectors causes capital to initially flow overseas to get a higher rate of return until the freeing up of resources for the rest of the economy causes investment to rise and capital to flow in. This highlights another fact from trade liberalization captured with this model. There are short run adjustment costs from liberalization of a country's own tariffs which are dominated by improved resource allocation gains in the long run. However, when other countries liberalize their barriers to the exporting countries gain in the short term. Hence, globally the adjustment costs are smaller when all countries liberalize. For this reason, even though the overwhelming gains are from unilateral liberalization, another round of comprehensive WTO trade talks is important. Apart from the short term initial effect there is very little difference between a global liberalization and Korea's own reform of protection (figure 12). The biggest difference between global trade reform (including services) and unilateral reform by a country is for Indonesia. The reason is the pattern of trade for Indonesia is to countries where the barriers are relatively greater.

f) A slowdown in the US economy due to a stockmarket collapse

The current account turnaround in East Asian economies from large deficit to large surplus has been remarkable. Of course, if the current account has improved for Asian economies, it must have deteriorated for one or more countries elsewhere in the world. One of the economies which has experienced a major deterioration in its current account has been the United States. The current account deficit in the US is now at record levels. The principal reason for this deterioration in America's current account has been the much better returns on investments in the United States economy due to their relatively higher productivity growth since the early 1990s as well as the shift in capital out of Asia.

As confidence in the United States economy has grown, so the equity risk premium — the risk premium on equities over secure investments, such as long term government bonds — has declined significantly. The equity risk premium between equities and bonds has fallen from around 8 per cent in the late 1980s to near zero levels now. It is this falling equity risk

premium that largely explains the booming stockmarket in the United States. As the stockmarket has boomed in America, the higher wealth of individuals has fuelled consumption spending and reduced the household savings rate.

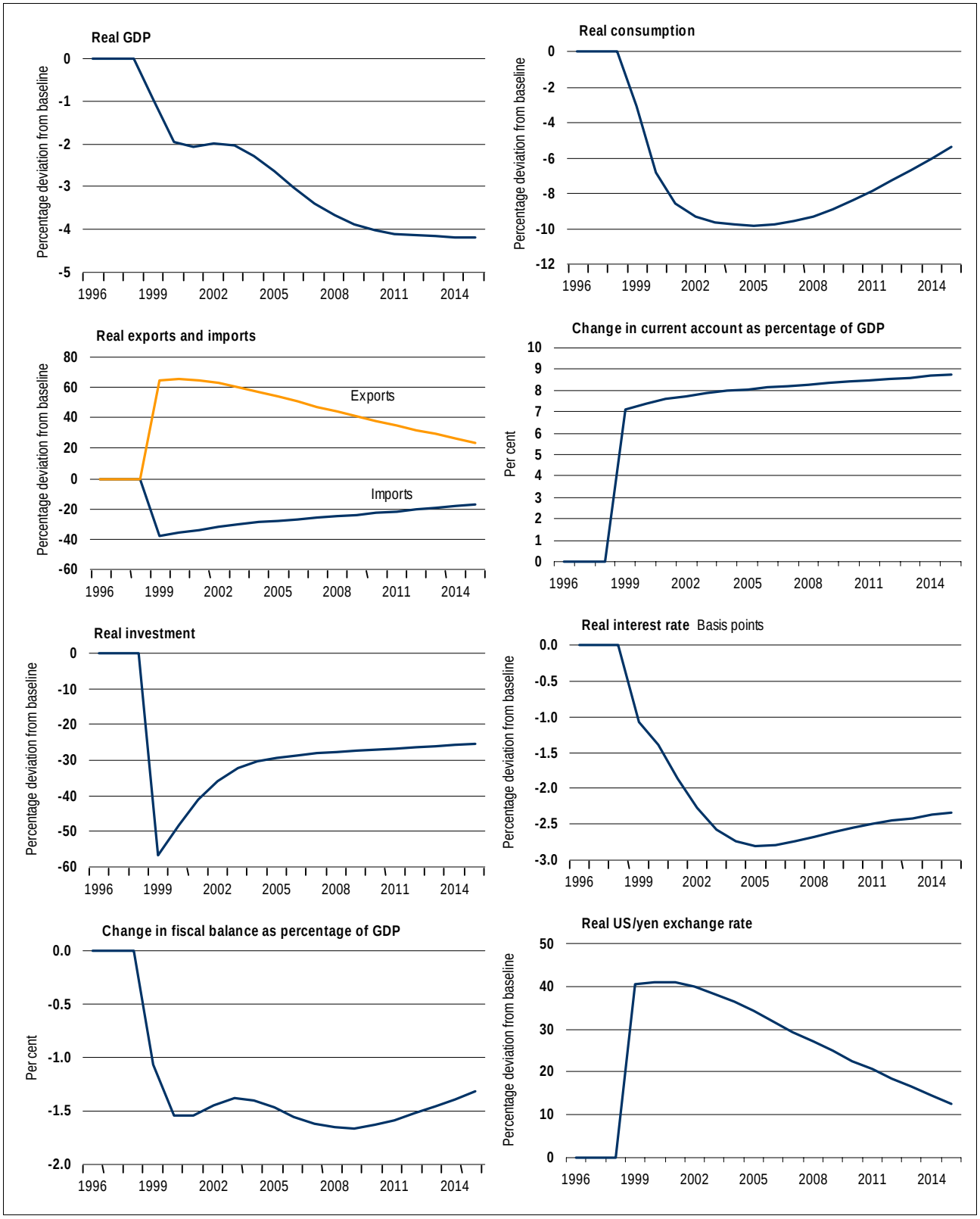
High spending and a strong US dollar accounts for the very high levels of imports flowing, in large part, from Asian economies.

These high US imports relative to exports is of course the flip side of the deterioration in the United States current account balance. So strong has this import demand been in America that some commentators have dubbed the United States as the 'spender of last resort'. Clearly, exporters from Asia have benefited from this strong growing US economy — it has enabled and enhanced their domestic recovery through expanding their exports. But what if the United States stockmarket — which many think is in a bubble — experiences a sudden sell-off? If equity prices fell suddenly, consumer spending in the United States could be expected to fall and could even lead to a recession. If a recession occurred, import demand could fall significantly. How vulnerable would East Asian economies be to a sudden stockmarket slump and what would it mean to their recovery? That is the question we now address in this simulation.

Since one of the important causes of the stockmarket boom in the United States has been the reduction in the equity premium, in this simulation we assume the premium on equities that normally existed prior to the late 1980s returns partly back to that level rising by 5% overnight. This event is assumed to occur in 1999. The consequences of such a shock for the United States economy are shown in figure 13.

