

Modelling the impact of the Global Financial Crisis on World Trade *

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1. What this study is about

The September 2008 collapse of Lehman Brothers, a mid-size ‘Wall Street’ investment banker, sent a wave of fear around world financial markets. Banks virtually stopped lending to each other. The risk premium on interbank borrowing shot up to 5 per cent, whereas typically it was close to zero. Although authorities scrambled to inject liquidity into financial markets, the damage was done. Large capital expenditure projects were shelved, the corporate sector virtually stopped borrowing, trade credit was hard to get and, with falling demand, particularly for investment goods and manufacturing durables like cars, trade volumes collapsed.

The result is that the global financial crisis saw the largest and sharpest drop in global economic activity of the modern era. In 2009, most major developed economies were in a deep recession. The fallout for global trade, both for volumes and the pattern of trade were dramatic. The OECD predicts world trade volumes could shrink by 13 percent in 2009 from 2008 levels.¹

The contraction in trade has several interrelated causes comprising both price and income effects as global financial flows readjust, real exchange rates realign, terms of trade change and domestic savings rise with a concomitant drop in domestic demand. That is, financial problems have had devastating real effects. Each of these effects reverberates around the world, some compounding and some offsetting each other.

Governments have responded with an easing of monetary and fiscal policy that in turn have their own effects on activity and financial and trade flows. The downturn in activity is causing unemployment to rise sharply and, with it, a political response to protect domestic industries through various combinations of domestic subsidies and border protection. There is potential for protectionism to rise further.

Both the causes of the crisis and the policy responses are reshaping the level and pattern of world trade. The objective of this study is to disentangle the various direct and indirect effects of the crisis on international trade and how events might unravel. To do this, a dynamic, intertemporal general equilibrium model that fully integrates the financial and real sectors of the economy is used to unravel and understand the mechanisms at work. The model incorporates wealth effects, expectations and financial markets for bonds, equities and foreign exchange as well as trade and financial flows. It is a suitable tool to analyse the impact of the crisis and policy responses on global trade and financial flows².

The paper is organised as follows. In the next section, the main linkages and mechanisms by which the financial crisis affects trade is given. This is necessary on two

¹ OECD 2009

http://www.oecd.org/document/12/0,3343,en_2649_37431_42788172_1_1_1_1,00.html

² Other studies using this model to explore aspects of the crisis include Mckibbin and Stoeckel (2010a, 2010b).

counts: it sets up the modelling approach and it also serves as a basis for developing the shocks to be imposed on the model that represent the financial crisis. The main features of the G-Cubed model that is used in this analysis are described briefly as the model is documented in full elsewhere.

In section 3, the simulations to represent the financial crisis are described and the justification given for the size of the shocks chosen. It turns out that the crisis can be modelled using three shocks for the crisis itself and three for the subsequent policy responses which covers monetary and fiscal stimulus as well as the potential for trade protectionism that has emerged.

Results are then discussed in two separate parts to disentangle the various macroeconomic influences on world economies including trade. In section 4 the effects of the crisis on world economies without the policy responses are described. Then in section 5, the results from the three policy responses are described on their own to gauge their relative impacts. Finally, in section 6, some of the main insights are highlighted and discussed.

2. How the financial crisis has affected trade outcomes

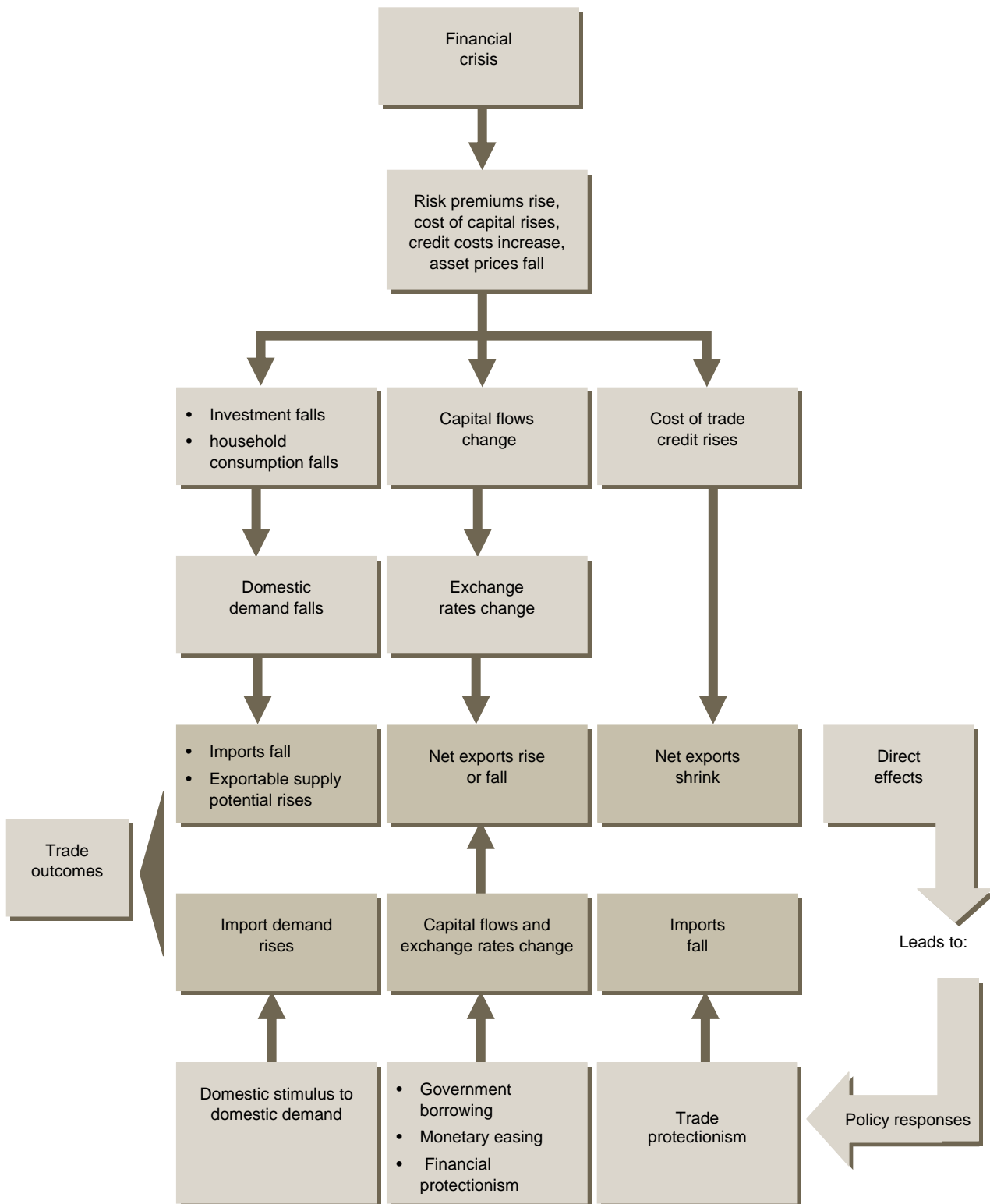
The mechanisms at work

The financial crisis has affected trade outcomes through several channels, some obvious, some less so. One obvious one is the slowdown in demand both by business and households. As households spend less so imports will fall, and hence someone else's exports will fall. But other effects are more complicated as set out in chart 2.1.

A financial crisis causes a sharp reappraisal of risk by households and business. With any loss of confidence, banks are no longer happy to lend at the same rates as before, if they lend at all. Trade credit under these circumstances is harder to come by. Such upward reappraisals of risk cause the cost of capital to rise and, with widespread uncertainty, countries become reluctant to lend to other countries. Therefore capital flows shrink and this means current account deficits and surpluses will contract. Such changes in current account balances affect trade balances and hence exports and imports. Facilitating all these adjustments will be changes in real exchange rates that affects the relative price of tradeables and non-tradeables and hence the supply and demand of exports and imports.

Falling output, trade and employment leads to unpleasant social consequences and so causes policy makers to counteract the effects and stimulate the economy. There are three ways policy makers look after their constituents. One is to ease monetary policy. Another is to stimulate domestic demand through expansionary fiscal policy. This can occur through hand-outs to households via tax breaks or direct payments, by extra government spending, often on infrastructure, or subsidies to producers, such as car makers. Extra spending by governments means extra borrowing in the first instance and

2.1 The main mechanisms affecting trade outcomes



this affects capital flows and trade once again. The third way governments sometimes choose to ‘look after their own’ is by protection: either by overt border measures such as tariff increases or more subtle ones such as “Buy Local” programs. Financial protection, for example where banks or firms are directed to lend at home, can also occur. Financial protection will affect relative rates of return and hence capital flows and trade.

All of the above mechanisms affect trade. Some will compound each other, others will be offsetting. The only to understand some of the key drivers is by use of a model as set out in Figure 2.1.

The model

The G-Cubed model is an intertemporal general equilibrium model of the world economy. The theoretical structure is outlined in McKibbin and Wilcoxen (1999)³. A number of studies—summarized in McKibbin and Vines (2000)—show that the G-cubed modelling approach has been useful in assessing a range of issues across a number of countries since the mid-1980s.

The G-Cubed model contains rich dynamic behaviour, driven on the one hand by asset accumulation and, on the other by sticky wage adjustment to a neoclassical steady state with capital adjustment costs. It embodies a wide range of assumptions about individual behaviour and empirical regularities in a dynamic general equilibrium framework.

In the version of the model used here there are 6 sectors (energy, mining, agriculture, manufacturing durables, manufacturing non-durables and services) and 15 countries/regions as set out in Table 2.2.

