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Abstract

Rising economic integration in Asia and periodic volatility in global and national financial markets raise the issue of the optimal degree and form of monetary cooperation among Asian economies. There is a large literature on the benefits and costs of monetary cooperation, however, less can be found with a specific focus on Asia. A number of studies have explored whether Asia might form an optimal currency area, although these have focused on the nature of shocks, in particular business cycle correlations, as well as the extent of trade linkages among economies. Less has been done on the impact of portfolio shifts and financial shocks, and how these shocks impact on financial cooperation.

This paper has two goals. The first is to explore the impacts of the current global financial crisis on Asian economies under existing monetary and exchange rate arrangements. The second is to explore how alternative forms of cooperation and exchange rate regimes might change the economic outcomes in Asia. In particular, the paper explores the impact of current regimes compared to one of three hypothetical regimes: (i) all countries peg to the US dollar, (ii) all Asian economies are in an Asian Currency Union with an Asian Central Bank setting policy, or (iii) floating exchange rates with each central bank in Asia independently choosing optimal time-consistent, close-loop policy rules to target a loss function consisting of deviation in inflation and output growth from desired levels.

Keywords: Monetary cooperation, exchange rates, financial crisis

JEL Classification: E27, E42, E44, E52, E58, F41, F42

1. Introduction

Rising economic integration in Asia and periodic volatility in global and national financial markets raise the issue of the optimal degree and form of monetary cooperation among Asian economies. The recent global financial crisis has provided a stark reminder that shocks to the global economy are difficult to anticipate and a sensible regime design is best undertaken in a period of market calm rather than in the midst of a crisis.

There is a large literature on the benefits and costs of monetary cooperation, however, less can be found with a specific focus on Asia. A number of studies have explored whether Asia might form an optimal currency area, although these have focused on the nature of shocks, in particular business cycle correlations, as well as the extent of trade linkages between economies (Alesina and Barro, 2002; Alesina et al., 2002; and Barro and Lee, 2009). Less has been done on the impact of portfolio shifts and financial shocks, and how these types of shocks impact on financial cooperation.

The paper begins by summarizing the literature on monetary cooperation, focusing on recent contributions and their relevance to Asian economies. An earlier study by McKibbin and Le (2004) explored some of the empirical issues regarding monetary cooperation in Asia using a micro-founded, large-scale simulation model to explore a variety of supply and demand side shocks. This paper extends that approach by exploring the consequences for Asia of a global financial crisis similar to that being experienced in 2008/9, but under alternative exchange rate regimes and degrees of monetary cooperation.[1]

The paper is structured as follows. Section 2 summarizes the debate on monetary cooperation in Asia and gives an overview of the alternative monetary and exchange rate regimes evaluated in this paper. We consider the current monetary regimes in Asia modeled as Henderson–Mckibbin–Taylor (HMT) rules[2] with different weights on output, inflation, and nominal exchange rate variability in each economy under various forms of floating exchange rates. The different exchange rate regimes include (i) pegging to the US dollar, (ii) an Asian currency union with a central bank of Asia following an HMT rule for Asia as a whole, and (iii) the optimal non-cooperative policy rules under floating exchange rates where each national central bank calculates the optimal time-consistent, closed-loop policy rule for interest rates given an objective function. Section 3 gives an overview of the version of the G-Cubed model used in this paper—a large scale dynamic stochastic general equilibrium (DSGE) model of the world economy with 16 countries and 6 sectors of production in each country. Section 4 outlines how we model a global financial crisis and presents results for a comparison across monetary regimes. Section 5 concludes with particular emphasis on the policy-relevant insights from the study.

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1 A further extension to consider the role of endogenous exchange rate risk premia in changing the quantitative outcomes is undertaken in Chanthapun (ANU PhD dissertation, forthcoming), where the author takes into account the portfolio approach to exchange rate determination that has re-emerged in the recent theoretical literature on modeling open economies in micro-founded models as well as allowing for the direct impact of trade balances on changing country risk.

2 See Henderson and McKibbin (1993), and Taylor (1993).

2. Monetary Policy Cooperation in Asia and Alternative Monetary Regimes

The debate on monetary and financial cooperation amongst Asia and Pacific countries was spurred after the 1997/98 Asian financial crisis and will undoubtedly expand with the current global financial crisis. The 1997/98 crisis was, to a large extent, characterized by a sudden reversal of capital flows in the international capital market.[3] Because of the capital account nature of the crisis, the development of regional liquidity arrangements and a regional capital market to prevent and resolve any future financial crises was a central issue surrounding the post-crisis debate in the region's policy forums. The Chiang Mai Initiative and the Asian Bond Markets Initiative are two major outcomes of this policy debate. Discussions have also focused on the stabilization of exchange rates and creation of an Asian currency unit. The issue of currency stability has led to a debate concerning an optimal level of foreign exchange reserves as East Asian countries, especially the People's Republic of China (PRC), have recently accumulated substantial reserves. The current global financial crisis provides greater impetus for Asian countries to explore further monetary cooperation. Coordinated monetary policies by Asian central bankers are viewed as necessary measures to prevent a contagion spreading to Asia and to curb the risk of a global recession. These issues of monetary and financial cooperation are discussed in turn below.

The 1997/98 Asian financial crisis caused countries in the region to realize the importance of ensuring the availability of sufficient liquidity in the event of a severe economic shock. Since accumulating reserves individually can be costly to an economy (a point that will be elaborated later), external liquidity arrangements are deemed desirable and necessary for the region. The Chiang Mai Initiative, which is a network of bilateral swap arrangements, was agreed to by members of the Association of Southeast Asian Nations (ASEAN) and the "ASEAN+3 countries" (members of ASEAN plus the PRC, Republic of Korea, and Japan) in May 2000.[4] Besides serving an obvious purpose of precautionary liquidity needs, the Chiang Mai Initiative has also been said to serve as a form of financial integration to enhance real integration in the region (Asian Development Bank [ADB], 2004). Rajan (2008) stresses that while the Chiang Mai Initiative represents a significant step in Asian monetary cooperation, several important details still need to be sorted out for it to be an effective liquidity enhancing device. These include increasing the current aggregate size of the pooled reserves, making the condition of withdrawal transparent and automatic, and, perhaps most importantly, making the framework more multilateral.

There have also been active discussions concerning the development of regional bond markets. Progress includes the creation of the Asian Bond Fund by the Executive Meeting of East Asia–Pacific Central Banks (EMEAP) and the Asian Bond Markets Initiative by ASEAN+3. These endeavors to develop efficient and liquid bond markets in Asia are taking place against a background in which the underdevelopment of capital

[3] See Corsetti, Pesenti, and Roubini (1998); Krugman (1998); and McKibbin and Martin (1998) using an earlier version of the model used in the current paper.

[4] For recent development, see The Joint Ministerial Statement of the 10th ASEAN+3 Financial Ministers' Meeting (Kyoto, Japan) (http://www.aseansec.org/18352.htm).

markets in Asia (i) hinders Asian countries from diversifying their financial structures away from bank systems to bond financing, which is considered a relatively more stable source; and (ii) fosters Asian countries' dependence on short-term, foreign currency-denominated financing. The latter causes maturity and currency mismatches, and increases the region's vulnerability to volatility in short-term capital movements.[5]

Given that in recent years, East Asian countries have become capital exporters, the idea of developing regional bond markets is considered to be particularly appealing. Instead of channeling their surplus capital to low-yield United States (US) Treasury bonds and accumulating excessive foreign exchange reserves, efficient regional bond markets may enable better utilization of Asian savings for Asian investments. Under the Asian Bond Fund, foreign exchange reserves held by regional member central banks are pooled to invest in regional sovereign bonds. The region has also sought ways to spur issuance of basket currency bonds[6] from a pool of sizeable accumulated foreign exchange reserves in East Asian countries, especially the PRC.

As with the case of the Chiang Mai Initiative, the Asian Bond Markets Initiative remains a work in progress, with a size and membership that needs to expand. Major challenges include pinning down details of a number of important issues—from establishing required infrastructures, such as a credit rating and settlement systems, to determining the denomination of the proposed Asian basket currency bonds. Despite their early stages of development, these initiatives serve as a cornerstone to strengthening and deepening financial and monetary cooperation in the region. The Asian basket currency in particular, if successful, could form the foundation of an Asian currency unit and an Asian monetary union.

There is a wide range of discussions in various policy forums concerning regional exchange rate policy coordination and monetary integration. These discussions, especially on the optimal exchange regime for the region, intensified after the Asian financial crisis erupted in 1997 since it was believed that keeping the exchange rates fixed, while prematurely opening the capital account, was the policy mishap that led to the crisis.

On one hand, crisis-affected countries such as the Republic of Korea, Indonesia, and Thailand initially moved towards a floating exchange rate regime, mainly as a condition of the International Monetary Fund's (IMF) rescue package. The rationale for shifting from a managed float or a soft peg regime to a flexible exchange rate regime follows a popular concept known as "hollowing of the middle". It is argued that an exchange regime between a hard peg and an independent float is unsustainable since it lacks credibility and is vulnerable to speculative attacks. On the other hand, there is a counter-argument based on the "impossible trinity" saying that managed floating and other middle regimes may be viable for many countries with low capital mobility and underdeveloped capital and foreign exchange markets (Fischer, 2001 and Mussa et al.,

[5] See the Joint Ministerial Statement of the 6th ASEAN+3 Finance Ministers Meeting (Makati, 7 August 2003) (http://www.aseansec.org/15032.htm).

[6] Through the Asian basket currency (ABC) Initiative, see the Joint Ministerial Statement of the 8th ASEAN+3 Finance Ministers Meeting (Istanbul, 4 May 2005) (http://www.aseansec.org/17448.htm).

2000). Despite this debate, the reality is that most East Asian countries, except Japan, adopt a managed float or a de facto peg against the US dollar, although these have become more flexible since the 1997/98 Asian financial crisis.[7]

Given the de facto dollar peg used widely in the region, the post-crisis debate on exchange rate regime choice has shifted to exchange rate policy coordination to stabilize intraregional exchange rates. In the post-1997/98 Asian financial crisis period, East Asian currencies faced significant upward pressure vis-à-vis the US dollar, particularly the PRC's yuan, which was prompted by substantial inflows of capital to East Asia. This phenomenon may provide impetus toward regional exchange rate coordination, according to Kawai (2007), who argues that if the appreciation of East Asian currencies is inevitable, then collective action that allows maintaining intraregional exchange rate stability is desirable so that adjustment costs can be spread among them. He goes so far as to suggest that such a joint response by the countries in the region has the potential to lead to greater forms of exchange rate policy coordination. Examples of coordination include adoption of an Asian currency unit (ACU) through an ADB initiative and, in the long run, formation of an East Asian monetary zone. Besides serving as a means of benchmarking the extent of currency movements, an important rationale for an ACU is to reduce the region's reliance on the US dollar and other external currencies. Regional financial and trade transactions would be invoiced in the ACU and, hence, reduce the region's exposure to external shocks.

Several systematic studies on the development of formal exchange rate coordination have been conducted including, for example, Girardin and Steinherr (2008), who proposed a road map for the development of a basket currency in Asia. Despite these attempts, there appears to be a consensus that it is premature at this stage for Asian countries to commit to a strict currency stability rule or any formal exchange rate coordination, let alone a monetary union. The basis for this argument includes the divergence in economic structures and a lack of supporting institutions and macroeconomic policy coordination within the region (Alesina et al., 2002; and Kato, 2007). It is also argued that a regime of inflation targeting can increase the synchronization of business cycles and, hence, help to ease the transition towards monetary union (Rose, 2009). Barro and Lee (2008) find that low political proximity among East Asian countries presents an additional barrier to the formation of a currency and monetary union in the region.

Another policy concern in the post-1997/98 crisis period that has been touched upon above is the rapid and significant build-up of foreign exchange reserves across Asia in recent years.[8] This development suggests that Asian economies heavily manage their currencies in a fashion indicative of currency undervaluation. A question that receives a great deal of attention is whether the level of foreign exchange reserves accumulated by East Asian countries, particularly the PRC, is excessive. Although determining whether a country holds excessive reserves depends considerably on the choice of benchmark, the accumulation of foreign exchange reserves in East Asia has raised concerns about the

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7 ADB. 2007. *Asian Economic Monitor*. Manila. December 2007 (Box 2).

8 At the end of 2006, the PRC; Japan; Taipei,China; Republic of Korea; Singapore; and Hong Kong, China held over half of the USD5 trillion total of official foreign exchange reserves.

creation of excessive global liquidity. The justification of such concerns depends on East Asian countries' ability to fully sterilize their respective foreign exchange interventions. The failure of these economies to fully sterilize the effects on their domestic monetary aggregates can result in economic overheating, asset price bubbles, and a resumption of domestic inflation. Since the currencies of these economies are de facto stabilized against the US dollar, their monetary authorities cannot effectively tighten monetary conditions to reign in credit growth. Studies concerning this issue include Aizenman and Marion (2003), Jeanne and Ranciere (2006), and Ouyang et al (2007).