The first thing that happens as a result of a return in the equity risk premium in the United States is that investors take their money out of equities and redistribute it over other assets, both internationally and within the United States. The consequence is that real interest rates drop in the United States as people buy government bonds. The real interest rate falls by nearly 3 per cent below baseline by 2005 in the United States. As foreign assets now look relatively

Figure 13 **A slowdown in the US from a stockmarket collapse: United States**



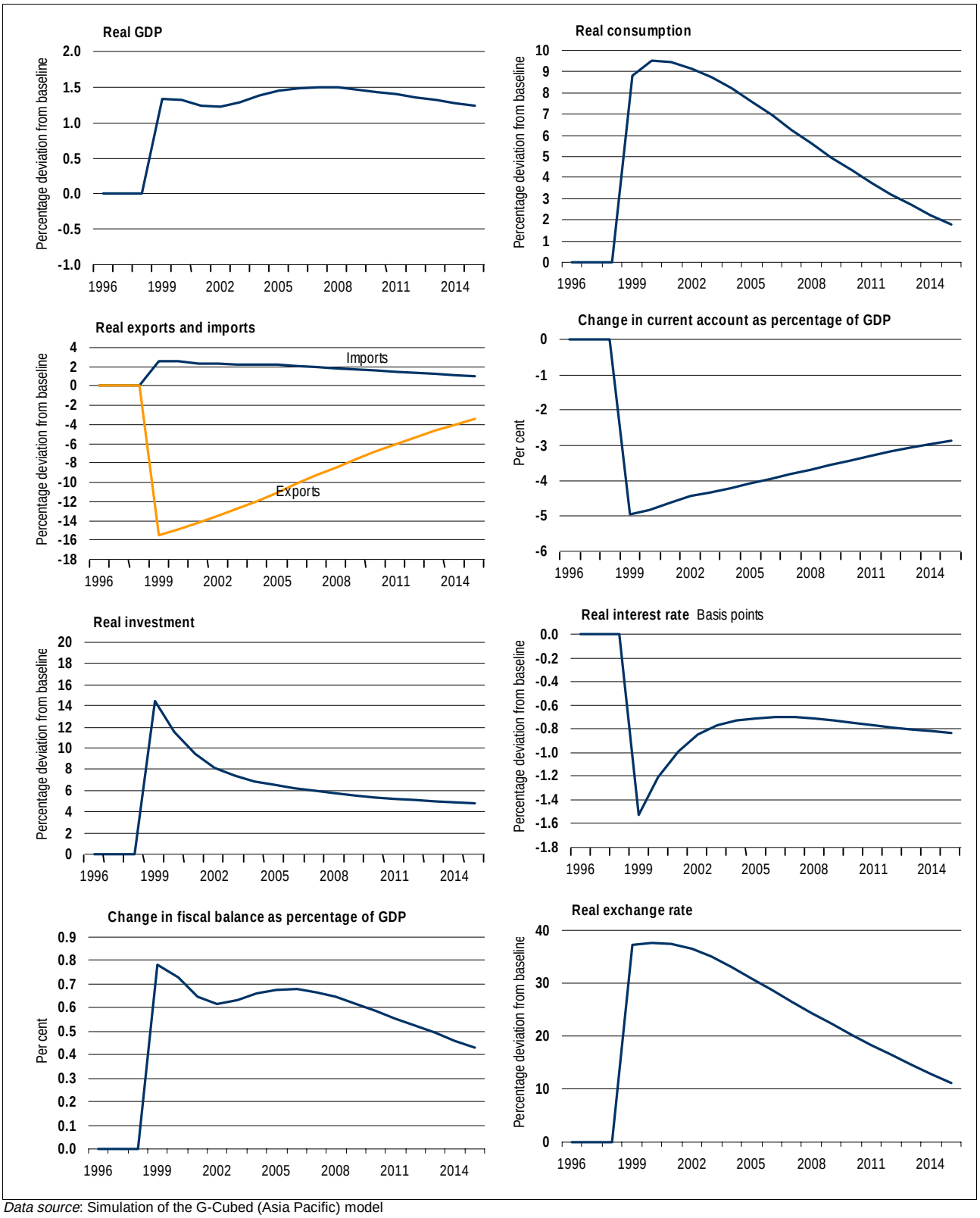
***Data source*:** Simulation of the G-Cubed (Asia Pacific) model.

more attractive, there is a large capital outflow. This outflow causes a large improvement in the current account, which improves by 7 per cent expressed as a percentage of GDP in 1999. Reflecting this capital outflow, there is a large improvement in the trade balance and exports rise by over 60 per cent above baseline while imports fall by 40 per cent below baseline in 1999. The US dollar depreciates by 40% relative to the yen (that is, the yen appreciates). With the capital outflow, there is a large initial drop in real investment in the United States, a fall in real consumption and a fall in real GDP. The fall in real GDP is around 4 per cent below the level it would otherwise have reached from 2010 onwards. This fall is relative to a baseline in which the United States in growing at roughly 3% and therefore real GDP growth does not go negative despite the size of the shock. Part of the reason is the stabilizing effects of lower real interest rates and a weaker US dollar both of which dampen the decline in investment and stimulate exports.

How does this deterioration in the United States economy impact on Asia? There are two effects operating on Asia and it is important to separate them out. One set of effects operate through the capital side and the other set of effects work through the trade side. Korea provides a good example of changes dominated by capital movements as shown in figure 14.

The United States capital outflow has to go somewhere and one of the recipients is Korea. The decline in United States stockmarket leads to investors switching some of their funds into Korea causing a spike in real investment and capital inflow that, in turn, causes the current account to deteriorate. Real interest rates fall as investors previously holding US equities now purchase both international and United States bonds, causing real interest rates to decline in Korea. The increase in real investment and the increase in real consumption leads to a rise in real GDP to a maximum of 1.5 per cent above baseline by 2008. There is an important qualification here. Recall that the simulation is a rise in the equity risk premium in the United States that leads to a sharemarket collapse in the United States. The implicit assumption is that there are no other changes in the premiums of equities versus bond in any other economies around the world. It would be a reasonable argument to mount that a sudden change in the equity risk premium in the US and sharemarket collapse would lead investors around the world to reappraise risks and lead to commensurate changes but that would be a different simulation.