2.2 Countries/regions

United States	China
Japan	India
United Kingdom	Other Asia
Germany	Latin America
Euro Area	Other LDC
Canada	East Europe & Former Soviet Union
Australia	OPEC
Rest of OECD	

³ Full details of the model including a list of equations and parameters can be found online at: www.gcubed.com

3. Simulating the effects of the crisis

Events leading up to the crisis in 2008— the baseline

The focus of this study is on disentangling the many influences of the financial crisis on trade outcomes. The ‘crisis’ is defined here as the bursting of the housing market bubble in late 2007, the ensuing collapse in the sub-prime mortgage market and related financial markets and the subsequent collapse of Lehman Brothers in 2008 which resulted in a sharp increase in risk premia around the world. The effect of the financial crisis on global trade is therefore the difference between a world where there was no crisis and one where there is. That is, to assess the effects of the crisis on trade, a baseline, or “business as usual”, view of a world without a crisis has to be produced.

There are two aspects to this baseline. One is the exogenous productivity and population trends going forward and the other is the underlying imbalances brewing in the world economy prior to the financial crisis itself. The second aspect of a baseline is some of the prior events to the crisis. The problem is that some of the seeds of the financial crisis were sown in the decade before the crisis. There were a series of large global events, such as the bursting of the dotcom bubble in 2001 and the rapid growth of China, that were already reshaping the pattern and level of world trade before the 2008 financial crisis hit. Some of these events, like the large disparities between savings and investment in China (a surplus) and in the United States (a deficit) led to large differences between exports and imports for each nation so that large current account surpluses were accumulating in China and large deficits in America. It is important to appreciate that the results reported here are *deviations* from baseline from the financial crisis, as defined below.

The six shocks to represent the crisis and the policy responses

The above events have led to the now well known global downturn. All official forecasting agencies, such as the IMF and OECD, have described this downturn and so will not be expanded here. As the IMF notes ‘Global GDP is estimated to have fallen by an unprecedented 5 per cent in the fourth quarter (annualized), led by advanced economies, which contracted by around 7 per cent’⁴. Japan has been particularly hard hit with a fourth quarter GDP (2008) plummeting by 13 per cent. Demand for durable goods has been particularly hard hit. With the downturn there has been a sharp upturn in savings by households (and commensurate reduction in consumption), driven by a reappraisal of risk by households and a loss of net worth with falling house prices and equity prices.

⁴ IMF 2009, *Group of Twenty, Meeting of the Ministers and Central Bank Governors March 13-14, 2009*, London UK, p. 4.

Three main shocks capture the onset of the global financial crisis:

1. The bursting of the housing bubble causing a reallocation of capital and a loss of household wealth and drop in consumption.
2. A sharp rise in the equity risk premium (the risk premium of equities over bonds) causing the cost of capital to rise, private investment to fall and demand for durable goods to collapse.
3. A reappraisal of risk by households causing them to discount their future labor income and increase savings and decrease consumption.

Shock 1: The bursting of the housing bubble

Falling house prices has a major effect on household wealth, spending and defaults on loans held by financial institutions. Events in the United States typify a global phenomenon. House price changes in some areas have generated dramatic news headlines but, overall the United States index of house prices has fallen by 6.2 percent in real terms from the 1st quarter 2008 to the same quarter in 2009⁵.

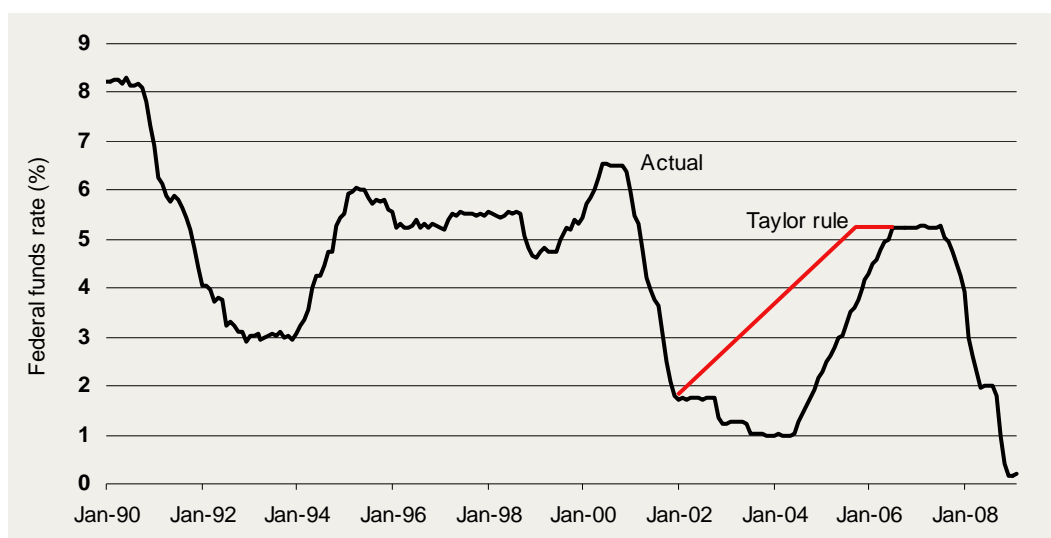
While house prices were rising so strongly, credit was supplied liberally to meet the demand as perceptions of risk fell. The rising wealth boosted confidence and spending. The housing bubble was a global phenomenon centered mainly on the Anglo-Saxon world.

The housing bubble was partly the result of a long period of low interest rates by the US Federal Reserve. The Federal Reserve cut interest rates by a total of 550 basis points in a series of steps between 2001 and 2004. The easing, subsequent tightening and current easing are shown in chart 3.1. Some believe⁶ that monetary policy was too loose for too long and this is what gave rise to the asset price bubble and commodity price spike. Taylor argues that had the Federal Reserve followed the Taylor rule, interest rates would have risen much sooner and the bubbles not appear to the same extent (chart 3.2).

⁵ Federal Housing Finance Agency May 2009, <http://www.fhfa.gov/webfiles/2406/1q09hpi.pdf>

⁶ Taylor, J.B. 2008, *The Financial Crisis and the Policy Responses: An Empirical Analysis of What Went Wrong*, p. 2.

3.1 Federal funds rate Actual and counterfactual



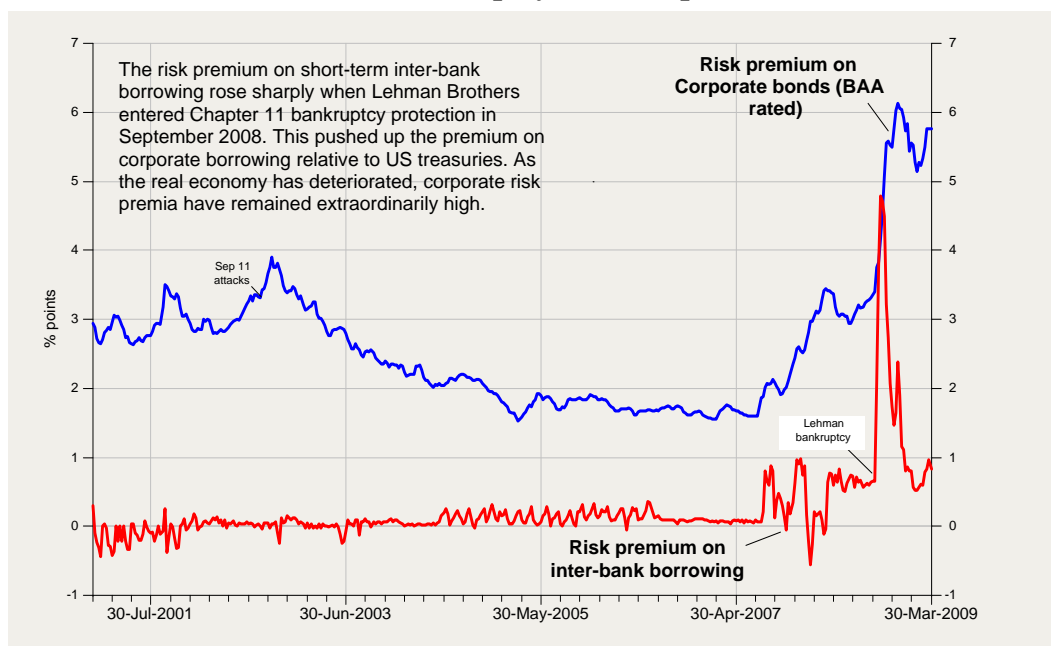
Note: The daily effective federal funds rate is a weighted average of rates on brokered trades. Weekly figures are averages of 7 calendar days ending on Wednesday of the current week; monthly figures include each calendar day in the month. Annualised using a 360-day year or bank interest.

Data source: US Federal Reserve Statistical Release, http://www.federalreserve.gov/releases/h15/data/Monthly/H15_FF_O.txt, Accessed 5 March 2009.

The bursting of the housing bubble is modelled as a surprise fall in the expected flow of services from housing investment – larger in the United States, United Kingdom and Europe but still significant throughout the world. Households in each economy solve an intertemporal consumption problem subject to an intertemporal budget constraint. The result is a time profile for the consumer in each country of 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 (housing plus other durables). 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 drop in housing productivity in the United States is assumed to be 10 per cent lower in 2009 and is calibrated to give, along with the other shocks, a drop in house prices in the US of the order of 6 per cent, roughly what has been observed for the last year⁷. A plausible scenario is where productivity returns to 'normal' by 2013.

⁷ A 10 per cent permanent drop in housing productivity in the United States alone gives a 5.4 per cent drop in housing values one year later. See McKibbin, W and Stoeckel, A, *Bursting of the US housing Bubble*, Economic Scenarios No 14, www.economicsscenarios.com.