There has been remarkable progress in deepening and strengthening monetary and financial cooperation in the Asia Pacific region. The 1997/98 Asian financial crisis provided an important impetus for countries in the region to recognize the need for such cooperation. The continuing turmoil in global credit and financial markets calls for a coordination of monetary policies in the region. So far, we have seen Asian central banks join their western counterparts in coordinated cuts in interest rates in an effort of curb the risk of the credit crisis leading to a global recession. Additional collective action by the central banks may be required as the crisis continues. The results below offer some support for this view.[9]

We do not intend to model all aspects of the above debate in this paper. Instead, we focus on the choice of monetary policy rules and exchange rate regimes. The regimes considered are summarized in Table 1. Although it is not an exhaustive list, it gives broad coverage to the various regimes proposed.

3. The G-Cubed Model

Table 2 summarizes the G-Cubed model and Appendix A provides additional details.[10] G-Cubed is a widely-used and dynamic intertemporal general equilibrium model of the world economy, which is known as a DSGE model in the macroeconomic literature. In the version used in this paper, there are 16 regions and 6 sectors of production in each region. It produces annual results for trajectories that run decades into the future.

Because G-Cubed is an intertemporal model, it is necessary to calculate a baseline, or "business-as-usual", solution before the model can be used for policy simulations. In order to do so, we begin by making assumptions about the future course of key exogenous variables. We take the underlying long-run rate of world population growth plus productivity growth to be 1.8% per annum, and take the long-run real interest rate to

[9] The region has also seen collective fiscal policy responses to the global financial crisis, primarily in the form of increased government budget deficits. Incorporating the fiscal policy responses may have important implications for the overall result regarding monetary policy coordination. This follows from the growing theoretical and empirical literature on the portfolio balance models, which emphasizes the role of relative government debts as an important determinant of a country's exchange rate [Branson 1975], Branson and Henderson [1985], Dominguez and Frankel [1993], Flood and Marion [2000], Kumhof and van Nieuwerburgh [2002 and 2007], Gourinchas and Rey [2007]). This issue is explored in Chanthapun (PhD dissertation at the ANU 2010, forthcoming).

[10] See McKibbin and Wilcoxen (1998) for a complete description. The version of G-Cubed used in this paper is 87V.

be 4.0%. We also assume that tax rates and the share of government spending devoted to each commodity remain unchanged.

Table 1: Monetary and Exchange Rate Regimes

Regimes	Monetary Policy Assumption	Fiscal Policy Assumption
1. Actual with various forms of HMT rules	Countries follow their actual policies implemented as an HMT rule with different weights on inflation output growth gap and exchange rate changes	Exogenous fiscal deficit with government spending rule to target deficit to GDP
2. Asian currency unit	A single currency in Asia with an Asian central bank adjusting regional monetary policy to target a weighted average inflation rate for the region (weights are GDP share)	As above
3. Pegged to the US dollar	Monetary policy targets USD exchange rates	As above
4. Flexible exchange rate with optimal non-cooperative monetary policy	Central bank calculates optimal time-consistent, closed-loop policy rules for interest rates given an objective function with weights on output growth (0.5) and inflation (1.0)	As above

GDP = gross domestic product, HMT = Henderson-Mckibbin-Taylor, US = United States.
Source: Authors' assumptions

In the G-Cubed model, projections are usually made based on a range of input assumptions. There are two key inputs into the growth rate of each sector in the model. The first is the economy-wide population projection, which differs by country according to the United Nations (UN) mid-projection. The second is the sectoral productivity growth rate. In Bagnoli et al. (1996), we modeled economy-wide productivity and then used the historical experience of differential growth across sectors to apportion the aggregate productivity projections to each sector within an economy. In McKibbin, Pearce, and Stegman (2007), this approach was changed. Each energy sector in the US is assumed to have a rate of productivity growth of 0.1% over the next century. Each non-energy sector has an initial productivity growth rate close to historical experience, while gradually converging to 1.8% per annum in the long run. We then assume that each equivalent sector in every other country will catch up to the US sector in terms of productivity, closing the gap by 2.0% per annum, except for the developing country region, which is assumed to close the gap by 1.0% per annum. The initial gaps are, therefore, critical for the subsequent sectoral productivity growth rate. We follow a two-step process in determining the initial size of the gap. The first step is to specify the gap between all sectors and the US sectors equal to the gap between aggregate purchasing power parity (PPP) GDP per capita between each country and the US. We cannot easily

use sectoral PPP gap measures because these are difficult to obtain in a consistent manner and with a wide enough coverage for our purposes. Thus, the initial benchmark is based on the same gap for each sector as the initial gap for the economy as a whole. If we then have evidence that a particular sector is likely to be either closer to or further away from the US sectors than the aggregate numbers suggest, we adjust the initial sectoral gaps, attempting to keep the aggregate gaps consistent with the GDP per capita gaps. We then assume that productivity growth in each sector closes the gap between that sector and the equivalent US sector by 2.0% per annum. The productivity growth is calculated exogenously to the model. We then overlay this productivity growth model with exogenous assumptions about population growth for each country to generate two of the main sources of economic growth.

Given these exogenous inputs for sectoral productivity and population growth, we then solve the model with the other drivers of growth, capital accumulation, and sectoral demand for other inputs of energy and materials—all of which are endogenously determined. Critical to the nature and scale of growth across countries are these assumptions plus the underlying assumptions that (i) financial capital flows to where the return is highest, (ii) physical capital is sector specific in the short run, (iii) labor can flow freely across sectors within a country but not between countries, and (iv) international trade in goods and financial capital is possible subject to existing tax structures and trade restrictions.

Thus, the economic growth of any particular country is not completely determined by the exogenous inputs in that country since all countries are linked through goods and asset markets.

Table 2: Overview of the G-Cubed Model (Version 87v)

Regions	
1	United States
2	Japan
3	United Kingdom
4	Euro Area
5	Rest of the OECD
6	Singapore
7	People's Republic of China
8	India
9	Republic of Korea
10	Indonesia
11	Malaysia
12	Philippines
13	Thailand
14	Other Developing Countries
15	Eastern Europe and the Former Soviet Union
16	Oil Exporting Developing Countries
Sectors	
1	Energy
2	Mining
3	Agriculture, Fishing, and Hunting
4	Durable Manufacturing
5	Non-Durable Manufacturing
6	Services
	Capital Producing Sector

OECD = Organisation for Economic Co-operation and Development
Source: G-Cubed model

4. Scenarios

4.1 Modeling the Global Financial Crisis

It is not a straightforward process to model the current international financial crisis that began in 2008. Following McKibbin and Stoeckel (2009), we represent the crisis through a number of shocks in the model. We model three broad components of the global financial crisis, which are discussed in detail below: (i) a shock to housing, (ii) a financial shock made up of a rise in equity risk premia and a rise in country risk premia, and (iii) a rise in household risk. The dilemma faced in analyzing the crisis in a large-scale model

is to simplify the shock as much as possible to draw out the analytical insights from the analysis. On the other hand, we want to have a crisis modeled as close to the actual experience as possible. This includes attempting to capture some of the asymmetries across sectors and across countries.

The first component of the crisis is the collapse of housing markets—particularly in the US, United Kingdom (UK), and Europe. We model this as a surprise fall in the expected flow of services from housing investment—which was largest in the US, UK, and Europe—while still being significant throughout the world. We model the household as solving an intertemporal consumption problem subject to an intertemporal budget constraint. The result is a time profile for the consumer in each country of the consumption of goods from all countries based on expected future income and expected relative goods prices. The household also chooses investment in a capital good. The household capital stock combines housing and other durable goods. For simplicity of exposition, we will refer to this capital good as housing. The investment decisions of households are modeled analogously to how we model the investment decisions of firms within an intertemporal framework subject to adjustment costs for capital accumulation. The household invests in housing to maximize consumption from the stream of future service flows that housing provides. This stream of services is analogous to a production function based on inputs of capital and a productivity term. We model the housing part of the crisis as a fall in the productivity of the service flow from the housing stock. This fall in expected future productivity of housing means that the Tobin's q for housing drops when the shock occurs. The value of the stock of housing in wealth will decline as will the incentive to invest in future housing.

The second aspect of the global financial crisis is a rise in financial risk. We model this as a rise in the equity risk premium by sector and by country. This equity risk premium shock is uniform across countries, but different across sectors. It is larger for energy, mining, agriculture, and services as a means of capturing the bursting of the price bubble in the energy, mining, and agriculture sectors; and to capture the role of the shock to financial services, which are included in the services sector. For countries that experienced the 1997/98 Asian financial crisis, we also implement a country risk premium as outlined below.

The last aspect of the financial crisis is a rise in household risk. We model this as a temporary rise in the rate at which consumers discount expected future after-tax labor income. This shock is intended to reflect the rise in risk facing households, which initially reduces consumption and raises savings.

The shocks are summarized in Tables 3 and 4. Table 3 contains the core shocks to the US. Note that the equity risk shocks are assumed to overshoot in the short run and then level out at 4.0% above baseline. This contains an assumption about the initially observed crisis in 2008 on risk spreads, which peaked at around 8.0%, and an assumption that equity risk premia are not expected to return to baseline (assumed to be 2007 risk premia), but rather are expected to remain permanently higher relative to the baseline. This is equivalent to assuming that the large fall in equity risk premia observed from the 1990s has partially reversed to more historical levels.

Given the core shocks to the US, we weight each shock in Table 3 by country-specific weights to scale the shocks up or down across all countries. For example, the housing shock in the US is –10, whereas in Japan it is weighted by 0.3 to give a housing shock of –3. For the country risk shocks, note that the weight on the US is zero, which means that there is no effective country risk shock for the US, but with a weight of 0.4 for India the country risk shock would be a temporary rise in country risk in 2009 of 1.2 (0.4*3 = 1.2).

In the results, we first consider each of the three types of shocks to understand the national effects and the spillover across countries. We then examine the sum of the shocks, which we call the global financial crisis. The initial analysis was conducted across all Asian economies in the model for the case of the assumed current exchange rate–monetary regime over a period of 12 years from the commencement of the shock. We then explore the different shocks individually as well as an aggregate shock representing all three aspects of the global financial crisis—under the four monetary and exchange rate regimes described above for the initial year of the crisis—to understand how each regime modifies the policy response. Clearly, we could have also analyzed fiscal policy responses using the same techniques, but we leave that for another paper.

Table 3: Core Shocks to the United States (Weighted by Table 4)

Shock to US	2009	2010	2011	2012	2013	Onwards
Financial Risk:						
Equity Risk						
Sector 1	8	6	4	4	4	4
Sector 2	8	6	4	4	4	4
Sector 3	8	6	4	4	4	4
Sector 4	6	4	2	2	2	2
Sector 5	6	4	2	2	2	2
Sector 6	8	6	4	4	4	4
Country Risk	8	6	4	2	0	0
Household Risk	3	2	1	0	0	0
Housing Productivity	-10	-10	-10	-10	-10	-10

US = United States.
Source: Authors' assumptions.

Table 4: Weights on Each Country for Shock Adjustment

	USA	JPN	GBR	EUR	SNG	PRC	IND	KOR	OEC	INO	MAL	PHI	THA	LDC	EEB	OPC
Financial Risk:																
Equity Risk																
Sector 1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Sector 2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Sector 3	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Sector 4	1	1.2	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Sector 5	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Sector 6	1	1	1.2	1	1	1	1	1	1	1	1	1	1	1	1	1
Country Risk	0	0	0	0	0	0	0.4	0.4	0	1	0.4	1	0.75	1	0.4	0
Household Risk	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Housing Productivity	1	0.3	1	1	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5

USA = United States, JPN = Japan, GBR = United Kingdom, EUR = Euro Area, SNG = Singapore, PRC = People's Republic of China, IND = India, KOR = Republic of Korea,
OEC = Rest of the Organisation for Economic Co-operation and Development (OECD), INO = Indonesia, MAL = Malaysia, PHI = Philippines, THA = Thailand, LDC = Other Developing Countries, EEB = Eastern Europe and the Former Soviet Union, OPC = Oil Exporting Developing Countries.
Source: Authors' assumptions.

Table 5: Coefficients on HMT Monetary Policy

	USA	JPN	GBR	EUR	SNG	PRC	IND	KOR	OEC	INO	MAL	PHI	THA	LDC	EEB	OPC
Inflation	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0
ROG output	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0
Exchange Rate	0	0	0	0	0	-10	-10	-10	-10	-10	-10	-10	-10	-10	-10	-1000

Country abbreviations are as in Table 4.
Source: G-Cubed model.