Figure 14 **Effects of a slowdown in the US from a stockmarket collapse: Korea**



Data source: Simulation of the G-Cubed (Asia Pacific) model

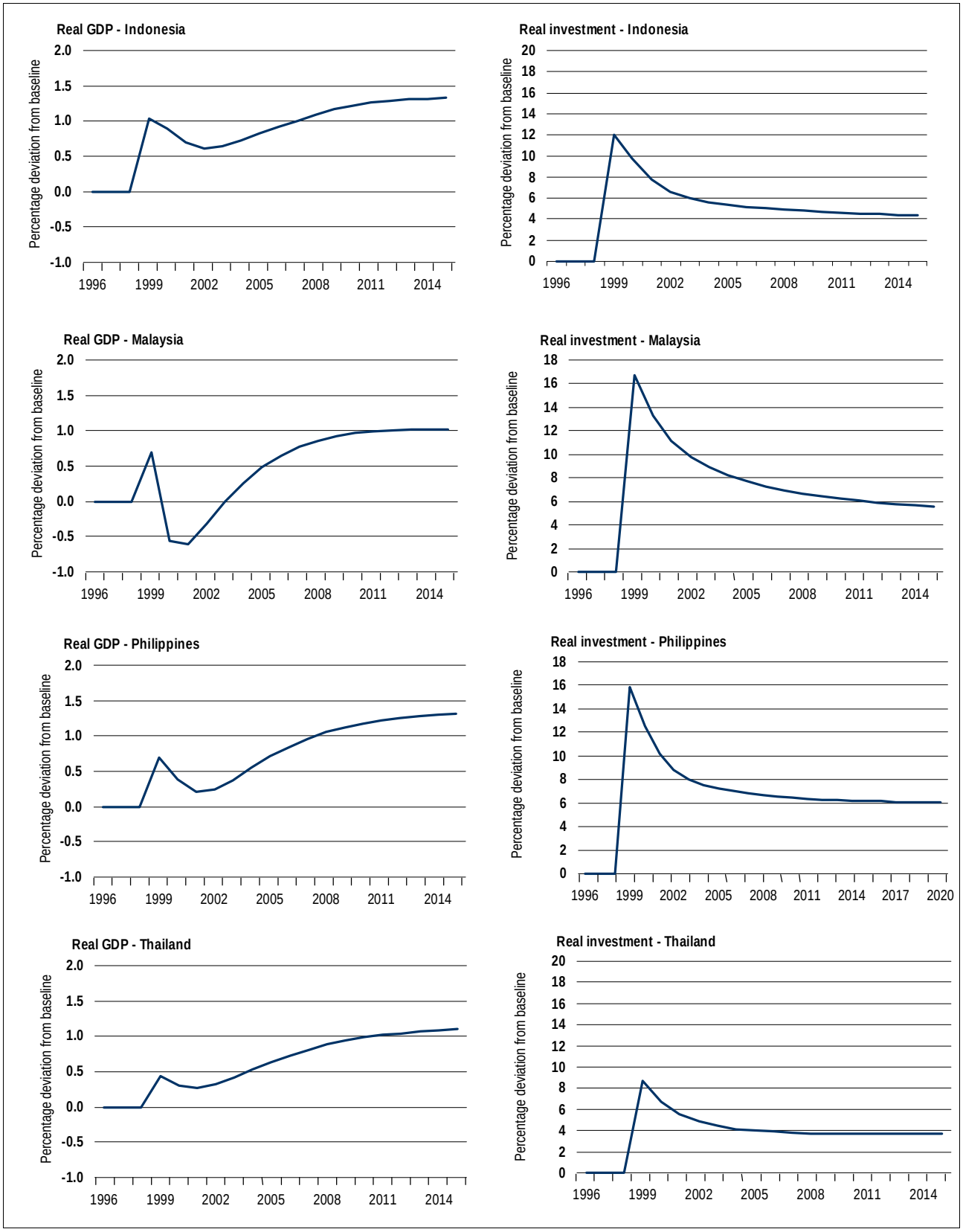
By concentrating just on a US sharemarket change we can test the vulnerability of Asia to a downturn in the world's largest economy and see for example what effect a 40 per cent drop in imports has. The answer is that if that is all that happens the effects are not catastrophic for Asia provided investor confidence does not fall in those markets. And there are plenty of steps Asian markets can take to ensure investor confidence remains — good public and private governance is one of the steps. Also, open economies and microeconomic reform were all seen previously to lift the return on capital and encourage investment.

Of interest in this simulation is that the large drop in US imports leads to some major differences across Asian countries as seen in figure 15. What happens in these other economies depends on both the movement of capital and the pattern of trade with the United States. Because the US economy has slowed down, those countries trading relatively heavily with the United States do not fare as well from the portfolio reallocation of funds within the United States and the capital outflow that occurs from the stockmarket shake-out. Some of these differences across economies is shown in figure 15. All crisis hit Asian economies gain overall in terms of real GDP as a result of the rise in real investment resulting from the United States stockmarket slump. Malaysia suffers a small loss of GDP in the second and third years after the shock as the beneficial effects of the real investment are outweighed by the loss of exports to the US market. The conclusion is that East Asian economies are not particularly vulnerable to a sudden United States stockmarket sell-off provided, of course, there are not also changes in risk premia globally. It is important to reiterate that in this simulation the only change is the return of the equity risk premium back towards levels of the late 1980s within the United States. A global reappraisal of investments would be a different simulation with worse consequences.

g) A sharp slump in the Japanese economy

Japan is the world second largest economy. It has obviously strong trade and investment links with Asia. Japan's economy has been performing poorly over most of the 1990s. While some economic recovery was apparent in 1999, Japan has significant debts — both government and within the banking system. Common criticisms leveled at the Japanese economy are a lack of

Figure 15 **Changes in real GDP and investment as a result of a US stockmarket collapse**



***Data source*:** Simulation of the G-Cubed (Asia Pacific) model

microeconomic and institutional reform and a failure to address non-performing loans in the banking system. It is not clear just how robust the Japanese economic recovery starting in 1999 will turn out to be and one of the vulnerabilities of East Asian economies is the prospects of a further slump in Japanese economic growth. In this simulation we assume there is a slump in the Japanese economy brought about by a 1 per cent slow-down in productivity growth starting in 1999 and finishing in 2002.