3.2 The Lehman Brothers' bankruptcy and risk premia



a Notes: Weekly data. Risk premium on inter-bank borrowing approximated by the rate on one month Euro-dollar deposits less the Federal funds rate. Risk premium on corporate bonds measured as the yield on BAA rated corporate bonds less the 10 year Treasury bond yield. *Data source:* Federal Reserve Board.

Shock 2: Rising equity risk premia

The surprise up-swing in commodity prices from 2003 but most noticeable during 2006 and 2007 led to concerns about inflation that caused a sharp reversal in monetary policy in the US. This tightening in US policy also implied a tightening of monetary policy in economies that pegged to the US dollar. It was the sharpness of this reversal as much as the fall in US house prices and the failures of financial regulation (for example, the mortgage underwriters Fannie Mae and Freddie Mac) that led to the financial problems for 2008-09. Lehman Brothers' failure was primarily due to the large losses they sustained on the US subprime mortgage market. The failure of Lehman Brothers in September 2008 and effect on risk premiums across markets can be seen clearly on chart 3.2.

The rise in the equity risk premium since the collapse of Lehman Brothers was initially of the order of 8 percentage points. A plausible scenario where confidence is gradually restored so things are back to 'normal' by 2013 is therefore assumed.

- Under this scenario, balance sheets of financial institutions are gradually restored through existing and new programs to address distressed assets. Combined with new capital raising, confidence and lending returns. Also, investors learn to live with the 'new world' and economic recovery encourages new investment and a virtuous circle of further improvements in confidence.
- This scenario is plausible in the opinion of the authors. The world will recover but the size and speed of the drop in economic activity has been a salutary lesson for

investors who are not likely to forget that quickly. So, to capture the collapse of commodity prices and the financial sector, an initial rise in the equity risk premium of 8 percentage points for the United States is taken for the six sectors in the model: the energy, mining, agriculture, durable and non durable manufacturing and services sectors in 2009 and then dissipates in equal steps over the next four years but staying permanently higher by 2 percent from 2012. The permanent rise in the risk premium reflects the baseline risk premium which is assumed to be close to zero in the projection based on the experience from 2003. Thus there is an overshoot in the return to “normal”.

Shock 3: A rise in household risk

The reappraisal of risk by firms as a result of the crisis also applies to households. As households view the future as being more risky, so they discount their future earnings and that affects their savings and spending decisions. The increase in household risk in the United States is assumed to be 3 percentage points in the ‘plausible’ scenario in 2009, half that in 2010 and back to ‘normal’ in 2011 and thereafter.

Summary of three crisis shocks and country differences

The three shocks by sector the United States are shown in table 3.3.

3.3 Equity risk premium, household risk and housing productivity for the United States under the plausible scenario

	<i>2009</i>	<i>2010</i>	<i>2011</i>	<i>2012</i>	<i>2013</i>	<i>...beyond 2014</i>
Plausible scenario						
Equity risk premium by sector:						
– Energy	8	6	4	2	2	2
– Mining	8	6	4	2	2	2
– Agriculture	8	6	4	2	2	2
– durable manufacturing	8	6	4	2	2	2
– non durable manufacturing	8	6	4	2	2	2
– services	8	6	4	2	2	2
Household risk	3	1.5	0	0	0	0
Housing productivity	-10	-8	-6	-4	-4	-4

Source: authors’ calculations.

The shocks in table 3.3 are for the United States — the ‘epicentre’ of the crisis. But not all countries have been equally affected by the crisis. For example, durable

manufacturing in Japan would be hit harder by the risk reappraisal given the collapse of their durable exports (dominated by cars) as a result of the combination of the global downturn and the appreciation of the Yen that resulted from the collapse in commodity prices and improvement in their terms of trade.

Also, Japan had their housing bubble a decade earlier than did the United States, so over the last few years they never experienced a property bubble as in America. So the shock to their economy from the bursting of the housing bubble would be less than for the United States. Therefore the shocks for equity risk, the housing bubble bursting and household risk are scaled off the United States. Taking the United States as 1 a series of weights for other sectors and economies appears in table 3.4.

3.4 Weight for country and sector shocks

	USA	JPN	GBR	DEU	EUR	CAN	AUS	OEC	CHI	IND	OAS	LAM	LDC	EEB	OPC
Equity risk by sector															
– energy	1	1	1	1	1	1	1	1	0.8	0.8	0.8	0.8	0.8	0.8	0.8
– mining	1	1	1	1	1	1.2	1.2	1	0.8	0.8	0.8	0.8	0.8	0.8	0.8
– agriculture	1	1	1	1	1	1	1	1	0.8	0.8	0.8	0.8	0.8	0.8	0.8
– durable manufacturing	1	1.2	1	1.2	1	1	1	1	0.8	0.8	0.8	0.8	0.8	0.8	0.8
– non durable manufacturing	1	1	1	1	1	1	1	1	0.8	0.8	0.8	0.8	0.8	0.8	0.8
– services	1	1	1.2	1	1	1	1	1	0.8	0.8	0.8	0.8	0.8	0.8	0.8
Household risk	1	0.3	1	0.5	1	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Household productivity	1	0.1	1	0.5	1	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5

Three main shocks capture the policy responses

On top of the above three financial crisis shocks there has been an unprecedented policy response comprising three more elements:

4. An easing of monetary policy to near zero official rates of interest in major developed economies.
5. An easing of fiscal policy across countries and large run-up in government deficits.
6. A rise in trade and financial protectionism.

Shock 4: Monetary easing

There is an endogenous monetary response in the model for each economy where each economy follows a Henderson-McKibbin-Taylor rule as 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.

$$i_t = i_{t-1} + \beta_1(\pi_t - \pi_t^T) + \beta_2(\Delta y_t - \Delta y_t^T) + \beta_3(\Delta e_t - \Delta e_t^T) \quad (1)$$

The assumed parameter values are set out in McKibbin and Stoeckel (2009a). Note that China and most developing economies have a non-zero weight on the change in the \$US exchange rate. The monetary easing that has occurred is close to the endogenous monetary policy response already built into the model so any extra monetary stimulus is not required. Of course it is possible that authorities, being fearful of raising interest rates too early and pricking the nascent recovery, could end up easing too much for too long and would be an interesting simulation, especially if different countries chose different amounts of ‘over-easing’ which would set up capital flow changes and hence trade flow changes.

Shock 5: Fiscal easing

There is an endogenous fiscal policy response in the model but the rule is a targeting of fiscal deficits as a percent of GDP. The easing of fiscal policy announced by most economies has been an extra unprecedented stimulus in the modern era and expansion of fiscal deficits and has to be simulated.

The discretionary stimulus packages announced by each country have mainly occurred over 2009 and 2010 and is usefully summarised by the OECD⁸. For the United States the cumulative stimulus is nearly 5 per cent of GDP and for China it is over 11 per cent of GDP. It is unlikely that such a stimulus will suddenly end in 2010 for two reasons: it is hard to crank up government spending on things like infrastructure quickly and governments usually find it hard to reign in spending quickly once programs are announced. Therefore, whilst assuming the same cumulative fiscal response as outlined by the OECD and other studies, the fiscal response has been assumed to taper off quickly after 2010 but finishing in 2012. The assumed fiscal response is outlined in table 3.5.

⁸ OECD 2009, *Fiscal Packages Across OECD Countries: Overview and Country Details*, Paris, 31 March.

3.5 The assumed fiscal policy response per cent of GDP

<i>Country/region</i>	<i>2009</i>	<i>2010</i>	<i>2012</i>	<i>2013</i>	<i>Cumulative</i>
United States	2.07	1.55	1.04	0.52	5.18
Japan	1.46	1.10	0.73	0.37	3.65
United Kingdom	1.32	0.99	0.66	0.33	3.29
Germany	1.38	1.04	0.69	0.35	3.45
Euro area	1.30	0.98	0.65	0.33	3.25
Canada	1.68	1.26	0.84	0.42	4.20
Australia	2.48	1.86	1.24	0.62	6.21
Rest of OECD	1.00	0.75	0.50	0.25	2.50
China	4.80	3.60	2.40	1.20	12.00
India	0.50	0.38	0.25	0.13	1.25
Other Asia	2.00	1.50	1.00	0.50	5.00
Latin America	0.50	0.38	0.25	0.13	1.25
Other LDC	0.50	0.38	0.25	0.13	1.25
EEFSU	1.70	1.28	0.85	0.43	4.25
OPEC	3.00	2.25	1.50	0.75	7.50

Source: OECD 2009 and authors' calculations.

Shock 6: Rise in trade and financial protectionism

Rising trade protectionism is a real threat. It occurred during the Great Depression and is attributed with making matters far worse. The main driver for this protectionism was to protect jobs. The Smoot-Hawley legislation in the United States at the time of the Great Depression saw tariffs increase and help trigger the beggar-thy-neighbour round of tariff increases by other countries. Could it happen again?

The answer is that it has already started, albeit on a small scale so far. At the G-20 meeting in November last year, leaders affirmed their commitment to open trade and declared they would not put up more barriers. Yet within 36 hours, India and Russia, two attendees at the summit had put up some trade barriers⁹. Just about every major, and minor car producer for that matter, has given its domestic industry various concoctions of subsidies, grants and soft loans. President Obama was implored to weed out the 'Buy American' provisions in his fiscal stimulus package. Although 'softened', it got through.