4.2 Results

There are an enormous number of permutations of results to be discussed. It is useful to recall what the purpose of the paper is in organizing the results. The first goal is to explore the dynamics of adjustment to the financial crisis and, second, to explore what impact each monetary–exchange rate regime in Asia implies for individual Asian economies.

To this end, we present the results in a number of ways. First, results comparing the dynamics for the US and each Asia and Pacific country under its respective existing regime are shown in Figures 1–9. This shows the impact of each aspect of the global financial crisis—namely the housing shock, the rise in financial risk, and the rise in household risk perceptions—as well as the overall impact in the short- to medium-term across all economies. Second, because the different monetary responses show most in the first year (after 5 years most monetary regimes are the same due to the long-run neutrality of money in the model), we focus on the first period impacts of the shocks under each monetary and exchange rate regime. Tables B-1 to B-8 contain the first period impact of the financial crisis on the US, UK, and eight Asia and Pacific economies, with one variable per table, the regimes across the columns, and the individual and aggregate shocks down the rows.

First consider Figures 1–9, which show both the dynamics of adjustment to the various components of the global financial crisis as well as the overall shock under the assumption of existing exchange rate and monetary regimes. Note that all results are presented as deviations from a baseline projection. Thus, if inflation in country A was 5% in the baseline and the result shows a fall in inflation of 4%, there is a new inflation rate of 1% after the shock. A more important issue is that some variables are expressed as a percentage of baseline GDP. Thus, a fall in investment equivalent to 5% of GDP in an economy where investment is 10% of GDP results in a fall in investment of 50%. Finally, it is important to note that the GDP numbers are deviations in the level of GDP from the baseline level. Thus, a fall in GDP of 5% relative to the baseline in year 1, where the baseline growth rate is 3%, results in a new growth rate in the first year of –2% (i.e., a recession). If the level of GDP growth were to remain lower by 5% indefinitely, then the growth rate of GDP in year 2 returns to the baseline. Thus, in growth rate terms, the crisis is resolved after the first year in many countries although the level of GDP remains below the baseline for many years.

4.2.1 Housing Shock

The collapse in the expected return to housing in each economy, but mostly in the US and UK, causes a sharp fall in the value of housing as a function of household wealth and a sharp fall in investment in housing. The wealth effect causes consumption to fall sharply and since the housing shock is permanent, consumption is permanently lower in all countries. However, the impact of the housing shock is smaller in those economies, such as low income Asian economies, where housing comprises a small share of household wealth.

4.2.2 Financial Shock

The equity risk shock causes a shift out of equities into other domestic assets, such as housing and government bonds, and to asset purchases overseas. To the extent that all countries experience the same equity shock, the international portfolio relocation is

muted.[11] The shift into government bonds drives up their prices and substantially pushes down real interest rates around the world. Surprisingly, this raises human wealth because expected future after-tax income is discounted at a much lower real interest rate. Thus, in the US and many other countries, the equity shock rises alone are positive rather than negative for consumption in the short run. Investment, on the other hand, falls sharply. Note that the unit of measurement in Figures 1–9 is the percentage of GDP change in investment. Thus, the equity shock reduces US investment by 1% of GDP, or about 10% of itself. The rise in equity risk implies a sharp selloff of shares due to a large rise in the required rate of return to capital. The higher equity risk premium implies that the existing capital stock is too high to generate the marginal product required from the financial arbitrage condition and, thus, investment falls. Over time and due to the existence of adjustment costs, the capital stock falls and potential output is permanently reduced. Note that the medium-term impact on GDP is larger for the financial shock because it permanently reduces potential output in each economy.

4.2.3 Household Risk

The results for the rise in housing risk are different from the other shocks. Firstly, the impact is temporary. Secondly, it has the effect of changing the relative price of consumption so that current consumption is expensive relative to future consumption. Households increase their savings and cut current consumption. Thus, future consumption can increase from the additional savings in the short run. If the shock occurs for each country alone, the effect is unambiguously a fall in consumption. However, when this shock occurs in all countries simultaneously, the spillover of shocks from larger countries can change the sign of the effect in small countries. For example, a rise in savings in the US leads to a capital outflow. The extent that capital flows into small countries can raise—rather than lower—private consumption, thereby offsetting the risk component within the small country. Globally, the shock would be expected to raise investment because at a global level the only way savings can be undertaken is if physical capital is raised since global savings equal global investment. Because the shock is global, there is a positive impact on investment in each country, while the savings effects are ambiguous in each country. The increase in investment raises potential output, which enables future consumption to occur. In the first period, the demand effect on output is negative in large countries but positive in small countries because the capital inflow dominates the domestic shock. In all countries over time, the supply effect of higher investment kicks in. The household risk shock is also mildly deflationary in countries experiencing a fall in consumption and mildly inflationary in countries where demand rises.

4.2.4 Global Crisis

Combining each of the shocks together gives a representation of the global financial crisis. Plummeting stock markets, contracting output in the short term, sharply falling investment and consumption, and sharply falling real interest rates are common across all economies. The trade effects are different because capital flows across economies

[11] This is in contrast to the 1997/98 Asian financial crisis modeled in McKibbin and Martin (1998) in which an asymmetric rise in risk premium leads to very large movements of financial capital from impacted economies to the rest of the world.

depending on how each economy is affected. For example, if the US trade balance worsens, it represents a capital inflow to the United States. This is a common feature of the model, which has quadratic adjustment costs to investment. If a global shock reduces the return to capital, the US attracts capital, given its large scale and capacity to absorb a dollar of investment at lower marginal cost than a smaller economy. In the case of the same global shock, Japan experiences a substantial depreciation of the yen.[12] Meanwhile, the PRC has a capital inflow and the trade balance worsens by 1.5% of GDP, but the exchange rate barely changes because of the assumption that it is partly pegged to the US dollar. Similar patterns exist across the region. Most countries that are pegging to the dollar achieve the relative price adjustment through aggregate price adjustment. Note the strong deflationary effect in the PRC, Indonesia, Malaysia, and the Philippines.
The monetary and fiscal reactions also obviously matter. We have assumed that fiscal deficits are not changed in these results so as to focus on the core shock. Of course, a fiscal response would change the results substantially. The monetary response in the "actual policy" case would have each country following an HMT rule shown in equation (1) with different weights on inflation (π) relative to target, output growth (Δy) relative to potential, and the change in the exchange rate (Δe) relative to target.

$$i_t = i_{t-1} + \beta_1(\pi_t - \pi_t^T) + \beta_2(\Delta y_t - \Delta y_t^T) + \beta_1(\Delta e_t - \Delta e_t^T) \quad (1)$$

The assumed parameter values are set out in Table 5. Note that the non-Asian Organisation for Economic Co-operation and Development (OECD) economies have a zero weight on the change in the US dollar exchange rate.

The output effects of the global financial crisis are clearly negative, which implies that where possible central banks cut short-term nominal interest rates substantially. Inflation rises initially in the US as a result of the global financial crisis, but falls everywhere in Asia (except under the ACU exchange rate regime shown later). However, inflation returns to trends due to the assumption that central banks place a weight on inflation or peg an exchange rate to a country that cares about inflation.

It is clear from these figures that while it takes a decade for the level of output to recover, growth rates recover more quickly. Recall that the results are a deviation from the baseline and the slope is the deviation in the growth rates from potential. Thus, growth begins to stabilize the year after the global financial crisis and rises over subsequent years, but the level of output is always below the base because the equity risk premium is permanently above base and capital stock must, therefore, be permanently below base. This is a de-leveraging story.

[12] In fact, the Japanese yen appreciated substantially at the early stages of the current crisis because of the collapse in the oil price bubble and prices for energy and resources in general, which substantially improved Japan's terms of trade. This real appreciation of the exchange rate also accounts for a large part of the collapse in Japanese exports and the initial GDP drop. This particular shock is not modeled in this paper.

4.3 Comparing Exchange Rate–Monetary Regimes

The choice of monetary regime makes a difference in the short run. Tables B-1 through B-8 show the shock down each row and the different regimes across each column for 10 regions. Four illustrative regimes were set out in Table 1: (i) the HMT regime is a simple feedback rule of the change in the interest rate on inflation relative to base, output growth relative to base, and change in the exchange rate relative to the US dollar (this approximately represents current policy); (ii) the optimal rule is found numerically for each country, assuming a floating exchange rate and a central bank objective function with a unit weight on inflation deviations from the baseline and half this weight on output growth deviation from baseline; (iii) the ACU column is an HMT rule for a central bank of Asia related to Asian inflation and Asian GDP growth; and (iv) the US dollar peg is a complete peg to the US dollar.

First, consider the overall financial crisis, which is the last row in each box. Under the various HMT rules, the fall in output growth implies a relaxation of monetary policy through a reduction in real and nominal short-term interest rates. The fall in inflation that also occurs adds additional incentive to relax monetary policy in each of the Asian economies. In the case where countries also place a weight on the deviation of the currency relative to the US dollar, this reaction is offset. In each country, the currency tends to depreciate relative to the dollar as capital flows towards the US. This means that monetary policy is tighter in an Asian economy that pegs to the dollar than would be preferred if countries only cared about domestic inflation and output growth. In Table B-1, note that the outcomes for GDP under the global financial crisis for all Asian economies are more negative under the US dollar peg column than under the HMT column.[13] Note that for the optimal rule, in which the optimal feedback coefficients are used, the GDP loss is smaller than for the simple HMT rules assumed and much smaller than the US dollar peg. Note also that there is greater deflation in the Asian economies (Table B-7) because monetary policy is tighter than is optimal. Indeed, under the optimal rule, it is possible to substantially reduce inflation relative to the HMT rule. This is not surprising given that inflation is assumed to have twice the weight as output growth in the welfare function of the central banks. Under the ACU peg, a central bank in Asia is adjusting policy for all Asian economies. This is better than the US dollar peg because it allows some deviation from US monetary policy in the event of a shock that is asymmetric between the United States and Asia. Interestingly, the output loss is small for Asia excluding Japan because the central bank relaxes monetary policy to offset the substantial output losses in Asia. This also leads to a decline in small inflation and, in some cases, is mildly inflationary (e.g., the PRC, Indonesia, and the Philippines).

These results for the global financial crisis as a whole tend to carry over to each of the component shocks that make up the crisis, except for the household risk shock in which the ACU accentuates the rise in GDP in some Asian economies as a result of the allocation of savings from the US to the rest of the world. In this shock, the exchange rates in Asia tend to appreciate and, thus, policy is relaxed within these economies, which raises output. For economies in which GDP was lower (e.g., the PRC, Japan, Singapore), the output loss is reduced. For the other countries in which GDP was above

[13] Japan does not peg at all to the US dollar under either the HMT rule or the US dollar peg.

baseline because of the capital inflows dominating the short-run consumption decline (e.g., Indonesia, Republic of Korea, Malaysia, Philippines, and Thailand), the GDP change is larger under the ACU regime.

Overall, a regime of pegging to the US dollar is not a very good outcome for Asian economies because it inherits the monetary policy stance of the United States, which is responding to a different scale of shock in the US then to that in Asia. Secondly, the ACU appears to work well for the Asian economies in the face of the global financial crisis because this is largely a shock that is more symmetric within Asia than between Asia and the US. In an earlier version of this paper, this was not the case because Japan's policy was very different from desired policies in the rest of Asia. The ACU, with GDP weights driving the objective of the central bank of Asia, is dominated by the Japanese economy.[14] Smaller Asian economies essentially inherit the monetary policy suitable for Japan since its economy is more than half of the weight in Asian inflation and output measures targeted by the Asian central bank. With the PRC representing another 25% of the weight, the rest of the Asian economies are given a very small weight in the policy response. As it turns out for the global financial crisis modeled in this paper, the ACU captures the desired policy response reasonably well and better than the current HMT rules because they have a partial US dollar peg built into them.

Some of the key determinants of the domestic responses to the shock depend on the structure of the economies and the trade linkages between economies. There is some asymmetry in the short-run equity shocks, which means that countries with a relatively high manufacturing share in the economy are less impacted than countries with a relatively high dependence on mining, energy, agriculture, or services. Overall, these effects are offset by the larger asymmetry in the housing shocks between the US and UK, which are larger than those in Asia.