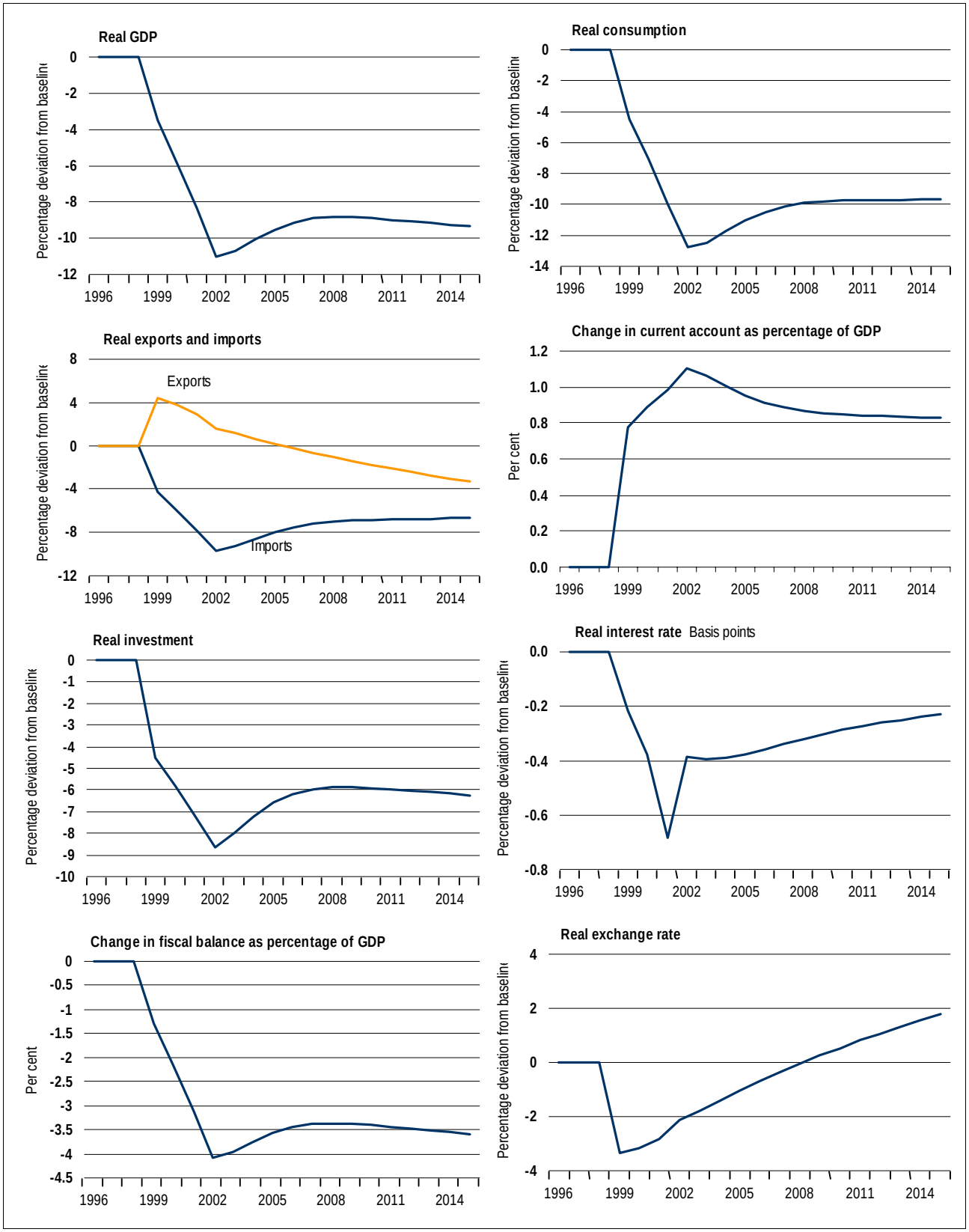
The effect of such a slow-down in Japan is self-evident: there is a drop in the return to capital and this causes a decline in real investment, real consumption and real GDP (see figure 16). With better returns to capital elsewhere in the world, there is an outflow of capital and an increase in the Japanese current account surplus. The Yen weakens as a result of the capital outflow. The weaker yen makes Japanese products cheaper in world markets and net exports rise. The fiscal balance worsens due to the drop in GDP and lower tax collections by government.

The effects of the slow-down on East Asian economies varies according to whether countries have significant trade with Japan or not. The effects of the Japanese slump on Korea are shown in figure 17. Korea is one of the economies that is a recipient of the capital outflow from Japan so there is an increase in real investment above baseline and a deterioration in the current account.

Unlike Korea, the effect of the Japanese slump on other East Asian economies — Indonesia, Thailand and Malaysia — is to cause GDP to decline (see chart 17). These economies have strong trade links to Japan through supplying intermediate inputs and the adverse effect of a slower Japanese economy on exports from these other Asian economies outweighs any beneficial effect from the relatively better prospects for world interest rates.

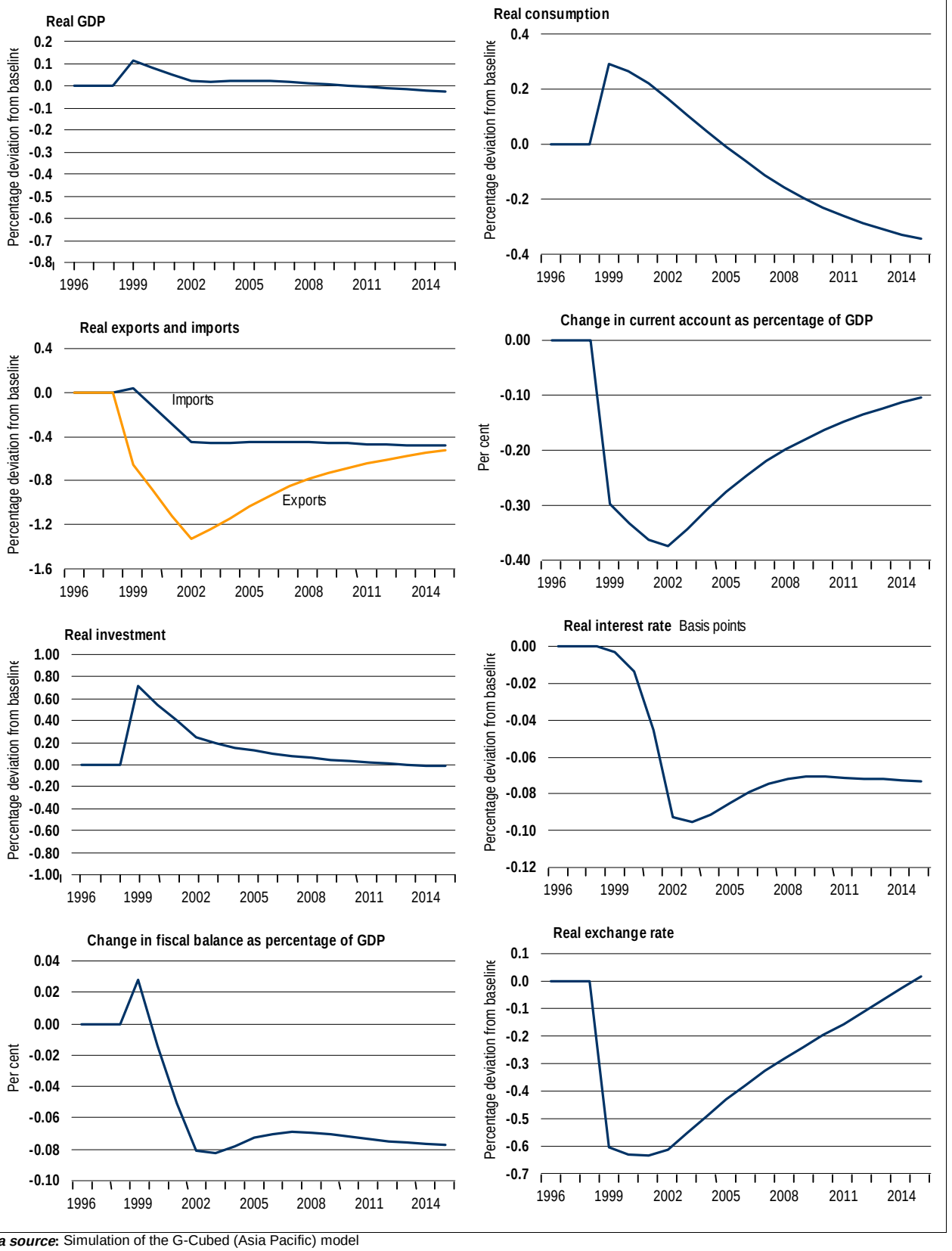
Overall a stronger Japanese economy is beneficial to the Asian crisis economies although this needs to be through greater productivity growth rather via a fiscal stimulus in Japan. McKibbin