The problem is that WTO members are only legally required to not increase tariffs above their 'bound' rates. But actual tariffs in force today (the 'applied' rates) are much

⁹ Although Russia is not yet a member of the WTO and bound by their laws, they still declared, along with the other G-20 participants, not to increase tariffs.

lower than bound rates, especially for developing countries. That means countries can legitimately put up tariffs without any legal discipline from the WTO or recourse to dispute settlement procedures.

4. Effects of US Only crisis without a fiscal policy response

Mechanisms at work

To appreciate the mechanisms at work from the three shocks an illustrative scenario where shocks affect the United States *alone* is shown in chart set 4.1. The bursting of the housing bubble has the biggest negative impact on real consumption, which being roughly 70 percent of the domestic economy, has the biggest negative impact on real GDP. The permanent loss in wealth causes consumption to fall sharply and because the housing shock is assumed to be permanent, consumption is permanently lower in all periods as shown on chart set 4.1.

The financial shock has the largest negative impact on stock market values from baseline in 2009 and an equally large impact as the bursting of the housing bubble on investment. The equity risk shock causes a shift out of equities into other domestic assets, such as housing and government bonds as well as to asset purchases overseas. The shift into government bonds drives up their prices and pushes down real interest rates substantially. This surprisingly raises human wealth because expected future after-tax income is discounted at a much lower real interest rate. Thus in the US, the equity shock alone is positive rather than negative for consumption in the short run.

Investment on the other hand falls sharply. The equity shock reduces US investment by about 15 percent below baseline. The rise in equity risk implies a sharp sell-off 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 investment falls. Over time, due to the existence of adjustment costs, the capital stock falls and potential output is permanently reduced.

Under this simulation where the US alone is assumed to be affected by the crisis, there is little impact on US exports (bottom left hand panel of chart set 4.1) because there is little net impact on the rest of the world. The negative trade effects are offset by positive effects from United States capital going elsewhere as elaborated below. But as the drop in US consumption hits imports, the trade balance improves over baseline especially in 2009 and remains that way until 2013.

Each of the three shocks has a negative effect on the United States and, combined, has the effect of lowering real GDP by 4 percent below baseline in 2009 and real GDP does not return to baseline until 2017, nearly a decade later. That is sufficient to put the US

into recession in 2009 (baseline growth is 3.4 percent) but will allow positive growth in 2010¹⁰.

A key compositional effect also occurs when household discount rates rise and risk premia generally rise. The effect is a much sharper fall in the demand for durable goods relative to other goods in the economy. This is shown clearly in chart set 4.2. Imports and domestic production of durable goods falls by more than non durable goods. The differences are substantial. The high risk adjusted cost leads to a reduction in the flow of services from durables and therefore the demand for these goods drops sharply. This compositional effect is critical for the trade outcomes. Countries that export durable goods are particularly affected by a crisis of the type modelled.

The recession in the United States has two main effects on the world economy. One is the negative knock-on effect from the loss in activity with those economies most dependent on the United States market are most affected. The second effect runs counter to the first. As prospects dim in the United States, so the returns on investment look better elsewhere. Money flows out of the United States (or strictly in the case of the US, less inflow than otherwise) and into other economies where it stimulates investment and economic activity. This is illustrated by the effect on China (see chart set 4.3). The United States is a large importer from China. As US imports fall, China's exports fall (see bottom left hand panel of chart set 4.3), with a combined effect from the three shocks of a drop in exports of 5 percent below baseline in 2009. China's trade balance worsens, but note how small the effect is: barely 1 percent below baseline (as a percent of GDP).

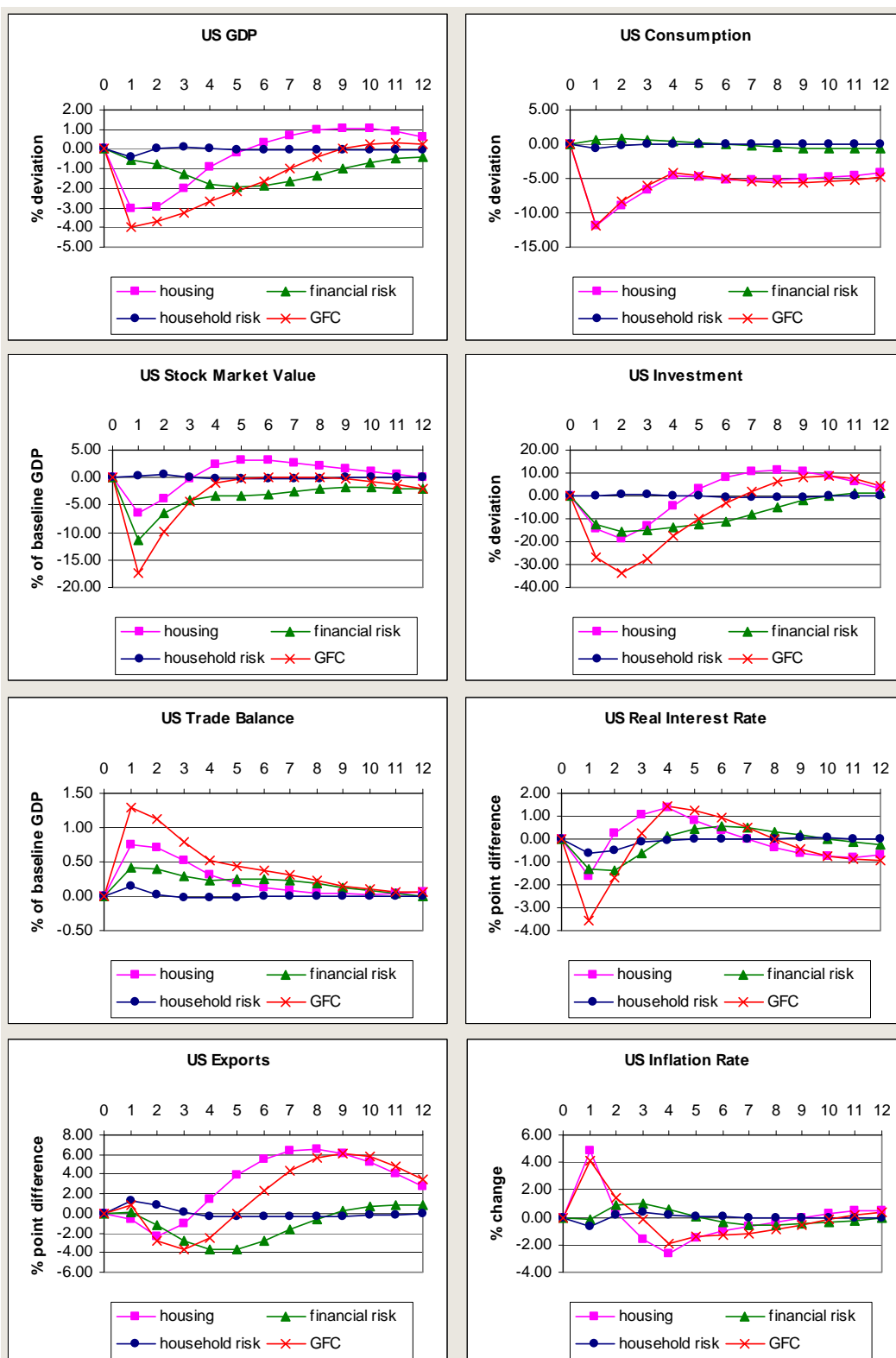
Note also the net small effect on China's real GDP even though China's exports are a large proportion of their GDP. When the United States alone is affected by the crisis, there is a small combined effect on China of a reduction in real GDP of 0.75 percent below baseline in 2009 and a positive effect from 2011 onwards. Looking at China's real investment provides the answer. Because investment prospects in the United States are now dire under the combined scenario, money flows elsewhere, one recipient of who is China. China's real investment could be 3.5 percent above baseline in 2011 and 2012, in response to the relatively better investment prospects. China gains at the United States' expense. The favourable stimulus from extra investment largely offsets and eventually outweighs the negative effects from the loss of exports to the United States.

The conclusion is that the financial crisis which started in the United States, had it been confined to the US alone, would not have had dire consequences for the world economy. Of course the real story is different. Contagion and rising risk premiums

¹⁰ Note that all results are presented as deviations from a baseline projection. A fall in GDP of 4% in year 1, relative to baseline, where the baseline growth rate was 3% is a new growth rate in the first year of negative 1% (i.e. a recession). If the level of GDP remains 4% lower forever the growth rate of GDP in year 2 is back at baseline growth. Thus in growth rate terms, the crisis is resolved after the first year in many countries although the level of GDP remains below baseline for many years.