5. Summary and Conclusions for Policy

This paper has attempted to address two questions on the issue of monetary and exchange rate cooperation in the Asia and Pacific region. The first question is: what are the impacts of a global financial crisis on the region under current monetary arrangements? The second question is: what effect would alternative monetary and exchange rate regimes that might be adopted have on this impact? We find that adjustment to the crisis is substantial, but the global nature of the crisis makes it quite different from the 1997/98 Asian financial crisis, which was very much an asymmetric shock with substantial exchange rate adjustments resulting from capital flight. Although still severe, the current crisis is less likely to cause severe dislocation in the region from the transmission mechanism alone. However, there is always the possibility of a domestic crisis emerging due to domestic conditions in an individual country that are not captured in the simple model used here. The key shocks are the synchronized changes in risk and loss of confidence, which have been global, rather than the trade effects of a collapsing US and European housing market. Secondly, we find that the different monetary and exchange rate arrangements can cause significant short-run differences in

[14] See McKibbin and Chanthapun (2009) for an earlier version of this paper.

the economic outcomes among Asian economies in the face of a global financial crisis such as the current one. In the case of this global financial crisis, pegging to the US dollar led to worse outcomes in Asia. For other shocks as found in Mckibbin and Le (2002), fixing an exchange rate may reduce the volatility in the face of other types of shocks.

This paper suggests that having domestic monetary policy under a degree of exchange rate flexibility tends to handle a shock, such as the current global financial crisis, better than regimes with fixed exchange rates. This, of course, assumes that countries can maintain credible domestic policies and it ignores some important issues in the debate on the choice of monetary regimes. The ACU appears to work well for the scenarios in this paper, but in an earlier version of this paper with different shocks, the ACU performed poorly. It is clear that a US dollar peg (or a global common currency) leads to significant losses relative to alternative regimes in terms of handling shocks. This poor performance relative to more discretionary monetary regimes may be outweighed empirically by the gains from tying the hands of domestic monetary authorities. In any exchange rate pegging regime, it is not clear that the foreign monetary policy responses to various shocks, whether taken by the US or Japan, would always be in the interest of the very diverse economies of Asia.

Appendix A: The G-Cubed Model

The G-Cubed model is an intertemporal general equilibrium model of the world economy. The theoretical structure is outlined in McKibbin and Wilcoxen (1998).[15] A number of studies—summarized in McKibbin and Vines (2000)—show that the G-Cubed modeling approach has been useful in assessing a range of issues across a number of countries since the mid-1980s.[16] Some of the principal features of the model are as follows:

- The model is based on explicit intertemporal optimization by the agents (consumers and firms) in each economy.[17] In contrast to static computable general equilibrium (CGE) models, time and dynamics are of fundamental importance in the G-Cubed model. The MSG-Cubed model is known as a dynamic stochastic general equilibrium (DSGE) model in the macroeconomics literature and a dynamic intertemporal general equilibrium (DIGE) model in the CGE literature.

- In order to track the macro time series, the behavior of agents is modified to allow for short-run deviations from optimal behavior, either due to myopia or to restrictions on the ability of households and firms to borrow at the risk-free bond rate on government debt. For both households and firms, deviations from intertemporal optimizing behavior take the form of rules of thumb, which are consistent with an optimizing agent that does not update predictions based on new information about future events. These rules of thumb are chosen to generate the same steady state behavior as optimizing agents so that in the long run there is only a single intertemporal optimizing equilibrium of the model. In the short run, actual behavior is assumed to be a weighted average of the optimizing and the rule of thumb assumptions. Thus, aggregate consumption is a weighted average of consumption based on wealth (current asset valuation and expected future after-tax labor income) and consumption based on current disposable income. Similarly, aggregate investment is a weighted average of investment based on Tobin's q (a market valuation of the expected future change in the marginal product of capital relative to the cost) and investment based on a backward-looking version of q.

- There is an explicit treatment of the holding of financial assets, including money. Money is introduced into the model through a restriction that households require money to purchase goods.

- The model also allows for short-run nominal wage rigidity (by different degrees in different countries) and, therefore, allows for significant periods of unemployment

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15 Full details of the model, including a list of equations and parameters, can be found online at: www.gcubed.com.

16 These issues include: Reaganomics in the 1980s; German unification in the early 1990s; fiscal consolidation in Europe in the mid-1990s; formation of the North American Free Trade Agreement (NAFTA) in the mid-1990s; the 1997/98 Asian financial crisis; and the productivity boom in the United States (US).

17 Blanchard and Fischer (1989), and Obstfeld and Rogoff (1996).

depending on the labor market institutions in each country. This assumption, when taken together with the explicit role for money, is what gives the model its macroeconomic characteristics. (Here again, the model's assumptions differ from the standard market-clearing assumption in most CGE models.)

- The model distinguishes between the stickiness of physical capital, within sectors and within countries, and the flexibility of financial capital, which immediately flows to where expected returns are highest. This important distinction leads to a critical difference between the quantity of physical capital that is available at any time to produce goods and services, and the valuation of that capital as a result of decisions about the allocation of financial capital.

As a result of this structure, the G-Cubed model contains rich dynamic behavior, driven on the one hand by asset accumulation and, on the other, by wage adjustment to a neoclassical steady state. It embodies a wide range of assumptions about individual behavior and empirical regularities in a general equilibrium framework. The interdependencies are solved out using a computer algorithm that solves for the rational expectations equilibrium of the global economy. It is important to stress that the term “general equilibrium” is used to signify that as many interactions as possible are captured, not that all economies are in a full market-clearing equilibrium at each point in time. Although it is assumed that market forces eventually drive the world economy to a neoclassical, steady-state growth equilibrium, unemployment does emerge for long periods—due to wage stickiness—to an extent that differs between countries based on differences in labor market institutions.

Table B-1: Impact on GDP (% Deviation) in Year 1

United States

	HMT	Optimal	ACU	$Peg
Housing	-4.08	-3.68	-4.06	-4.08
Financial Risk	0.32	0.39	0.34	0.31
Household Risk	-0.61	0.09	-0.61	-0.61
GFC	-4.37	-3.20	-4.33	-4.37

United Kingdom

	HMT	Optimal	ACU	$Peg
Housing	-4.32	-4.93	-4.34	-4.32
Financial Risk	-0.51	-0.22	-0.51	-0.51
Household Risk	-0.74	-0.04	-0.75	-0.74
GFC	-5.56	-5.19	-5.59	-5.56

Japan

	HMT	Optimal	ACU	$Peg
Housing	-2.30	-1.89	-2.93	-2.30
Financial Risk	-1.18	-0.80	-1.35	-1.19
Household Risk	-0.80	-0.08	-0.99	-0.80
GFC	-4.28	-2.77	-5.27	-4.29

People's Republic of China

	HMT	Optimal	ACU	$Peg
Housing	-2.96	-2.03	-1.55	-2.99
Financial Risk	-2.53	-0.24	0.24	-2.65
Household Risk	-0.45	0.06	-0.31	-0.44
GFC	-5.93	-2.21	-1.63	-6.08

Republic of Korea

	HMT	Optimal	ACU	$Peg
Housing	-0.10	0.33	0.89	-0.10
Financial Risk	-3.98	-1.77	-2.20	-4.17
Household Risk	0.33	0.49	0.45	0.35
GFC	-3.74	-0.95	-0.86	-3.92

Singapore

	HMT	Optimal	ACU	$Peg
Housing	-2.16	-1.69	-2.18	-2.75
Financial Risk	-1.13	-0.73	-0.84	-1.98
Household Risk	-0.29	0.13	-0.21	-0.27
GFC	-3.58	-2.29	-3.24	-5.00

Indonesia

	HMT	Optimal	ACU	$Peg
Housing	1.18	0.67	2.09	1.22
Financial Risk	-4.18	-1.94	-2.74	-4.46
Household Risk	0.42	0.39	0.53	0.44
GFC	-2.58	-0.88	-0.13	-2.80

Malaysia

	HMT	Optimal	ACU	$Peg
Housing	-2.79	-1.60	-1.73	-2.89
Financial Risk	-2.26	-0.48	-0.17	-2.51
Household Risk	0.24	0.52	0.36	0.26
GFC	-4.81	-1.56	-1.54	-5.13

Philippines

	HMT	Optimal	ACU	$Peg
Housing	2.65	2.36	3.17	2.65
Financial Risk	-4.90	-3.37	-4.07	-5.08
Household Risk	0.94	0.89	1.01	0.96
GFC	-1.31	-0.12	0.11	-1.47

Thailand

	HMT	Optimal	ACU	$Peg
Housing	-0.22	0.17	0.17	-0.26
Financial Risk	-1.48	-0.74	-0.76	-1.62
Household Risk	0.25	0.32	0.30	0.26
GFC	-1.45	-0.25	-0.30	-1.62

Table B-2: Impact on Consumption (% of Baseline GDP) in Year 1

United States

	HMT	Optimal	ACU	$Peg
Housing	-8.55	-8.49	-8.53	-8.55
Financial Risk	1.37	1.46	1.39	1.37
Household Risk	-0.66	-0.37	-0.65	-0.66
GFC	-7.84	-7.39	-7.79	-7.84

United Kingdom

	HMT	Optimal	ACU	$Peg
Housing	-8.66	-8.75	-8.68	-8.66
Financial Risk	0.50	0.49	0.50	0.50
Household Risk	-0.81	-0.69	-0.82	-0.81
GFC	-8.98	-8.95	-9.01	-8.98

Japan

	HMT	Optimal	ACU	$Peg
Housing	-3.73	-3.63	-3.83	-3.74
Financial Risk	0.02	0.23	0.01	0.02
Household Risk	-0.83	-0.72	-0.86	-0.83
GFC	-4.55	-4.12	-4.67	-4.55

People's Republic of China

	HMT	Optimal	ACU	$Peg
Housing	-3.17	-2.99	-2.84	-3.17
Financial Risk	0.85	1.45	1.49	0.82
Household Risk	-0.60	-0.47	-0.57	-0.60
GFC	-2.92	-2.01	-1.92	-2.95

Republic of Korea

	HMT	Optimal	ACU	$Peg
Housing	-2.43	-2.26	-2.09	-2.43
Financial Risk	-1.10	-0.27	-0.51	-1.17
Household Risk	0.06	0.14	0.10	0.07
GFC	-3.47	-2.39	-2.50	-3.53

Singapore

	HMT	Optimal	ACU	$Peg
Housing	-3.64	-3.41	-3.54	-3.51
Financial Risk	-0.57	-0.12	-0.48	-0.39
Household Risk	-0.36	-0.23	-0.36	-0.37
GFC	-4.57	-3.76	-4.38	-4.27

Indonesia

	HMT	Optimal	ACU	$Peg
Housing	-0.80	-1.34	-0.26	-0.77
Financial Risk	-2.97	-1.57	-2.14	-3.14
Household Risk	0.62	0.57	0.69	0.63
GFC	-3.15	-2.34	-1.71	-3.28

Malaysia

	HMT	Optimal	ACU	$Peg
Housing	-2.77	-2.55	-2.47	-2.80
Financial Risk	-0.35	0.15	0.22	-0.42
Household Risk	0.36	0.41	0.40	0.36
GFC	-2.76	-1.98	-1.85	-2.86

Philippines

	HMT	Optimal	ACU	$Peg
Housing	-1.07	-1.36	-0.58	-1.07
Financial Risk	-4.19	-2.58	-3.42	-4.37
Household Risk	0.97	0.88	1.04	0.99
GFC	-4.29	-3.06	-2.96	-4.45

Thailand

	HMT	Optimal	ACU	$Peg
Housing	-2.67	-2.51	-2.49	-2.72
Financial Risk	-0.74	-0.28	-0.41	-0.85
Household Risk	0.27	0.27	0.30	0.28
GFC	-3.14	-2.52	-2.60	-3.30

Table B-3: Impact on Stock Market Value (% of Baseline GDP) in Year 1

United States

	HMT	Optimal	ACU	$Peg
Housing	-27.98	-23.84	-27.94	-27.98
Financial Risk	-32.29	-32.70	-32.25	-32.30
Household Risk	2.42	5.66	2.43	2.42
GFC	-57.85	-50.88	-57.77	-57.86

United Kingdom

	HMT	Optimal	ACU	$Peg
Housing	-29.26	-34.52	-29.15	-29.26
Financial Risk	-35.83	-33.53	-35.73	-35.84
Household Risk	3.10	7.80	3.13	3.10
GFC	-61.98	-60.24	-61.75	-62.01

Japan

	HMT	Optimal	ACU	$Peg
Housing	-20.19	-15.89	-27.01	-20.19
Financial Risk	-51.04	-49.31	-53.01	-51.06
Household Risk	4.32	11.19	2.26	4.32
GFC	-66.91	-54.01	-77.76	-66.93

People's Republic of China

	HMT	Optimal	ACU	$Peg
Housing	-10.20	-4.31	-1.52	-10.42
Financial Risk	-59.02	-46.16	-42.35	-59.78
Household Risk	4.30	6.50	5.19	4.35
GFC	-64.92	-43.97	-38.68	-65.85

Republic of Korea

	HMT	Optimal	ACU	$Peg
Housing	-3.36	0.03	5.91	-3.35
Financial Risk	-78.62	-60.84	-62.21	-80.31
Household Risk	5.33	5.90	6.36	5.49
GFC	-76.64	-54.91	-49.94	-78.18