Figure 16 **Effects of a slump in the Japanese economy: Japan**



Data source: Simulation of the G-Cubed (Asia Pacific) model.

Figure 17 **Effects from a slump in the Japanese economy: Korea**



Data source: Simulation of the G-Cubed (Asia Pacific) model

and Martin (1998) show that a Japanese fiscal stimulus can be counterproductive for the Asia crisis economies because the negatives of higher real interest rates driven by large government borrowing dominate the short term growth impulse from a fiscal expansion.

h) High growth in China

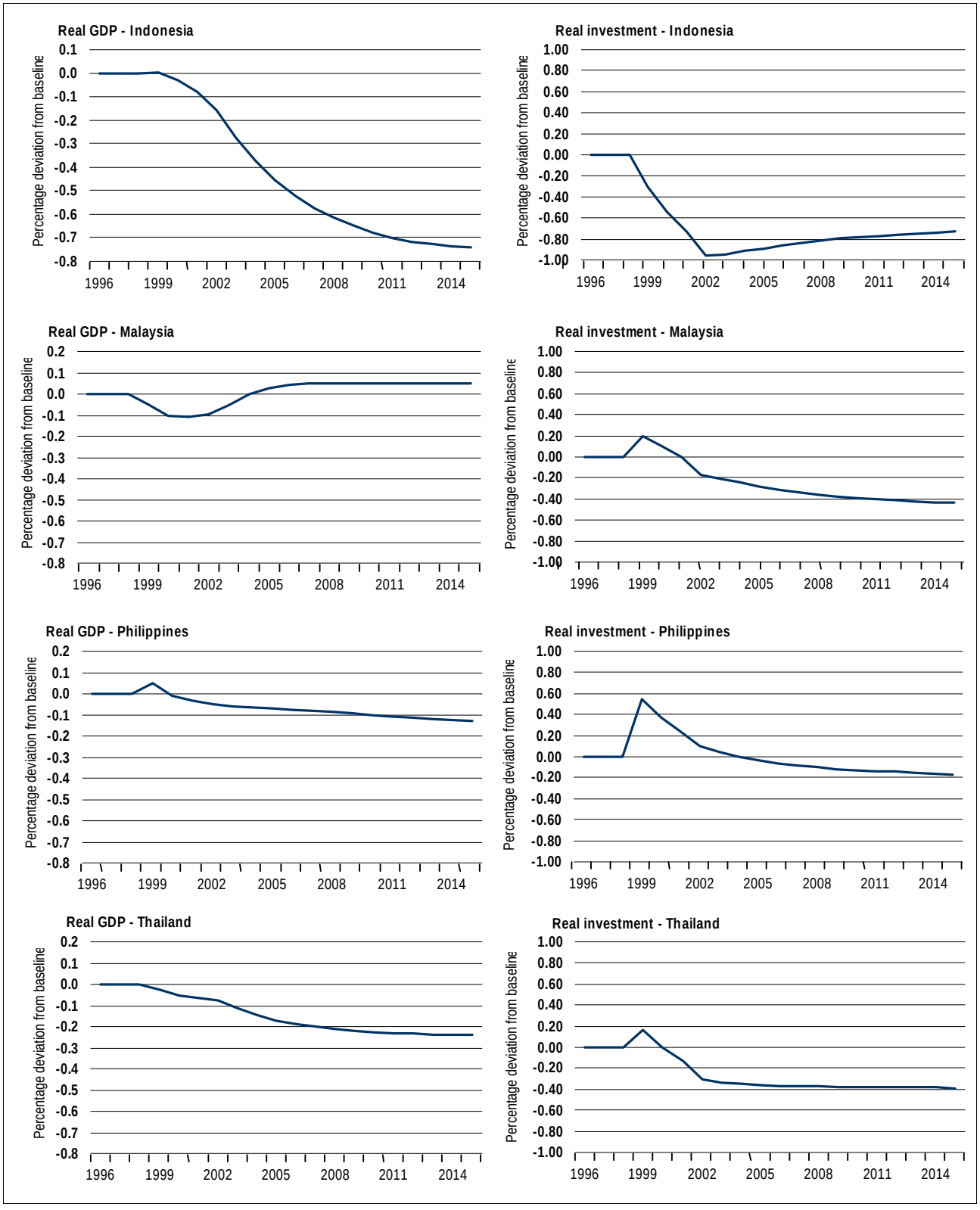
China has weathered the crisis in Asia. In this section we consider the impacts of a rise in Chinese growth brought about by an increase in labor augmenting technical change in China. The actual shock is a rise of 2% in labor augmenting technical change in 1999. The level of productivity growth remains unchanged thereafter.