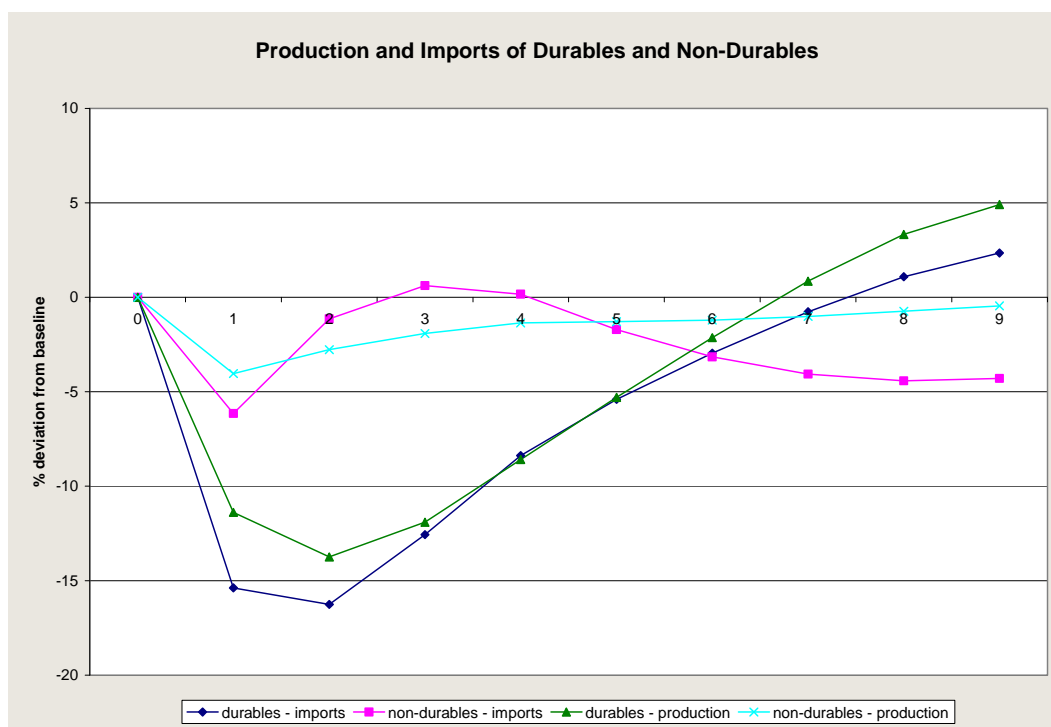
everywhere have caused a different scenario. When everyone is affected the consequences for the United States also depends on who and how other countries are affected.

4.1 Impact of a US only financial crisis on the United States

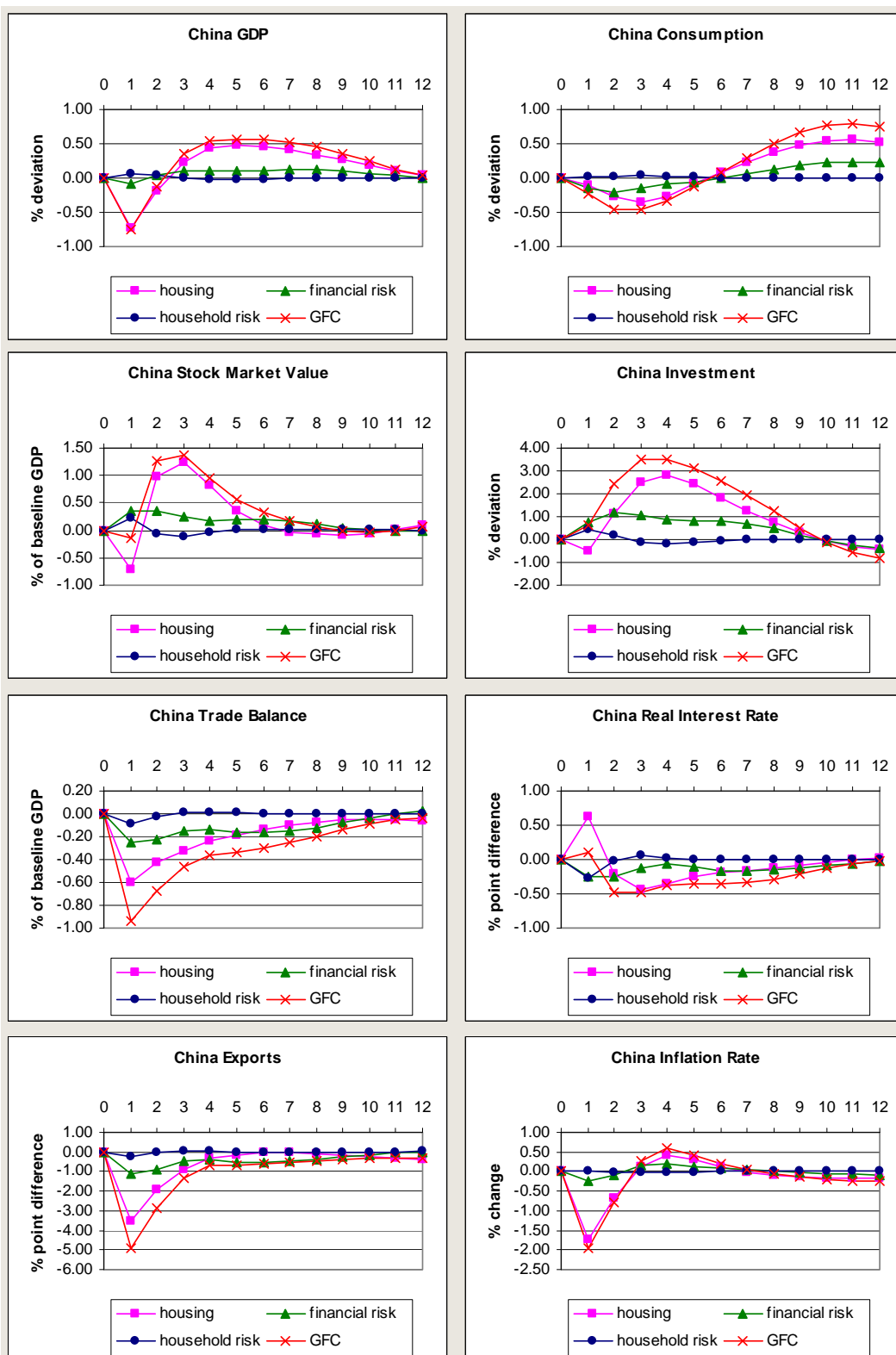


Data source: G-Cubed model simulations

4.2 Impact of a US only financial crisis on Durables versus Non-Durable goods in the United States



4.3 Impact of a US only financial crisis on China



Data source: G-Cubed model simulations

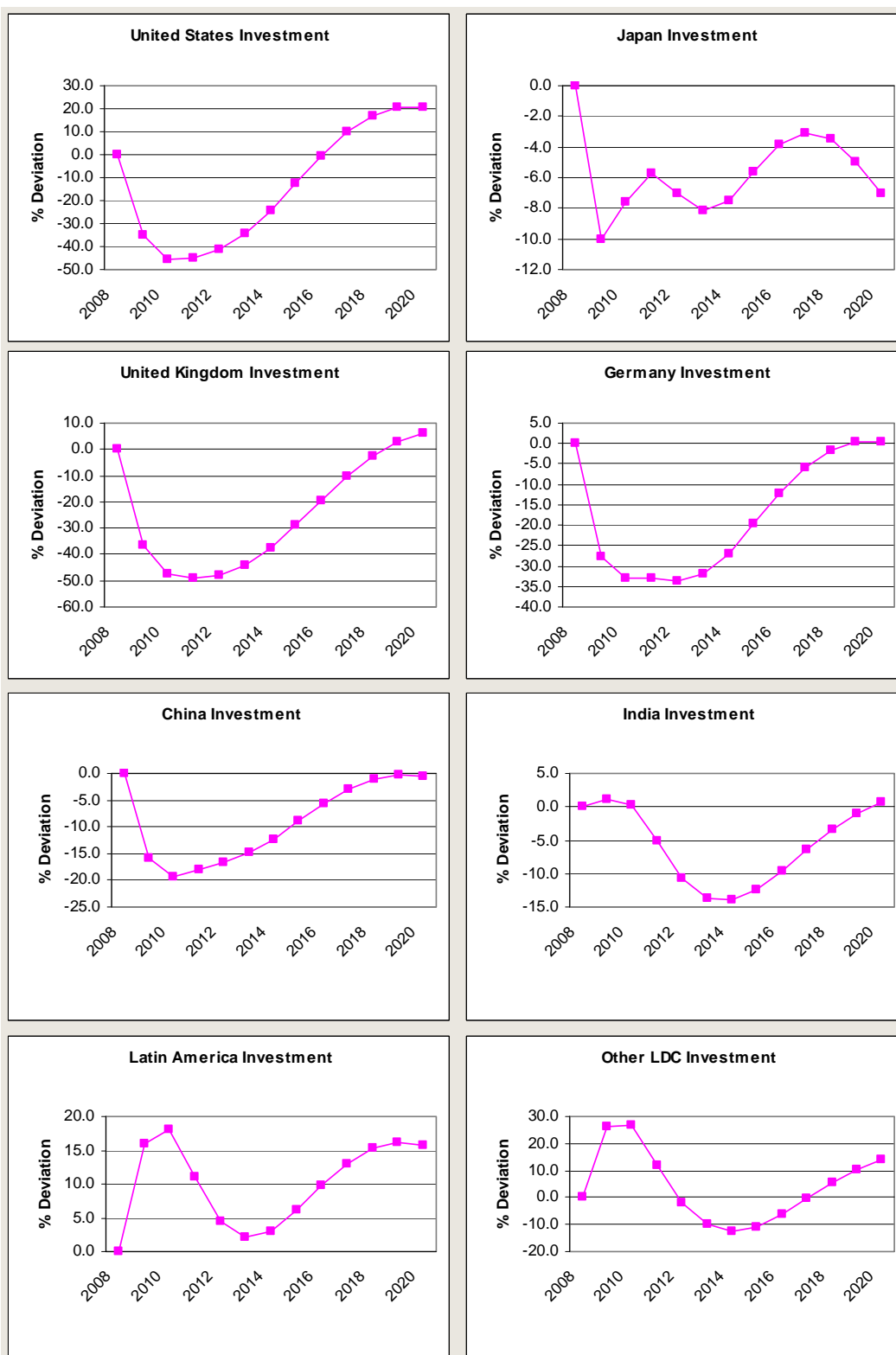
Projected outlook from the global financial crisis without fiscal stimulus

When all economies are affected by the global financial crisis through global changes in risk premia, other countries like China are adversely affected. When other economies are also adversely affected by the reappraisal of risk, the cost of capital for them also rises and, in effect, causes the existing capital stock to be too large. Investment plummets, but not everywhere because it is relative effects that matter. The impact on investment is shown in chart set 4.4. Whereas Chinese investment rose when just the United States was assumed to be affected by the crisis, now Chinese investment falls to a low of over 8 percent below baseline in 2010. Real interest rates fall everywhere by over 400 basis points both reflecting a long run decline in the marginal product of capital but also reflecting a response of monetary authorities in lowering nominal interest rates.