Singapore

	HMT	Optimal	ACU	$Peg
Housing	-10.37	-6.56	-11.22	-18.55
Financial Risk	-42.46	-42.18	-39.71	-54.09
Household Risk	4.05	6.79	5.03	4.34
GFC	-48.78	-41.95	-45.91	-68.30

Indonesia

	HMT	Optimal	ACU	$Peg
Housing	2.36	1.72	6.71	2.51
Financial Risk	-67.68	-58.72	-60.70	-68.82
Household Risk	3.31	3.19	3.80	3.39
GFC	-62.01	-53.82	-50.19	-62.93

Malaysia

	HMT	Optimal	ACU	$Peg
Housing	-9.16	-0.25	-1.39	-9.72
Financial Risk	-70.45	-59.11	-55.65	-71.88
Household Risk	5.28	5.93	6.21	5.41
GFC	-74.33	-53.44	-50.83	-76.20

Philippines

	HMT	Optimal	ACU	$Peg
Housing	10.54	9.10	15.81	10.69
Financial Risk	-76.15	-64.96	-67.68	-77.59
Household Risk	4.31	3.33	4.95	4.44
GFC	-61.30	-52.53	-46.93	-62.46

Thailand

	HMT	Optimal	ACU	$Peg
Housing	3.05	8.24	8.43	2.88
Financial Risk	-80.73	-73.29	-71.10	-81.79
Household Risk	6.53	7.05	7.14	6.60
GFC	-71.15	-58.00	-55.53	-72.31

Table B-4: Impact on Investment (% of Baseline GDP) in Year 1

United States

	HMT	Optimal	ACU	$Peg
Housing	-2.68	-2.38	-2.67	-2.68
Financial Risk	-0.70	-0.75	-0.68	-0.70
Household Risk	0.22	0.62	0.22	0.22
GFC	-3.16	-2.51	-3.13	-3.17

United Kingdom

	HMT	Optimal	ACU	$Peg
Housing	-2.68	-3.22	-2.67	-2.68
Financial Risk	-1.16	-0.99	-1.15	-1.16
Household Risk	0.11	0.50	0.12	0.11
GFC	-3.72	-3.71	-3.70	-3.73

Japan

	HMT	Optimal	ACU	$Peg
Housing	-1.74	-1.40	-2.42	-1.74
Financial Risk	-2.37	-2.18	-2.57	-2.37
Household Risk	-0.01	0.69	-0.21	-0.01
GFC	-4.11	-2.89	-5.20	-4.11

People's Republic of China

	HMT	Optimal	ACU	$Peg
Housing	-0.96	-0.32	0.23	-0.99
Financial Risk	-4.10	-2.36	-1.81	-4.20
Household Risk	0.33	0.60	0.45	0.33
GFC	-4.74	-2.08	-1.12	-4.86

Republic of Korea

	HMT	Optimal	ACU	$Peg
Housing	1.48	1.77	2.56	1.48
Financial Risk	-6.47	-4.36	-4.56	-6.67
Household Risk	0.76	0.79	0.88	0.78
GFC	-4.23	-1.80	-1.12	-4.42

Singapore

	HMT	Optimal	ACU	$Peg
Housing	-1.77	-1.18	-1.74	-2.31
Financial Risk	-2.77	-2.53	-2.46	-3.55
Household Risk	0.34	0.62	0.42	0.36
GFC	-4.20	-3.09	-3.77	-5.49

Indonesia

	HMT	Optimal	ACU	$Peg
Housing	2.35	1.98	2.89	2.37
Financial Risk	-5.98	-4.88	-5.13	-6.12
Household Risk	0.63	0.56	0.69	0.64
GFC	-3.00	-2.35	-1.54	-3.12

Malaysia

	HMT	Optimal	ACU	$Peg
Housing	0.29	1.02	1.24	0.21
Financial Risk	-5.08	-3.79	-3.30	-5.27
Household Risk	1.14	1.16	1.26	1.15
GFC	-3.65	-1.62	-0.80	-3.91

Philippines

	HMT	Optimal	ACU	$Peg
Housing	3.52	3.22	3.94	3.53
Financial Risk	-5.82	-5.02	-5.19	-5.93
Household Risk	0.80	0.66	0.86	0.81
GFC	-1.50	-1.15	-0.39	-1.59

Thailand

	HMT	Optimal	ACU	$Peg
Housing	2.09	2.32	2.50	2.05
Financial Risk	-4.60	-4.12	-3.91	-4.72
Household Risk	0.88	0.81	0.93	0.88
GFC	-1.64	-0.99	-0.48	-1.79

Table B-5: Impact on Trade Balance (% of Baseline GDP) in Year 1

United States

	HMT	Optimal	ACU	$Peg
Housing	0.41	0.43	0.39	0.41
Financial Risk	-0.88	-0.87	-0.89	-0.88
Household Risk	0.00	-0.06	-0.01	0.00
GFC	-0.48	-0.51	-0.51	-0.48

United Kingdom

	HMT	Optimal	ACU	$Peg
Housing	0.98	1.16	0.99	0.98
Financial Risk	-0.39	-0.29	-0.39	-0.39
Household Risk	0.21	0.28	0.21	0.21
GFC	0.80	1.15	0.81	0.81

Japan

	HMT	Optimal	ACU	$Peg
Housing	0.08	0.09	0.18	0.08
Financial Risk	0.33	0.33	0.39	0.32
Household Risk	0.30	0.31	0.32	0.30
GFC	0.71	0.74	0.89	0.71

People's Republic of China

	HMT	Optimal	ACU	$Peg
Housing	-1.30	-1.10	-1.33	-1.30
Financial Risk	-0.08	0.04	-0.08	-0.09
Household Risk	-0.10	0.05	-0.11	-0.10
GFC	-1.47	-1.00	-1.51	-1.48

Republic of Korea

	HMT	Optimal	ACU	$Peg
Housing	-2.72	-2.72	-2.96	-2.72
Financial Risk	2.34	1.94	1.98	2.38
Household Risk	-0.58	-0.45	-0.62	-0.59
GFC	-0.96	-1.23	-1.61	-0.93

Singapore

	HMT	Optimal	ACU	$Peg
Housing	1.73	1.24	1.51	1.38
Financial Risk	2.14	1.66	2.03	1.65
Household Risk	-0.18	-0.17	-0.17	-0.17
GFC	3.69	2.73	3.37	2.86

Indonesia

	HMT	Optimal	ACU	$Peg
Housing	-4.40	-3.84	-4.62	-4.41
Financial Risk	4.61	4.30	4.34	4.66
Household Risk	-1.00	-0.84	-1.03	-1.00
GFC	-0.78	-0.37	-1.31	-0.75

Malaysia

	HMT	Optimal	ACU	$Peg
Housing	-2.37	-2.13	-2.67	-2.37
Financial Risk	1.90	1.83	1.46	1.90
Household Risk	-1.35	-1.07	-1.40	-1.35
GFC	-1.82	-1.37	-2.61	-1.82

Philippines

	HMT	Optimal	ACU	$Peg
Housing	-5.12	-4.72	-5.41	-5.13
Financial Risk	5.21	4.64	4.85	5.29
Household Risk	-1.18	-0.91	-1.23	-1.19
GFC	-1.08	-0.99	-1.80	-1.03

Thailand

	HMT	Optimal	ACU	$Peg
Housing	-2.75	-2.76	-2.95	-2.71
Financial Risk	3.20	2.95	2.92	3.29
Household Risk	-0.97	-0.75	-1.02	-0.98
GFC	-0.53	-0.57	-1.05	-0.40

Table B-6: Impact on Real Interest Rate (% Point Difference) in Year 1

United States

	HMT	Optimal	ACU	$Peg
Housing	-1.62	-1.43	-1.63	-1.62
Financial Risk	-1.13	-1.10	-1.14	-1.13
Household Risk	-1.30	-1.73	-1.30	-1.30
GFC	-4.05	-4.26	-4.07	-4.05

United Kingdom

	HMT	Optimal	ACU	$Peg
Housing	-1.85	-0.99	-1.93	-1.85
Financial Risk	-1.69	-2.45	-1.75	-1.68
Household Risk	-1.32	-1.98	-1.34	-1.32
GFC	-4.86	-5.42	-5.02	-4.85

Japan

	HMT	Optimal	ACU	$Peg
Housing	-1.18	-1.04	-0.92	-1.18
Financial Risk	-1.59	-1.25	-1.57	-1.59
Household Risk	-1.70	-2.22	-1.56	-1.70
GFC	-4.47	-4.52	-4.04	-4.47

People's Republic of China

	HMT	Optimal	ACU	$Peg
Housing	-0.36	-0.54	-1.43	-0.34
Financial Risk	0.05	-1.61	-2.11	0.13
Household Risk	-1.19	-1.50	-1.31	-1.20
GFC	-1.50	-3.65	-4.85	-1.40

Republic of Korea

	HMT	Optimal	ACU	$Peg
Housing	-0.96	-0.82	-1.52	-0.96
Financial Risk	0.65	-0.60	-0.35	0.78
Household Risk	-1.12	-1.02	-1.19	-1.14
GFC	-1.43	-2.44	-3.06	-1.32

Singapore

	HMT	Optimal	ACU	$Peg
Housing	-1.33	-1.31	-1.26	-0.71
Financial Risk	-2.38	-2.24	-2.61	-1.48
Household Risk	-1.42	-1.56	-1.52	-1.46
GFC	-5.13	-5.11	-5.39	-3.65

Indonesia

	HMT	Optimal	ACU	$Peg
Housing	-0.27	-0.07	-0.67	-0.29
Financial Risk	2.04	0.82	1.42	2.17
Household Risk	-0.84	-0.77	-0.89	-0.85
GFC	0.93	-0.02	-0.14	1.02

Malaysia

	HMT	Optimal	ACU	$Peg
Housing	-0.81	-1.18	-1.40	-0.78
Financial Risk	1.04	0.12	-0.04	1.15
Household Risk	-1.38	-1.20	-1.46	-1.39
GFC	-1.15	-2.27	-2.90	-1.03

Philippines

	HMT	Optimal	ACU	$Peg
Housing	-0.56	-0.22	-1.08	-0.60
Financial Risk	2.49	1.00	1.72	2.65
Household Risk	-0.69	-0.38	-0.76	-0.71
GFC	1.23	0.40	-0.11	1.34

Thailand

	HMT	Optimal	ACU	$Peg
Housing	-1.02	-1.07	-1.29	-1.05
Financial Risk	1.74	1.31	1.32	1.76
Household Risk	-1.25	-1.14	-1.28	-1.25
GFC	-0.53	-0.89	-1.25	-0.55

Table B-7: Impact on Inflation Rate (% Point Difference) in Year 1

United States

	HMT	Optimal	ACU	$Peg
Housing	2.45	3.17	2.44	2.45
Financial Risk	-0.05	-0.05	-0.06	-0.05
Household Risk	-1.41	-0.10	-1.41	-1.41
GFC	0.98	3.02	0.97	0.99

United Kingdom

	HMT	Optimal	ACU	$Peg
Housing	2.29	0.70	2.23	2.29
Financial Risk	-0.61	0.01	-0.66	-0.61
Household Risk	-1.54	-0.02	-1.55	-1.54
GFC	0.14	0.70	0.02	0.15

Japan

	HMT	Optimal	ACU	$Peg
Housing	0.02	0.83	-1.62	0.02
Financial Risk	-0.48	0.19	-1.04	-0.47
Household Risk	-1.90	-0.13	-2.39	-1.90
GFC	-2.36	0.88	-5.05	-2.36

People's Republic of China

	HMT	Optimal	ACU	$Peg
Housing	-1.20	0.73	1.72	-1.27
Financial Risk	-4.37	0.05	1.40	-4.60
Household Risk	-1.04	-0.02	-0.75	-1.02
GFC	-6.61	0.75	2.37	-6.89

Republic of Korea

	HMT	Optimal	ACU	$Peg
Housing	-0.45	0.43	3.33	-0.43
Financial Risk	-8.10	0.05	-1.33	-8.85
Household Risk	-0.40	-0.02	0.02	-0.33
GFC	-8.95	0.47	2.02	-9.60

Singapore

	HMT	Optimal	ACU	$Peg
Housing	-1.00	0.02	-1.89	-5.50
Financial Risk	0.04	0.00	0.88	-6.33
Household Risk	-1.68	0.00	-1.16	-1.49
GFC	-2.64	0.02	-2.16	-13.33

Indonesia

	HMT	Optimal	ACU	$Peg
Housing	2.15	0.36	6.55	2.37
Financial Risk	-11.05	0.01	-4.03	-12.37
Household Risk	0.08	-0.01	0.57	0.18
GFC	-8.82	0.37	3.09	-9.82