The impact on China (not shown) is very similar to the previous simulation of the impact of slower Japanese productivity growth on Japan, except with the signs reversed. Higher growth raises the return to capital, which stimulates investment. Consumption rises in anticipation of higher current and future incomes and capital is attracted from overseas which worsens the trade balance.

The impact on neighboring countries is shown in figures 18 and 19. As with the above simulations there are two effects. Capital flows into China, which raises the cost of funds outside China. This is a negative effect on investment in countries outside China. On the other hand the expanding Chinese economy causes the demand for imports to rise which is a positive stimulus to the Asia crisis countries. Countries like Indonesia with trade ties with China tend to find the trade effect dominates the cost of capital effect. Korea on the other hand tends to lose slightly from a booming China because the capital outflow effect dominates the trade effect.

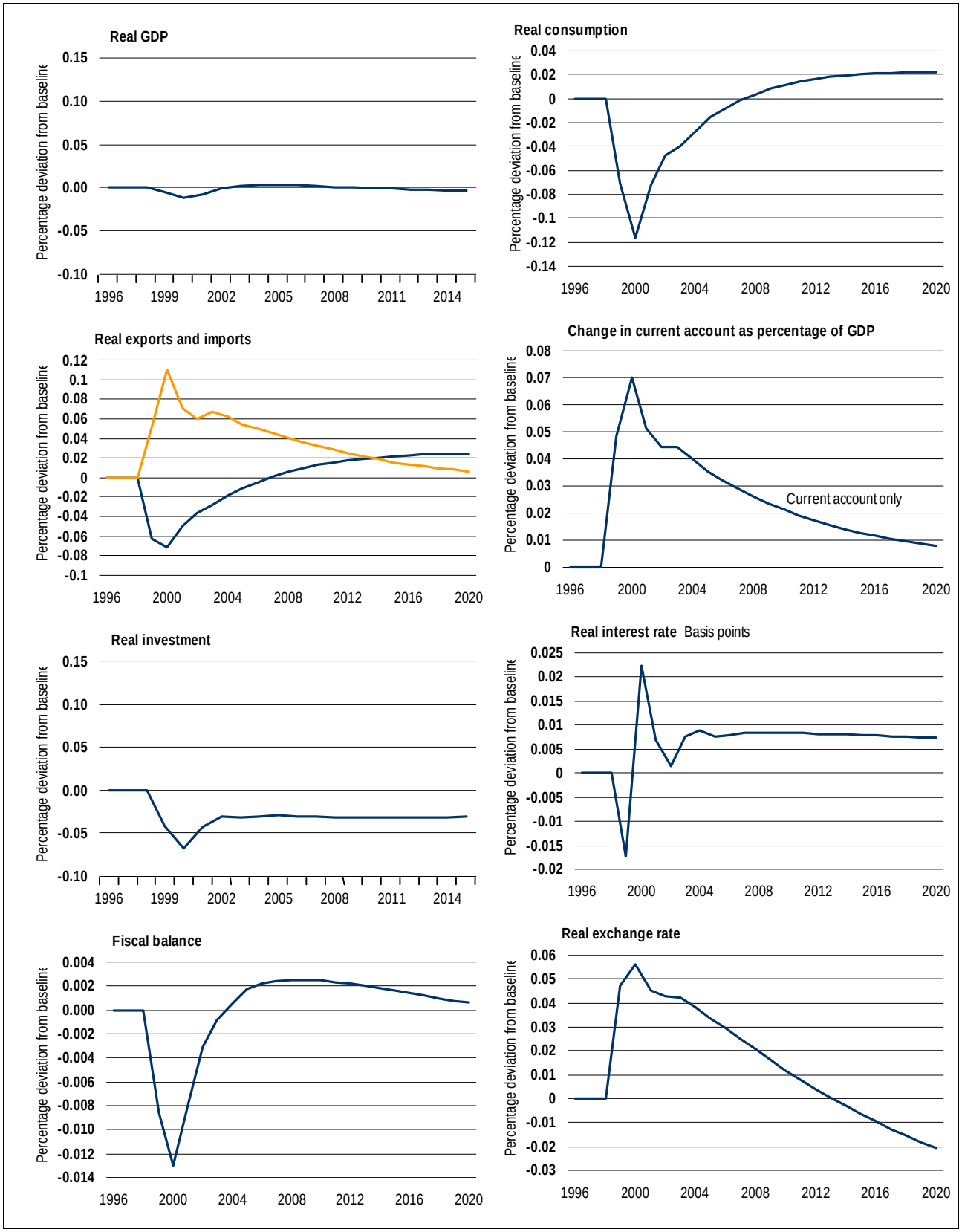
Perhaps a surprising feature of both this simulation and the previous simulation is how relatively small the direct spillovers are between Japan and China and the crisis Asian economies. Most of the risk for the recovery process lies primarily *within* the crisis economies themselves rather than in their large economic neighbors.

Figure 18 **Changes in real GDP and real investment from a slump in the Japanese economy**