Under the assumptions of the smaller rise in risk premia across Latin America and LDCs, these regions gain relatively from the global reallocation of investment. Investment in Latin America could be over 15 percent higher over baseline in 2009 and 2010 and well over 20 percent for LDCs for the same years. Latin America and other LDCs do not go into recession (see chart set 4.5) as a result of the global financial crisis as represented by the three shocks used in this study. In fact, those two regions experience a slight boost to real GDP.

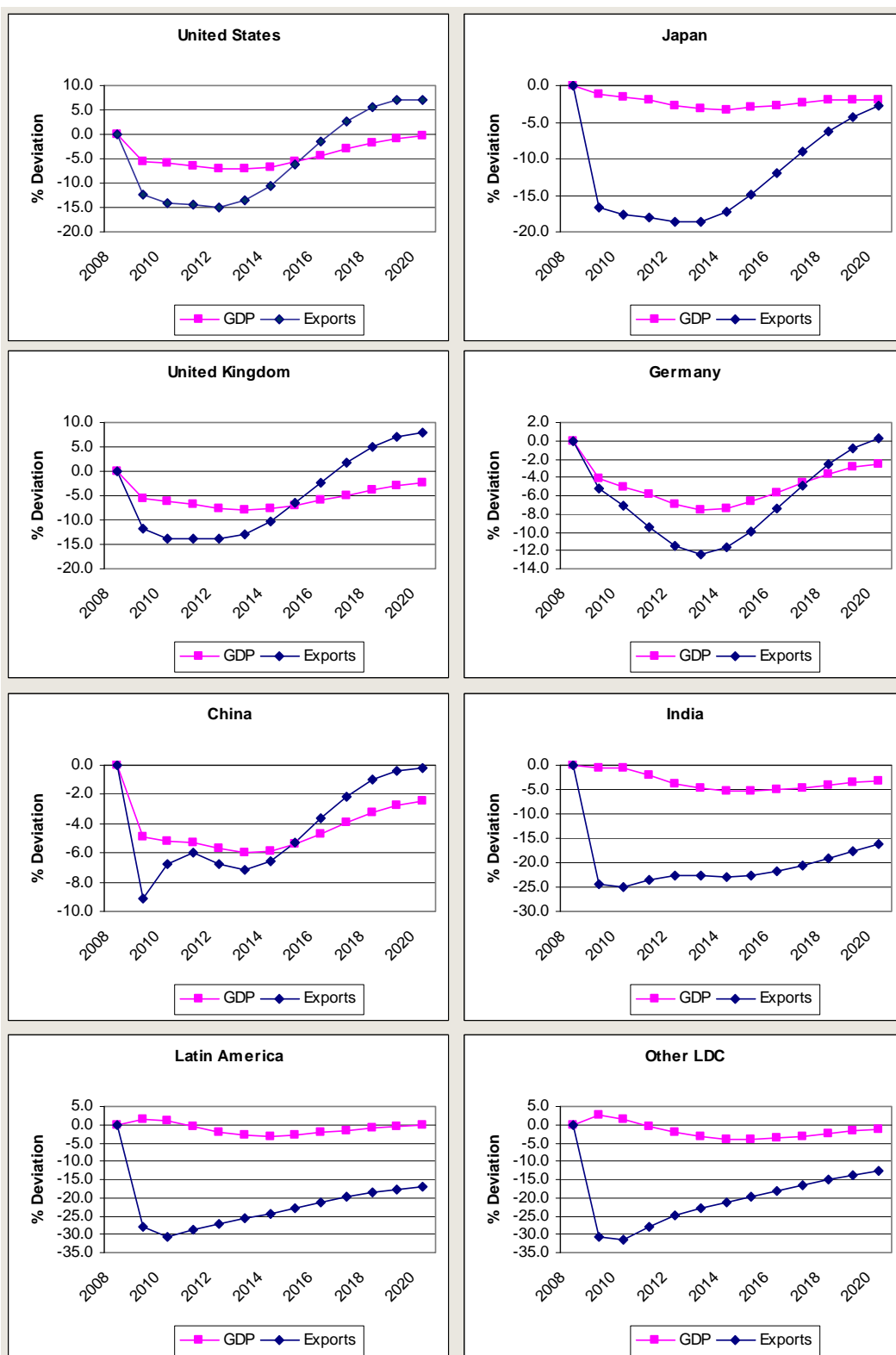
One of the key features of the crisis is reflected in the results in chart set 4.5. There is a substantially larger contraction in exports relative to the contraction in GDP in all economies. This massive shift in the relationship between trade and GDP is not the result of an assumption about the income elasticity of imports. It reflects some key characteristics of the model. First, imports are modeled on a bilateral basis between countries where imports are partly for final demand by households and government and partly for intermediate inputs across the six sectors. In addition, investment is undertaken by a capital sector that uses domestic and imported goods from domestic production and imported sources. As consumption and investment collapse more than GDP, imports will contract more than GDP. One country's imports are another country's exports thus exports will contract more than GDP unless there is a change in the trade position of a particular country. The assumption that all risk premia rise and the results that all real interest rates falls everywhere implies small changes in trade balances.

4.4 Investment effects of GFC



Data source: G-Cubed model simulations

4.5 GDP and trade effects of GFC



Data source: G-Cubed model simulations

5. Effects of policy responses

The results so far have built in a monetary reaction function in the form of an Henderson-McKibbin-Taylor rule for each economy with the short term nominal interest rate adjusting to a variety of factors in each economy. The rules assumed in the model have generated an endogenous monetary response which is similar to that observed so far. The assumption of an unchanged fiscal deficit is very different to what has been observed. In this section we focus on announced fiscal responses. The assumed fiscal policy changes were given earlier in Table 3.5. Note that we do not have infrastructure spending in the model so that the fiscal responses here are assumed to be spending on goods and services and not government investment in physical capital. Expenditure on infrastructure would likely also stimulate medium to long run supply in the model and therefore change the extent to which there is crowding out over time. However to the extent that even infrastructure spending is a demand stimulus for the first few years before the projects begin to deliver medium run supply responses, the initial results in this study can be used to understand the short run impacts of the packages.

Effects of the fiscal stimulus alone

To see the mechanisms at work, the effects of the fiscal stimulus alone are shown in chart set 5.1. These results should be added to the financial crisis results to get a picture of the financial crisis with fiscal response. In discussing these results we will talk about them relative to baseline which can also be interpreted as relative to what would be seen post crisis.

The fiscal stimulus gives a boost to real GDP above baseline for all major economies and regions in 2009, the first year of the fiscal packages. The effects are illustrated by referring to China. China's real GDP could be 1.6 per cent above what otherwise would be the case in 2009, but little different from baseline in 2010. Real GDP would be below baseline in 2011 in China as the effects of higher real interest rates kick in. Real interest rates could be over 3 percentage points above baseline in 2009 and 2010, offsetting much of the decline in real interest rates from the global financial shock and monetary policy responses. Real private investment is 9 per cent below baseline in 2010. Considering the massive 11.4 per cent cumulative fiscal stimulus in China, the effect of the fiscal stimulus alone is quite small and transitory.

Note that the fiscal stimulus in the first year raises GDP but for all countries this effect only lasts for a year and is much smaller than many commentators argue. Indeed when added to the results for the full GFC simulation this fiscal stimulus is not sufficient to completely neutralize the crisis in its impact on GDP. The main reason involves the real interest rate implications of the fiscal stimulus. The global nature of the stimulus implies a spike up in real interest rates which partly offset the spike down in the first year of the shocks. Higher real interest rates could persist for up to 6 years after the stimulus. This