Malaysia

	HMT	Optimal	ACU	$Peg
Housing	-4.10	0.26	-0.19	-4.33
Financial Risk	-6.21	0.03	1.41	-6.88
Household Risk	-0.50	-0.01	-0.04	-0.42
GFC	-10.81	0.27	1.18	-11.63

Philippines

	HMT	Optimal	ACU	$Peg
Housing	1.72	0.43	5.71	1.87
Financial Risk	-11.20	0.03	-4.81	-12.47
Household Risk	0.60	-0.01	1.09	0.73
GFC	-8.88	0.45	1.99	-9.87

Thailand

	HMT	Optimal	ACU	$Peg
Housing	-3.60	0.35	0.53	-3.76
Financial Risk	-6.99	0.02	0.61	-7.99
Household Risk	-0.70	-0.01	-0.23	-0.63
GFC	-11.29	0.37	0.90	-12.38

Table B-8: Impact on Nominal Exchange Rate (% Change) in Year 1

United States

	HMT	Optimal	ACU	$Peg
Housing	0.00	0.00	0.00	0.00
Financial Risk	0.00	0.00	0.00	0.00
Household Risk	0.00	0.00	0.00	0.00
GFC	0.00	0.00	0.00	0.00

United Kingdom

	HMT	Optimal	ACU	$Peg
Housing	-4.12	-0.06	-4.16	-4.11
Financial Risk	-4.34	-5.81	-4.38	-4.33
Household Risk	-0.59	-1.22	-0.61	-0.59
GFC	-9.05	-7.09	-9.15	-9.04

Japan

	HMT	Optimal	ACU	$Peg
Housing	-6.85	-6.11	-4.74	-6.86
Financial Risk	-10.18	-10.62	-9.44	-10.19
Household Risk	-1.12	-1.65	-0.44	-1.12
GFC	-18.15	-18.38	-14.62	-18.16

People's Republic of China

	HMT	Optimal	ACU	$Peg
Housing	-0.11	-1.71	-4.74	0.00
Financial Risk	-0.39	-7.40	-9.44	0.00
Household Risk	0.03	0.41	-0.44	0.00
GFC	-0.46	-8.70	-14.62	0.00

Republic of Korea

	HMT	Optimal	ACU	$Peg
Housing	0.02	0.75	-4.74	0.00
Financial Risk	-0.93	-10.94	-9.44	0.00
Household Risk	0.09	1.55	-0.44	0.00
GFC	-0.82	-8.64	-14.62	0.00

Singapore

	HMT	Optimal	ACU	$Peg
Housing	-5.85	-5.32	-4.74	0.00
Financial Risk	-8.29	-7.97	-9.44	0.00
Household Risk	0.24	0.17	-0.44	0.00
GFC	-13.89	-13.12	-14.62	0.00

Indonesia

	HMT	Optimal	ACU	$Peg
Housing	0.24	2.87	-4.74	0.00
Financial Risk	-1.47	-13.95	-9.44	0.00
Household Risk	0.11	1.94	-0.44	0.00
GFC	-1.12	-9.15	-14.62	0.00

Malaysia

	HMT	Optimal	ACU	$Peg
Housing	-0.26	-3.80	-4.74	0.00
Financial Risk	-0.77	-7.94	-9.44	0.00
Household Risk	0.08	1.44	-0.44	0.00
GFC	-0.94	-10.30	-14.62	0.00

Philippines

	HMT	Optimal	ACU	$Peg
Housing	0.20	2.86	-4.74	0.00
Financial Risk	-1.52	-15.03	-9.44	0.00
Household Risk	0.15	2.73	-0.44	0.00
GFC	-1.17	-9.45	-14.62	0.00

Thailand

	HMT	Optimal	ACU	$Peg
Housing	-0.11	-3.03	-4.74	0.00
Financial Risk	-1.00	-8.73	-9.44	0.00
Household Risk	0.07	1.13	-0.44	0.00
GFC	-1.04	-10.62	-14.62	0.00