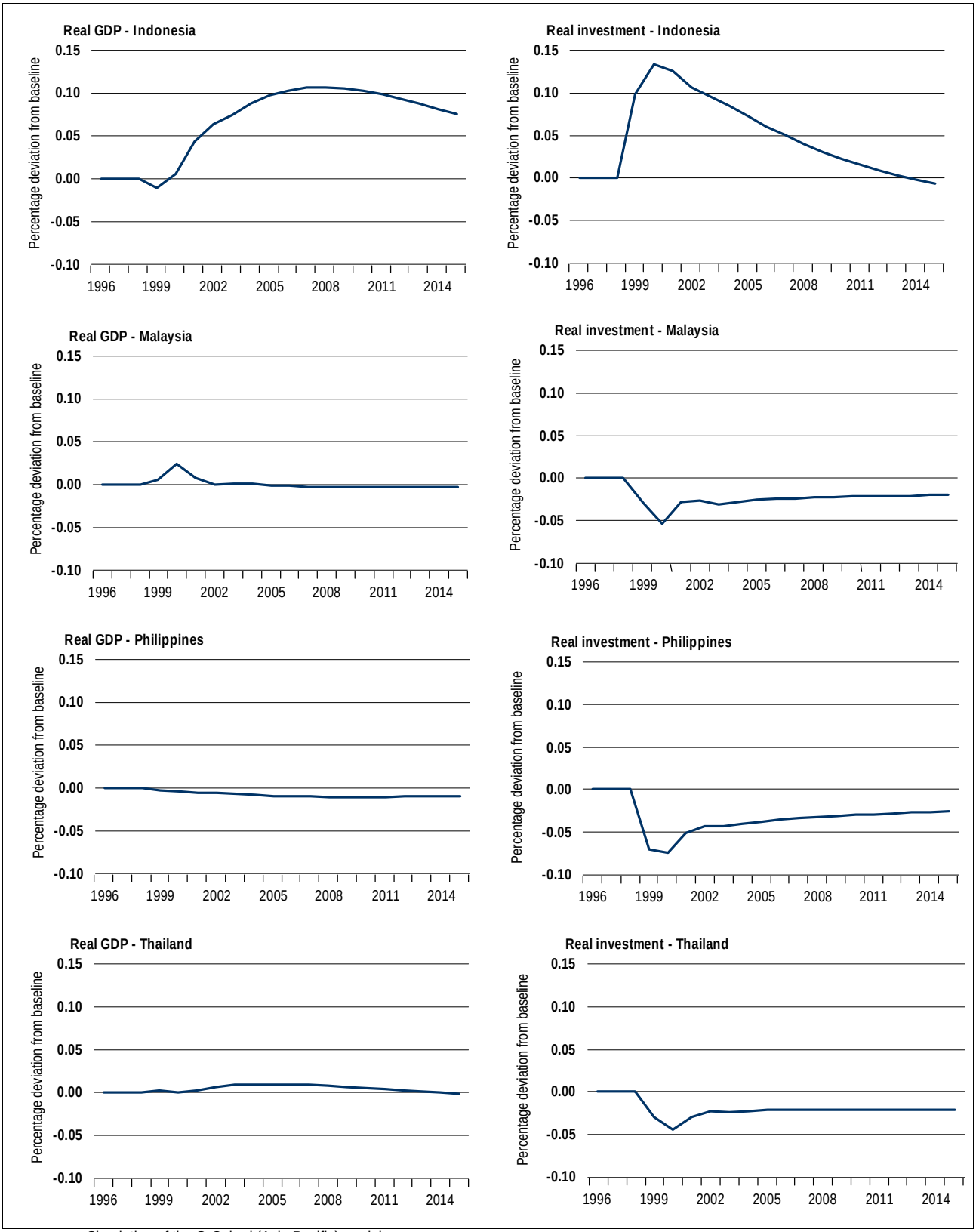
***Data source*:** Simulation of the G-Cubed (Asia Pacific) model

Figure 19 **Effects of a Chinese boom: Korea**



***Data source*:** Simulation of the G-Cubed (Asia Pacific) model

Figure 20 **Changes in real GDP and real investment from a boom in the Chinese economy**



Data source: Simulation of the G-Cubed (Asia Pacific) model

5. Implications

A key implication of the modeling results is that confidence is an important aspect of the recovery, as it was in the crisis itself. A fall in risk premia can boost the recovery process apparently already under way, although how to bring about a reduction in risk is a question not addressed in this paper. Other policies such as monetary and fiscal expansions, productivity inducing reforms and trade liberalization also have a role to play in the recovery process. Indeed if risk premia respond to factors that stimulate economic growth, then the policies considered in this paper may well also reduce risk premia and add further to the recovery process in the crisis economies. A related paper (Stoeckel, McKibbin and Tang 1999) draws the links between trade liberalization, higher productivity growth as a result and also the reduced risk premiums than can flow from trade liberalizations. The results show significant extra gains from trade liberalization.

The importance of changes in risk premia indicated in the results of this paper suggest that an important lesson from the Asia crisis is the role of risk minimization, risk monitoring and risk management in dealing with the inevitable shocks that periodically hit the world economy. Minimizing the changes in risk could perhaps be achieved by better institutional structures within these economies. Better accounting systems and more transparency — in other words better economic governance, both public and private — is also likely to help in this process. Better risk management in the sense of providing incentives for self insurance by minimizing the extent of government guarantee in economic decisions both in investment projects but also in managing exchange risk, is likely to be beneficial. Another aspect of risk management is through more appropriate use of the available policy levers. The model results support the proposition that a monetary and fiscal contraction in the midst of a panic does not help the growth process. The industrial economies seem to have understood this during their own financial crises in the 1980s, but this lesson was not applied in the crisis economies in Asia until well into the crisis.

We also considered the impact of factors outside the Asian economies on the prospects for the crisis economies. Again we find the direct spillovers through trade and capital flows of a significant crash on Wall Street, a significant further slowdown in Japan or developments in

China need not derail, nor provide significant impetus, to the recovery process in Asia. The direct impact of these external shocks depends on how much the crisis economies rely on the US, Japanese and Chinese economies for trade versus how much international capital is reallocated when there are shocks to these large economies. Indeed capital flows in this model tend to be stabilizing rather than de-stabilizing because (depending on the shock) capital flows can stimulate domestic economies through inducing lower real interest rates even when export markets are weakened through falling foreign demand. Indeed according to the model underlying this paper, the adjustment of international capital flows in response to the loss of confidence in Asia, is the primary reason that the United States and Australia experienced little aggregate fallout from the crisis in Asia.

In summary the importance of changing risk premia on economies indicated by this paper naturally suggests that policies should be aimed at both minimizing the chances of a change in risk perceptions as well as providing a way to deal with these shocks when they do occur. It is inevitable that there will be future shocks in the global economy – it is unlikely that these will be easy to forecast in advance. Thus risk monitoring, risk minimization and risk management are likely to be the crucial ingredients by which economies (developing and developed) can be buffered from the next major shock to the global economy.

APPENDIX A
G-CUBED (ASIA PACIFIC)— THE MODEL USED

G-Cubed (Asia Pacific)— the model used

The G-Cubed (Asia Pacific) model emerged from a research program designed to link two strands of quantitative economic modelling:

- traditional multi-sectoral general equilibrium models — which capture inter-actions between sectors but which are often static, do not generally incorporate the financial sector and do not have full macroeconomic closure; and

- macroeconomic models — which are mostly dynamic and have full macro-economic closure but which usually do not capture intersectoral interactions and often do not have a well-specified supply side.

Origins of G-Cubed (Asia Pacific) model

The origins of G-Cubed (Asia Pacific) are the MSG2 macroeconomic model (McKibbin and Sachs 1991) and the G-Cubed model. Both of these models have proved successful in a wide variety of applications. The G-Cubed model has been an important tool in analysing greenhouse gas policy in the global economy (McKibbin and Wilcoxen 1998).

Several features of G-Cubed (Asia Pacific) make it an ideal tool for analysing the effects of the Asian meltdown.