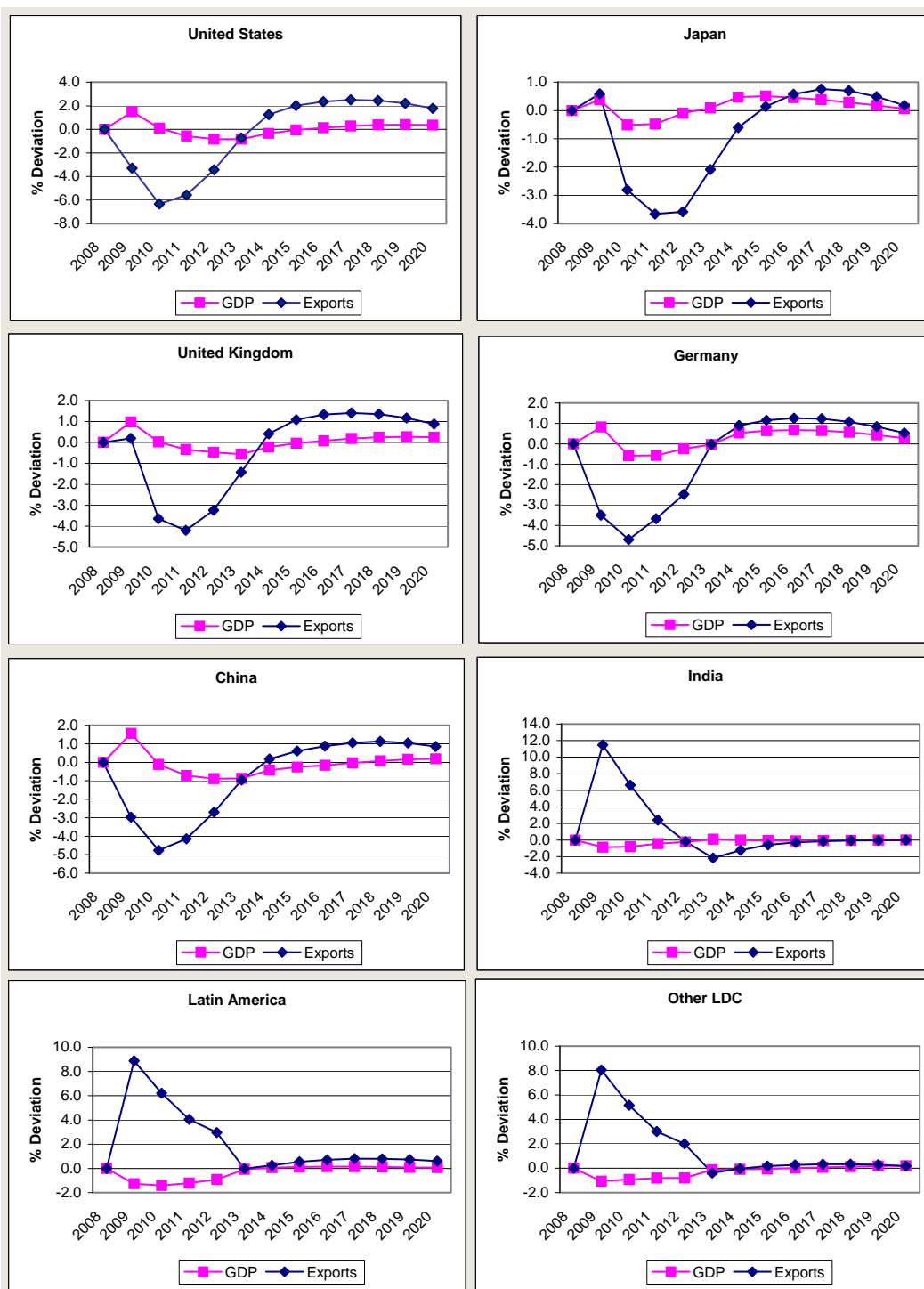
suggests some serious problems to be faced by policymakers during the recovery period from 2010 onwards.

The fiscal packages also have significant impacts on global trade. In the model the effect of fiscal policy on trade comes in a number of forms operating both through income and relative price effects. If an economy increased government spending, private consumption tends to rise and short term income rises. However the increased borrowing tends to increase real interest rates, which reduces private investment¹¹. These two responses have opposite effects on trade. In particular, durable goods consumption falls because of the rise in real interest rates, while non-durable goods consumption rises due to the income increase. The effect is that imports of durable goods fall and non-durables rise. In addition the higher real interest rate tends to attract foreign capital which appreciates the real exchange rate and tends to crowd out exports and stimulates income through relative price changes. A country acting alone has a substantial change in the mix of the components of final demand. Hence if there is a global fiscal stimulus, the real exchange rate (or relative price) effects are muted. However because all countries are acting the real interest rate effects are accentuated because the call on global savings is much larger than the outcome of any one country acting alone.

Chart set 5.1 shows an interesting story where exports of the industrial economies tend to fall as a result of the fiscal package. This occurs for several reasons. Firstly, because the OECD economies have relatively larger fiscal packages (apart from China), their real exchange rate will tend to appreciate relative to the non- OECD economies, crowding out exports. Secondly, these economies tend to export more durable goods whose demand is reduced by a rise in global interest rates. This effect was also present in the global financial crisis simulation where the risk adjusted discount rate rose sharply (even though real interest rates fell) and the demand for durable goods collapsed.

¹¹ To the extent that there is a substantial supply response through infrastructure, the need for interest rates to rise for a given constrained capacity would be reduced.

5.1 GDP and export effects of fiscal response



Data source: G-Cubed model simulations

Trade protectionism

The unfortunate tendency to trade protection was noted earlier. So far there has not been an all-out trade war, possibly due to the hard lessons learned during the Great Depression when such a trade war did break out with disastrous consequences. While industrial economies are in theory able to lift applied tariff rates up to bound tariffs, as they are legally entitled to do under WTO rules, it is possible to go further by invoking special circumstances and by imposing non-tariff barriers to trade.

To try and capture a plausible change in protection, the actual shock assumed is a rise in all tariff rates by 10 percentage points (i.e. if a tariff was 5% it becomes 15%). The impacts on real GDP from countries increasing tariff rates are shown in Chart set 5.2. The overall impacts on global trade are shown in Chart 5.3.

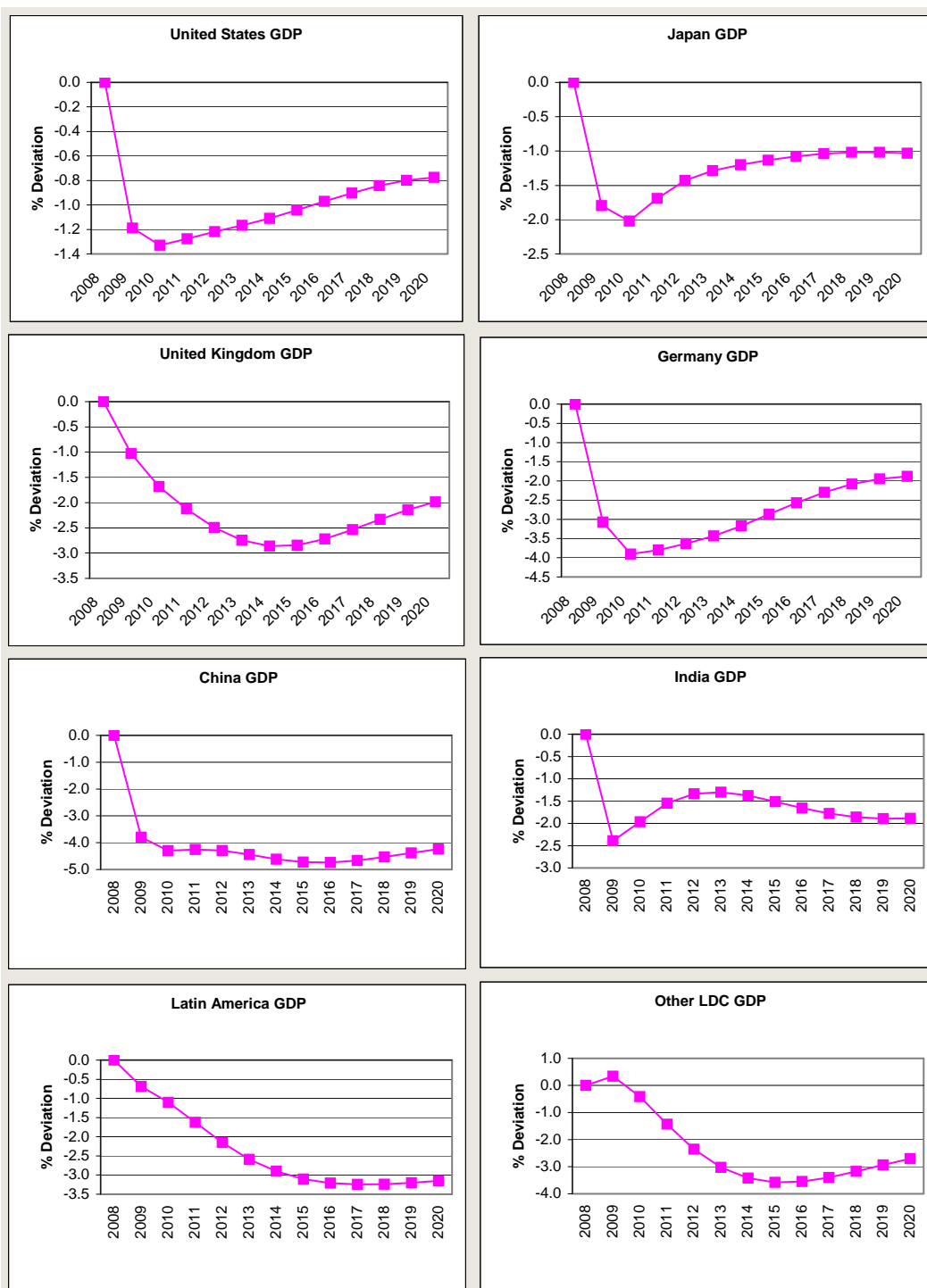
The rise in tariffs by 10 percentage points has a significant negative impact on GDP. The decline in real GDP relative to baseline varies in 2010 between 1.4 percent for the United States to 4.0 percent for Germany. The outcomes reflect the relative openness of the economies and the trade linkages between economies. Overall the effects of a rise in tariffs by 10 percentage points, is to reduce trade by nearly 17% by 2012 (see Chart 5.3).

As tariffs rise, the input costs of industries increase which tends to raise costs and reduce demand in the economy. The rise in relative prices of imports also causes import demand to fall which reduces incomes of the exporting countries. This contraction in global trade and contraction in global incomes is self reinforcing and hence the world economy contracts. There is a reallocation of global capital away from sectors in which tariffs have risen because the return to capital in those sectors is expected to fall because demand for those more expensive goods is expected to fall. There is also a rise in the imported price of capital goods which are traded and therefore the physical amount of capital created from a constant expenditure on investment is less in all economies. This further contracts potential output.