Figure 1: Impact of a Global Financial Crisis on the United States

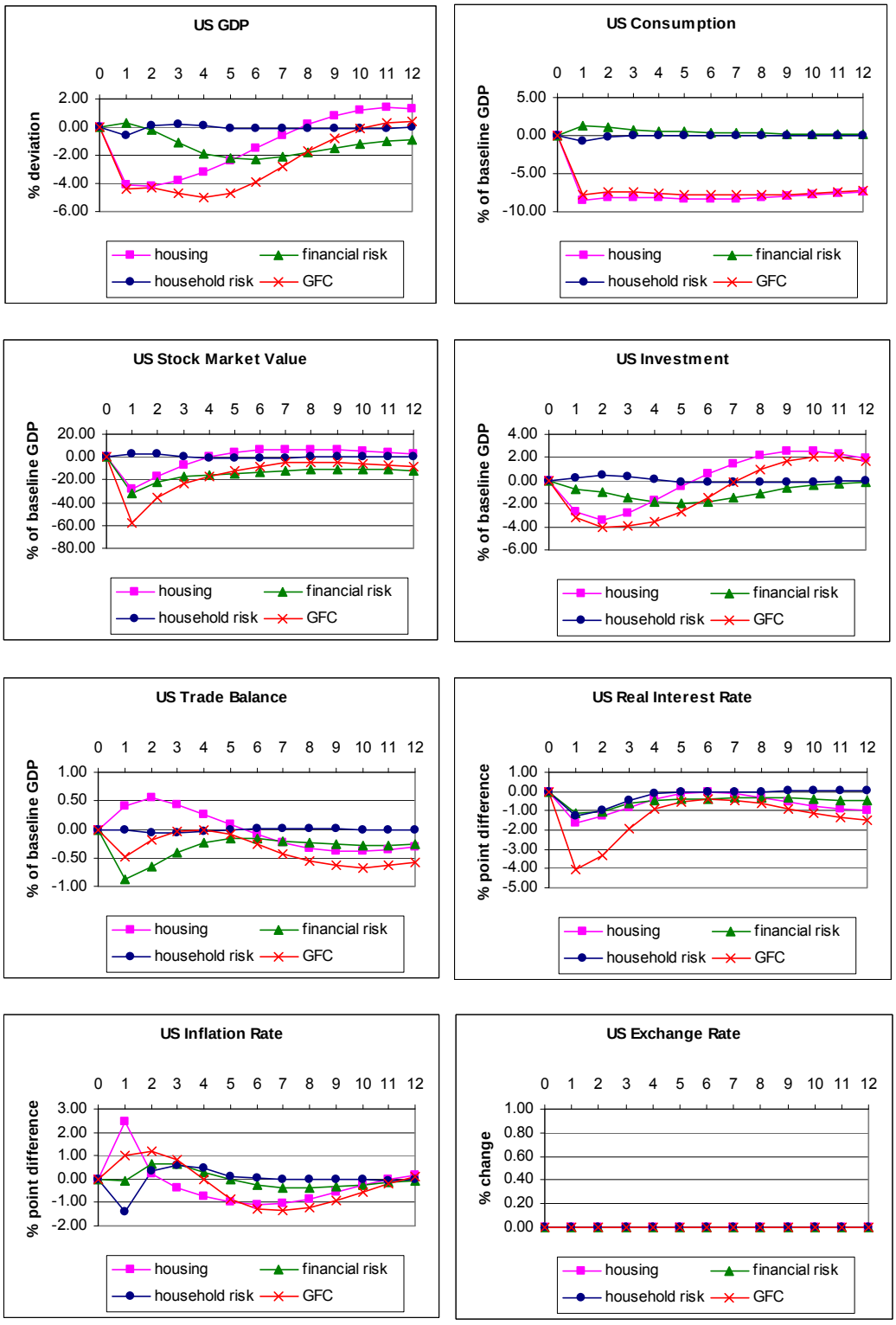


Figure 2: Impact of a Global Financial Crisis on Japan

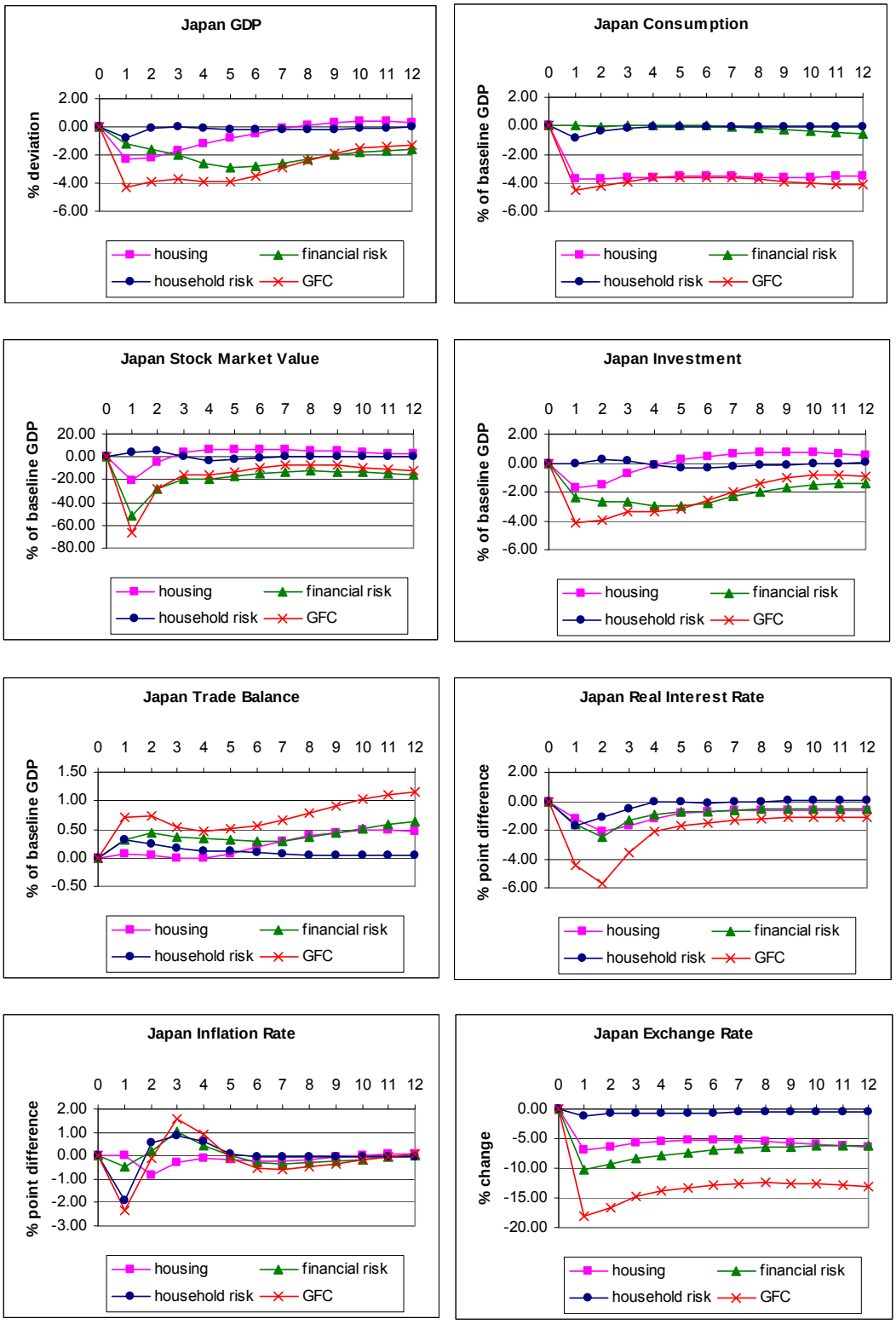


Figure 3: Impact of a Global Financial Crisis on People's Republic of China

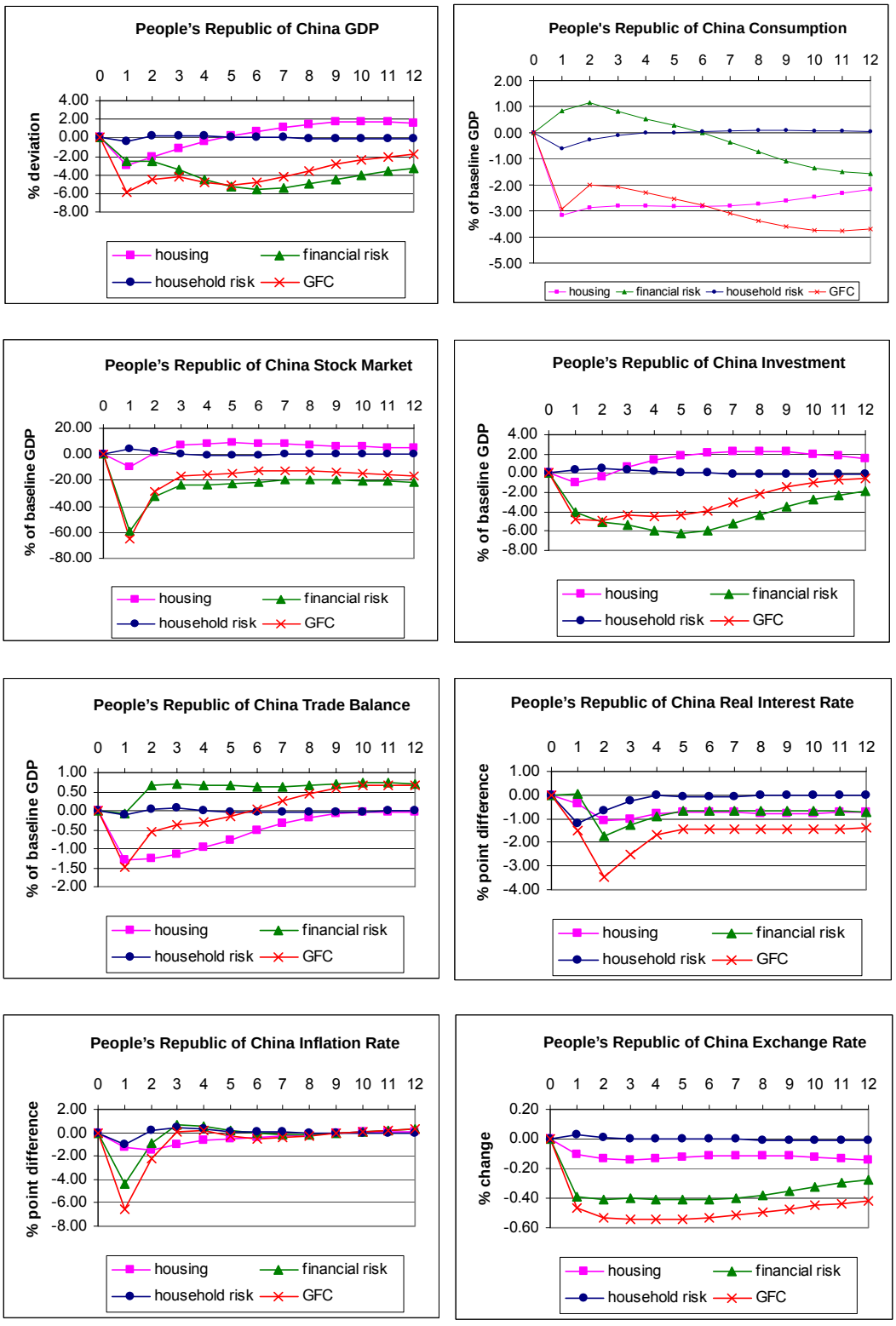


Figure 4: Impact of a Global Financial Crisis on Republic of Korea

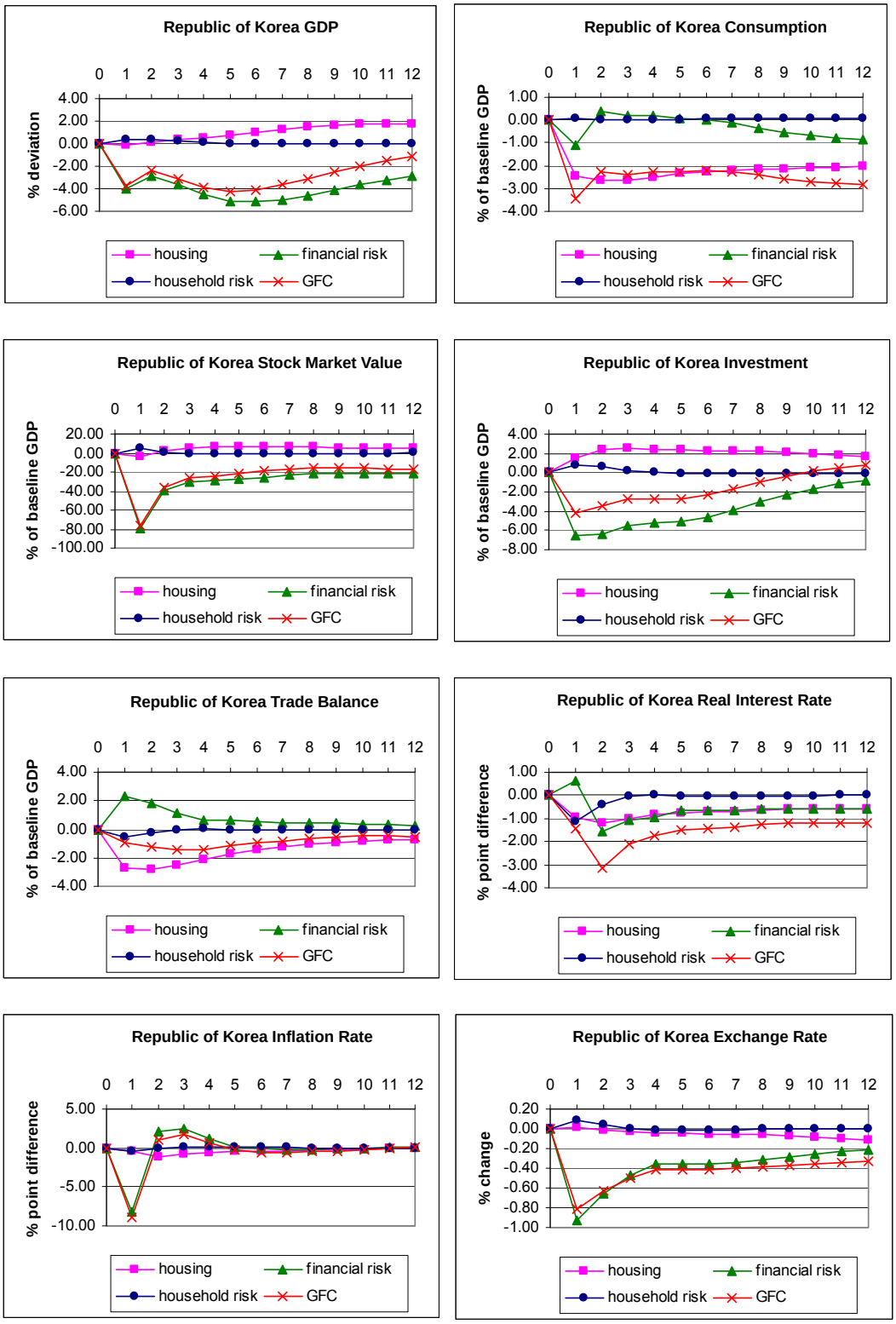


Figure 5: Impact of a Global Financial Crisis on Singapore