- With its macroeconomic detail, and integrated real and financial markets, G-Cubed (Asia Pacific) can account for the effects of a financial shock on interest rates, exchange rates and international capital movements. It can also account for the effects of different government fiscal and monetary responses to these shocks. The model fully integrates wealth effects on consumption and captures debt burdens and expectations.

- With its explicit treatment of expectations, G-Cubed (Asia Pacific) can account for the ways in which future policy changes that are credible can affect economic activity in the early stages of implementation.

- As a global general equilibrium model, G-Cubed (Asia Pacific) accounts for the interactions between sectors and between regions. Thus, it can capture the effects of policy changes and shock within an economy and between economies.

- As a dynamic model, G-Cubed (Asia Pacific) can account explicitly for the time path of policies and shocks.

By contrast, the comparative-static modelling frameworks used in traditional computable general equilibrium models do not include treatment of dynamics, interest rates, expectations or capital movements.

Country to industry coverage

G-Cubed (Asia Pacific) separately identifies 18 countries/regions. Table A1 sets out the economy and six sector coverage of the version of G-Cubed (Asia Pacific) used in this study. Some food items occur in nondurable manufacturing and the mapping between G-Cubed (Asia Pacific) and SIC sectors is shown in table A2.

A1 **Economy and industry coverage of G-Cubed (Asia Pacific)**

Economies		***Sectors***
United States	China	Energy
Japan	Chinese Taipei	Mining
Australia	Korea	Agriculture
New Zealand	Hong Kong	Durable Manufacturing
Indonesia	India	Nondurable manufacturing
Malaysia		Services
Philippines		
Singapore		
Thailand		
Other OECD		

A2 **Relationship between G-Cubed (Asia Pacific) and SIC sectors for agriculture and nondurable manufacturing**

G-Cubed (Asia Pacific)	*SIC code*	
Agriculture	01	Agricultural production-crops (excluding cereal preparations and flour)
	02	Agricultural production-livestock and animal specialities
	07	Agricultural services
	08	Forestry
	09	Fishing, hunting, and trapping
	24	Lumber
Nondurable manufacturing	20	Food and kindred products (including cereal preparations and flour)
	21	Tobacco products
	22	Textile mill products
	23	Apparel and other finished products made
	26	Paper and allied products
	27	Printing, publishing and allied industries
	28	Chemical and allied products
	30	Rubber and miscellaneous plastics products

Key features

Detailed specifications of the theoretical structure of G-Cubed (Asia Pacific) can be found in McKibbin (1996). The key features of G-Cubed (Asia Pacific) are that it:

- specifies the demand and supply sides of industrialised economies;

- integrates the real and financial markets of these economies;

- fully accounts for stocks and flows of real resources and financial assets;
- imposes inter-temporal budget constraints so that agents and countries cannot indefinitely borrow and lend without undertaking the resource transfers necessary to service outstanding liabilities;
- has short run behaviour that is a weighted average of neoclassical optimising behaviour and liquidity constrained behaviour;

- has a real side that is disaggregated to allow for production and trade of multiple goods and services within and between economies;
- has full short and long run macroeconomic closure with annual macrodynamics around a neoclassical growth model; and
- can be solved for the full rational expectations equilibrium annually from 1996 to 2100.

Like other models, G-Cubed (Asia Pacific) essentially consists of a theoretical framework, data and parameters.

Theory

The model theory consists of behavioural and accounting relationships. The model recognises a number of economic agents including firms, households and government.

Firms

Each sector is represented by a firm, which chooses its inputs and level of investment so as to maximise its stockmarket value, subject to a multiple input production function and output prices (which are given as far as the firm is concerned).

Sectoral output is produced using capital, labour, energy and materials. Energy and materials are aggregates of inputs of intermediate goods, which are in turn aggregates of imported and domestic commodities that are assumed to be imperfect substitutes.

The capital stock in each sector changes according to the rate of fixed capital formation and the rate of depreciation. Investment is subject to rising marginal installation costs so that total real investment is the value of purchases plus the per unit cost of installation. The per unit cost is a function of the rate of investment. This implies that, once in place, it is costly to move physical capital between sectors. In contrast, financial capital is perfectly mobile.

The goal of each firm is to choose its inputs to maximise intertemporal net (of tax) profits. Taxes included are a corporate income tax, taxes on inputs (such as a carbon tax) and an investment tax credit.

Wages

Wages are determined by assuming that labour is mobile between sectors in each region, but not between regions. Thus, each sector in a region pays the same wages. Wages in a particular country adjust according to an overlapping contracts model where nominal wages depend on current and expected inflation and on labour demand relative to labour supply. Long run labour supply is determined by the (exogenous) rate of population growth. In the short run, hours worked can fluctuate. For a given nominal wage the demand for labour determines short run unemployment in each sector. This varies, depending on the composition of demand for each sector's output.

Households

Household behaviour is assumed to be a weighted average of two types of behaviour. In the first, households aim to maximise intertemporal utility subject to a wealth constraint. Wealth consists of human wealth and financial assets. Human wealth is the present value of the expected future stream of after-tax labour income. Financial wealth is the sum of real money balances, real government bonds, net claims against foreigners and the value of capital in each sector.

In the second type of behaviour, households base their consumption on after-tax current income.

Government

Real government spending is exogenous and constant as a share of GDP. Government consumption is financed by taxes (corporate and personal income taxes) and by issuing government debt.

The government budget must balance in present value terms but need not balance in any single period. Thus, if the government runs a budget deficit today, it must run an appropriate budget surplus at some point in the future. If not, the government will be unable to pay interest on debt and private agents will not be willing to hold it. The specific fiscal closure chosen is that at

every instant in time the government must levy a lump sum tax equal to the value of interest payments on the outstanding debt.

Financial markets and balance of payments

The model accounts for flows of assets between regions, consistent with the flows of goods. The model specifies that money is required to undertake transactions and so the demand for money is a function of GDP and short term nominal interest rates. The supply of money is exogenously chosen by the central bank in each region.

Asset markets are assumed to be integrated across regions. The model allows for risk premiums on assets held in different currencies. These are calculated as part of the baseline of the model and are designed to replicate 1996. When undertaking simulations it is assumed that risk premiums are independent of the shock under consideration.

For the results reported in this paper, exchange rates are assumed to be floating. Also, it is assumed that OPEC (Organisation of Petroleum Exporting Countries) chooses its foreign lending in order to maintain a desired ratio of income to wealth and that Eastern Europe and the former Soviet Union, as well as other developing countries, are constrained in what they can borrow from the rest of the world. In these countries, any available foreign exchange — given a current account constraint, the demand for exports and the servicing costs of external borrowing — is allocated to imports of goods from all other regions.

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