Table 5.4 decomposes the effects of a change in global tariffs into the effects from the change in tariffs from each country or region listed across the columns on each country. Thus in 2011 the tariff scenario reduces US GDP by 1.3 percent below baseline. The impact of the US tariff increase alone on the United States is 0.3 percent in 2011. The US tariff reduces Canadian GDP by 1.8 percent in 2011 which is the major part of the total loss to Canada of 2.2 percent of GDP.

For many countries the effect of a tariff increase alone is to reduce its own GDP. Acting together reduces GDP even more. The favourable demand side impact of diverting demand from imports to domestic goods is found to be outweighed by the increase in the costs of production. This is a very important result from this paper. Tariff increases are not just beggar-thy-neighbour policies but are beggar- thy-self. The reason is because the usual expenditure switching benefits of a rise in tariffs by a country is more than offset by a fall in investment due to rise in the price in imported capital goods and a fall in the return to capital in sectors where protection rises. These two supply

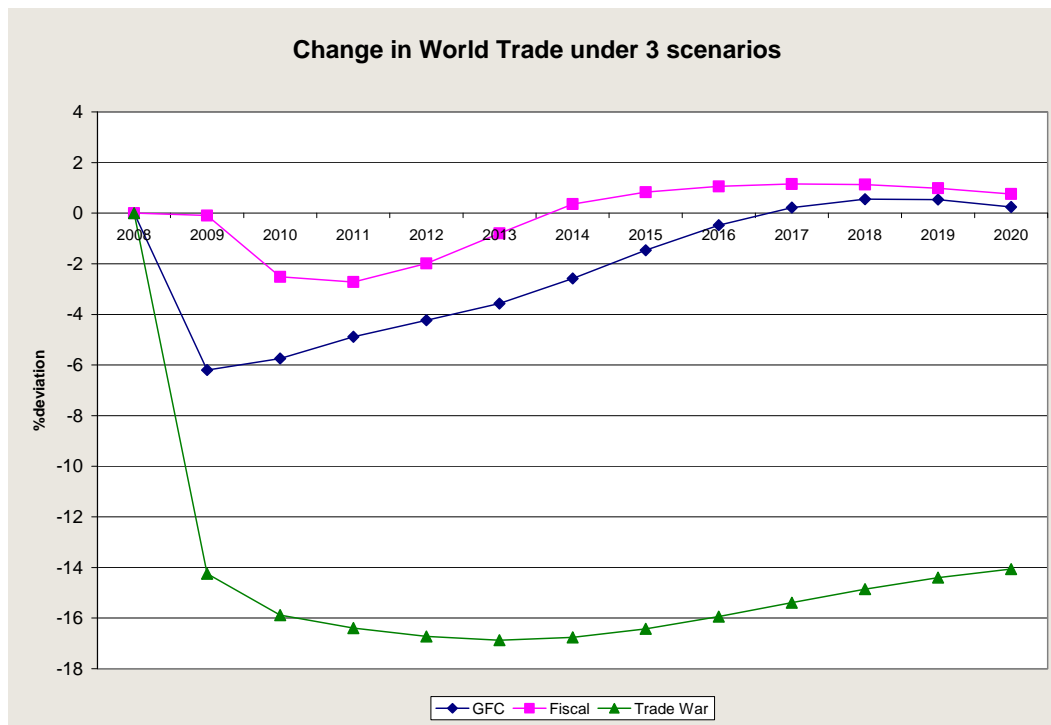
5.2 GDP effects of tariff rise



Data source: G-Cubed model simulations

contracting effects dominate any demand stimulus in the model. Most simple analytical models take aggregate supply as given and therefore the demand switching issue dominates. The supply impact of tariff changes found in the current model is supported by the experience of several decades of substantial expansion in output from countries that unilaterally liberalized trade. In a model with endogenous capital accumulation and international trade in durable capital goods, aggregate output is not fixed either nationally or globally.

5.3 Impact of the GFC, Fiscal Response and Trade War on Global Trade



Data source: G-Cubed model simulations

5.4 : GDP consequences of Tariff Changes by 2011 – percent deviation from baseline

	Source of Tariff Change								
	Global	USA	Japan	Europe ¹	OOECD ²	China	India	EEFSU	ODCs ³
USA	-1.3	-0.3	-0.1	-0.3	-0.3	0.0	0.0	0.0	-0.3
Japan	-1.7	-0.4	-0.6	-0.1	0.0	-0.1	0.0	0.0	-0.4
UK	-2.1	-0.3	0.0	-1.5	-0.2	0.0	0.0	-0.1	-0.1
Germany	-3.8	-0.3	0.0	-2.6	-0.3	0.0	0.0	-0.4	-0.1
Euro Area	-2.9	-0.3	0.0	-1.8	-0.2	0.0	0.0	-0.2	-0.3
Canada	-2.2	-1.8	0.0	-0.3	-0.2	0.0	0.0	0.0	0.1
Australia	-1.4	-0.3	-0.2	-0.3	-0.2	-0.1	0.0	0.0	-0.3
ROECD	-3.7	-0.4	-0.1	-1.7	-1.2	0.0	0.0	-0.2	-0.1
China	-4.3	-0.9	-0.3	-0.3	0.1	-1.1	0.0	-0.1	-1.6
India	-1.5	-0.2	0.0	-0.2	0.0	0.0	-0.6	0.0	-0.5
Other Asia	-3.9	-1.0	-0.2	-0.3	0.0	-0.4	0.0	0.0	-1.9
Latin America	-1.6								
Other LDC		-1.3	0.0	-0.3	0.1	0.0	0.0	0.0	-0.1
EEFSU	-3.5	-0.6	-0.1	-2.0	-0.1	-0.1	0.0	-0.6	-0.1
OPEC	-4.4	-0.9	-0.4	-1.0	-0.2	-0.2	-0.1	-0.1	-1.6

Notes: Source G-Cubed Model;

1. Europe is UK, Germany & Euro Area;

2. OOECD is Canada, Australia and ROECD;

3. ODCs is Other Asia, Latin America, Other LDC and OPEC

6. Insights gained

To represent the effects of the financial crisis on the world economy and trade flows, six elements are needed. For the crisis itself three shocks are needed to capture the observed drop in asset prices and reduction in demand and trade. It is necessary to simulate the bursting of the housing bubble centred in the United States and Europe, but extending elsewhere, rising perceptions of risk by business as reflected in the equity risk premium over bonds and rising perceptions of risk by households.

The policy response has been dramatic. So the analysis has included a monetary easing across the globe and a fiscal stimulus of varying proportions across countries and regions. Also, some trade protectionism has emerged, so far in terms of some tariff increases, some support for industry, such as automobile manufacturers and other effects such as “Buy Local” programs and directives. So a third policy response has been included in the analysis, namely a rise in protectionism. There has also been a rise in financial protectionism, such as directives to banks to lend locally, but absent any estimate of how big this effect is, has not been formally included in this analysis. But financial protection affects capital flows and so would affect trade flows.

Simulating the effect of the crisis itself (that is ignoring the policy responses not already built into the model such as the endogenous monetary policy rule) on the United States alone (the ‘epicentre’ of the crisis) shows several things. Had there not been the contagion across other countries in terms of risk reappraisal, the effects would not have been as dramatic. The adverse trade effects from the United States downturn would have been offset to some degree by positive effects from a global reallocation of capital. Were the US alone affected by the crisis, Chinese investment could have actually risen. The world could have escaped recession. When there is a reappraisal of risk everywhere including China, investment falls sharply – in a sense there is nowhere for the capital to go in a global crisis of confidence. The implication is that if markets, forecasters and policy makers misunderstand the effects of the crisis and mechanisms at work, they can inadvertently fuel fears of a ‘meltdown’ and make matters far worse.

When there is a global reappraisal of risk there is a large contraction in output and trade. The bursting of the housing bubble has a bigger effect on falling consumption and imports than does the reappraisal of risk, but the reappraisal of risk has the biggest effect on investment. Rising risk causes several effects. The cost of capital is now higher and leads to a contraction in the desired capital stock. Hence there is disinvestment by business and this can go on for several years – a deleveraging in the popular business media. The higher perception of risk by households causes them to discount future labor incomes and leads to higher savings and less consumption, fuelling the disinvestment process by business.

The fiscal policy response initially has the desired effect of increasing domestic demand and hence real GDP. While the boost to domestic demand on its own boosts trade there are other effects going on that have an adverse effect on trade. The fiscal stimulus and accompanying borrowing, causes real interest rates to rise over what they would otherwise be. This effect would be diluted if the global economy remained in recession for a long period. However, the natural recovery from the shocks as shown in the results implies that there will be competition by government and the private sector over scarce funds for either private investment or to finance fiscal deficits. The rise in real interest rates (relative to what they would have been) and fall in investment and durable good demand implies that exports fall and do not get back to baseline for several years. For the United States this is takes until 2013 and exports are 6 percent below baseline in 2010. The fiscal stimulus does not apparently help trade largely because of the impact of higher real interest rates on durable goods demand and investment.

So far, cases of rising trade protection have been sporadic as mostly governments have resisted protection refusing to bow to political pressure and protect narrow vested interests. Policy makers are right to be worried about trade protection though, as a resort to widespread protection would make matters much worse. Under WTO rules, countries are legally entitled to put up applied tariffs to bound rates and can invoke 'special' trade measures. If, for example, tariffs were to increase by 10 percentage points, additional falls of real GDP of between 1 and 2 percent below baseline could occur and exports could variously fall by between 5 and 20 percent below baseline for major economies. One of the conclusions of this study is that the crisis and the policy responses, both fiscal expansion and trade protection, all work to discourage exports.

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