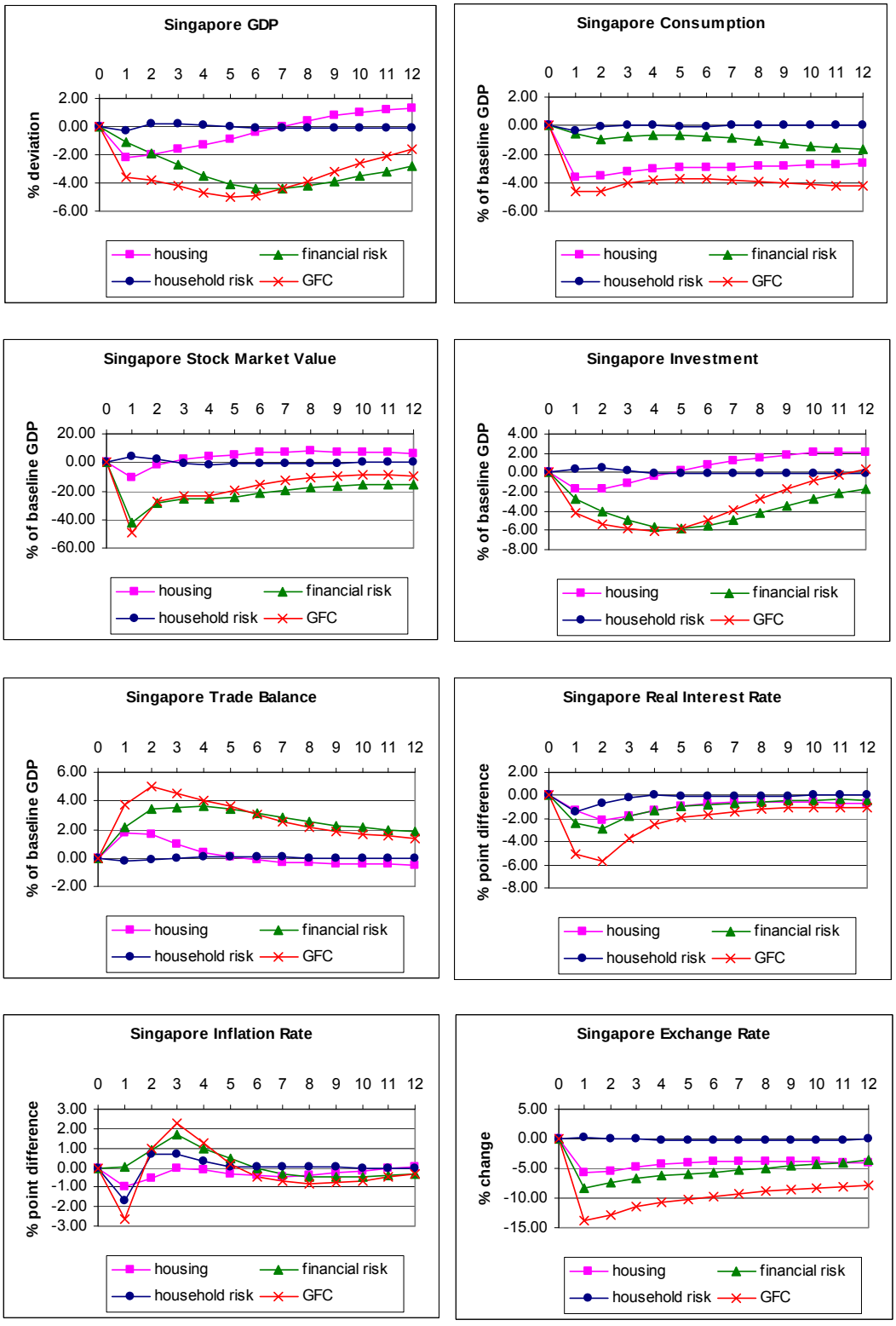


Figure 6: Impact of a Global Financial Crisis on Indonesia

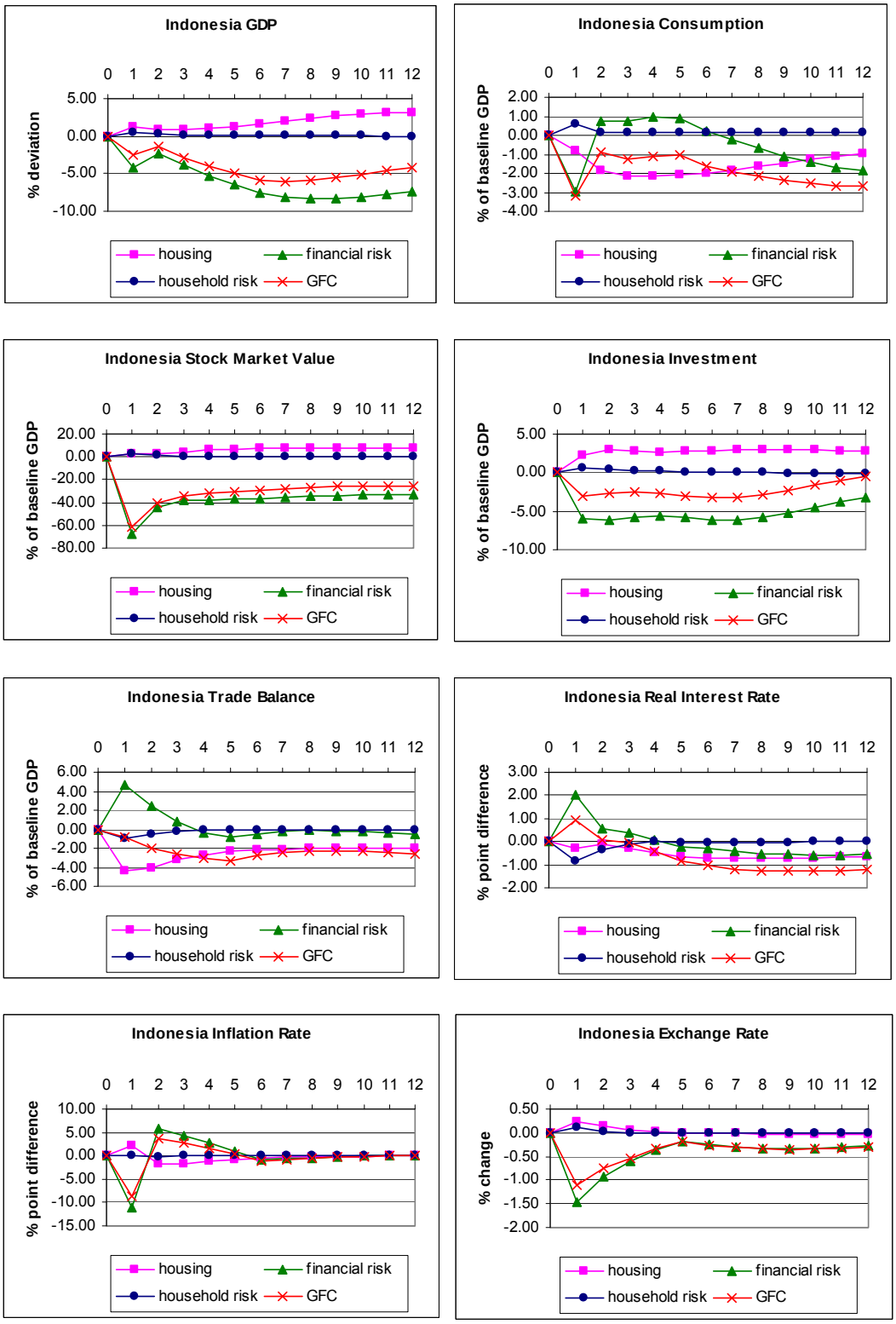


Figure 7: Impact of a Global Financial Crisis on Malaysia

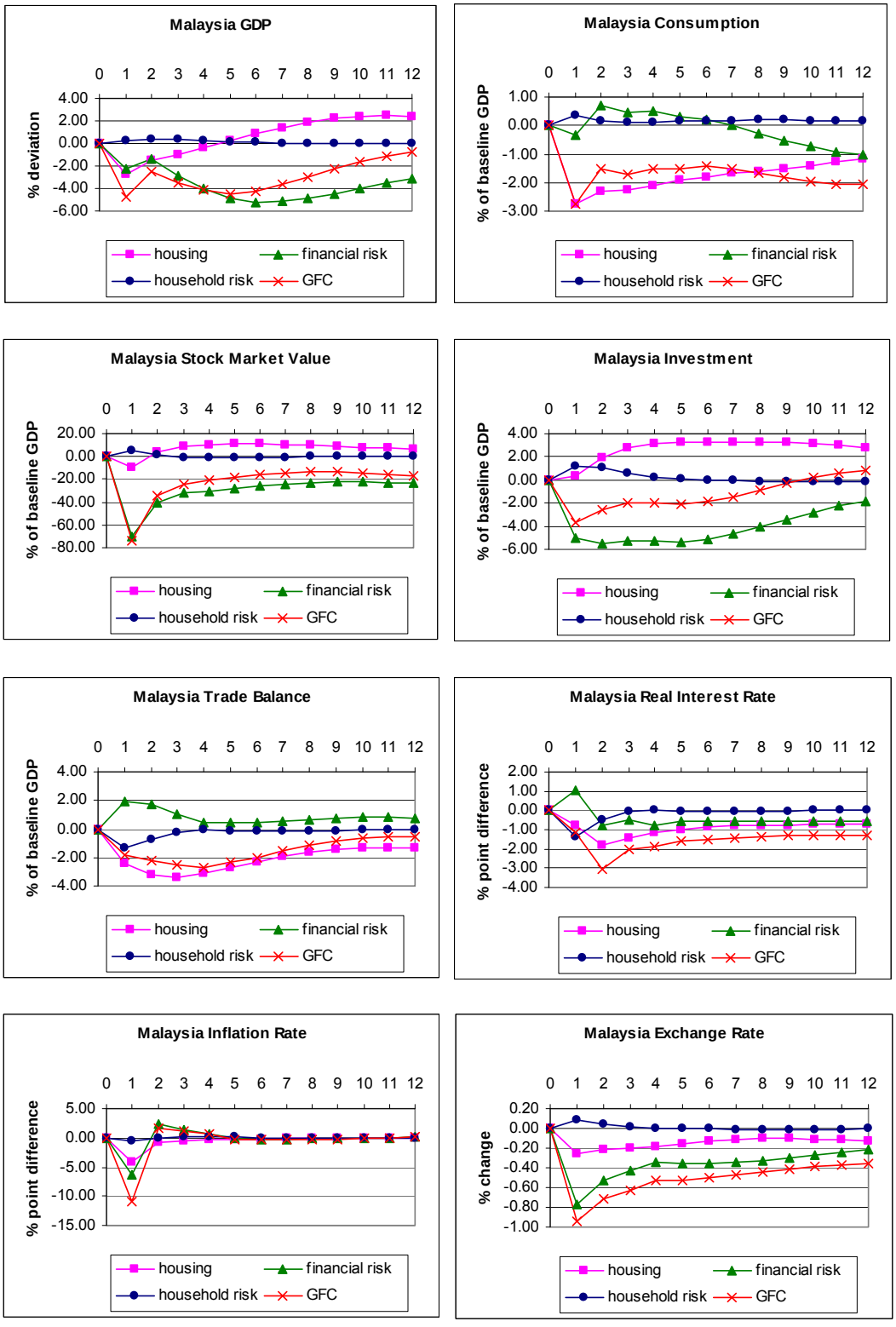


Figure 8: Impact of a Global Financial Crisis on Philippines

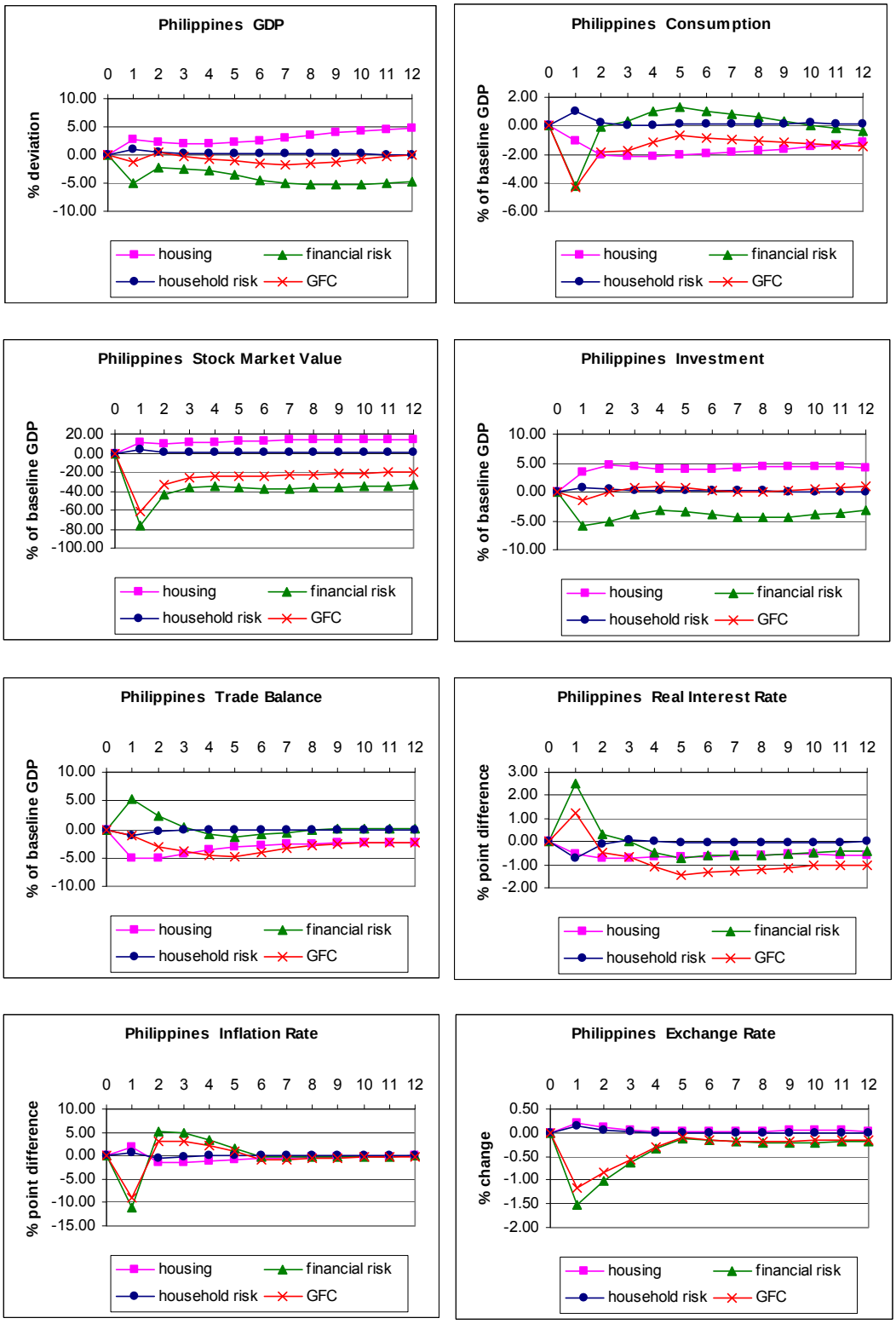
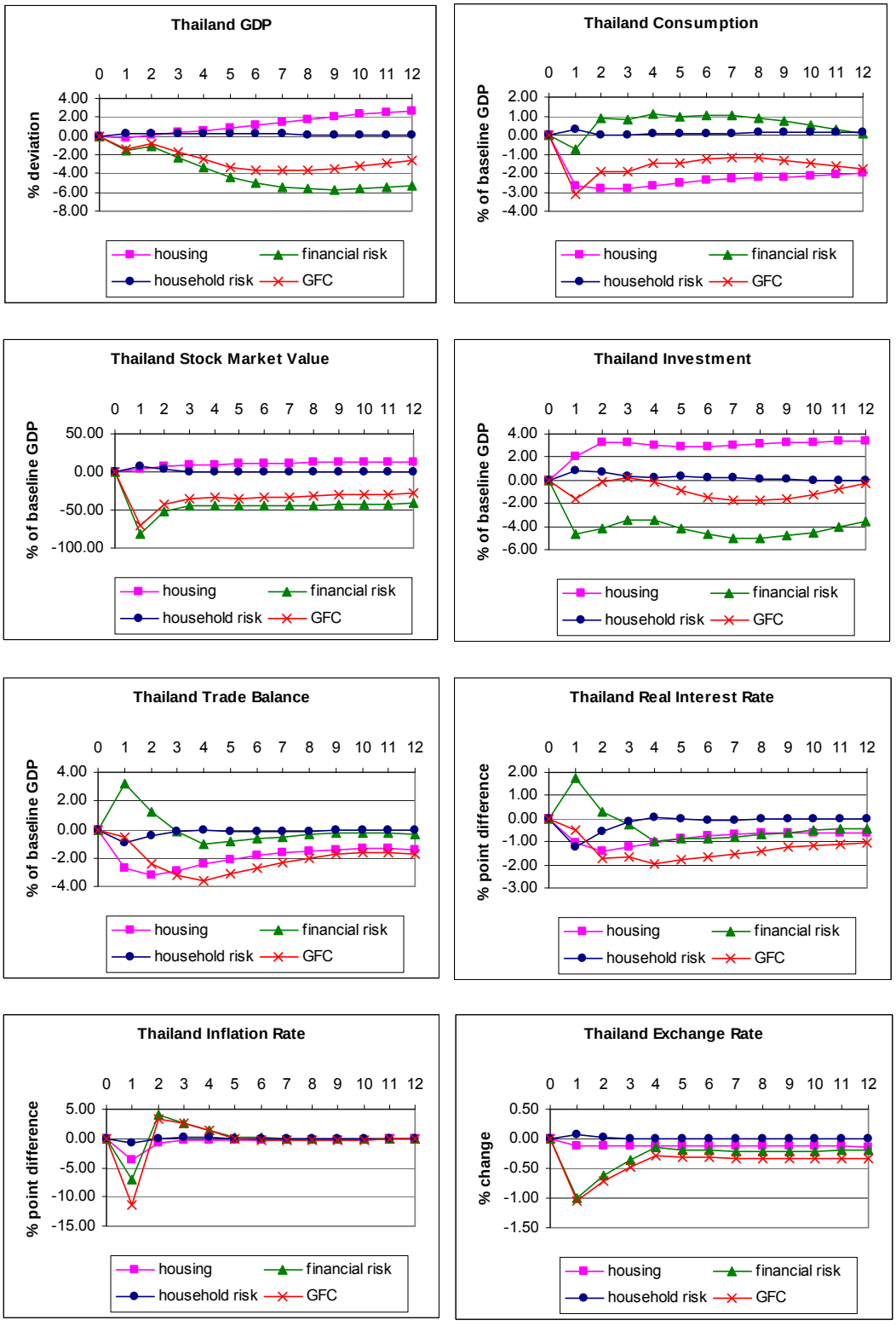


Figure 9: Impact of a Global Financial Crisis on Thailand



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