



WP/12/81

IMF Working Paper

Trade and Financial Spillover on Hong Kong SAR from a Downturn in Europe and Mainland China

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IMF Working Paper

Asia and Pacific Department

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March 2012

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Abstract

Hong Kong SAR was hit hard by the global financial crisis, which started out in the U.S. and spilled over to the rest of the world. Three years later, vulnerabilities in the euro area's financial system and concerns over a hard landing in Mainland China have started to weigh on Hong Kong's growth prospects. Against this backdrop, this paper aims to quantify the trade and financial spillovers on Hong Kong SAR's economy from a downturn in the euro area and Mainland China. Based on simulations using a version of the Global Integrated Monetary and Fiscal (GIMF) model and a Global VAR (GVAR) that includes both balance sheet and standard macroeconomic indicators, Hong Kong SAR's output growth could fall by as much as 1½ times the decline in euro area output growth given its high dependence on external trade and many links with the global financial system. A worsening of the crisis in the euro area could reduce Hong Kong SAR's output by as much as 4-4½ percent below baseline during the first two years after the shock, pushing Hong Kong SAR back into recession and possible deflation. In the event of a hard landing in China, the model simulations suggest that Hong Kong SAR would be on a sustained downturn with output growth falling by about 3 percentage points below baseline in the first two years. Should these events materialize, countercyclical fiscal response could help cushion, but not fully offset, the impact of slower growth in the euro area or China.

JEL Classification Numbers: C320, C650, D580, F410, F430, F470

Keywords: Macroeconomic Interdependence, Fiscal Policy, Exports, Growth, Global VAR, Applied General Equilibrium Model, Simulation

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I. INTRODUCTION

Hong Kong SAR was hit hard by the global financial crisis, which started out in the U.S. and spilled over to the rest of the world, affecting global trade and financial activity. Hong Kong SAR's GDP growth declined from 6.4 percent in 2007 to 2.3 in 2008 and -2.6 percent in 2009, as advanced economies entered into recession and activity in Mainland China decelerated. Hong Kong SAR was affected both through the trade and financial channels. In 2009, net exports collapsed, shaving 3½ percentage points off growth. The knock-on effect on private domestic demand was not trivial. At the trough around the end of 2008 to early 2009, private consumption has fallen by nearly 6 percent from a year earlier while private investment was around 19 percent lower than the previous year. On the financial side, equity prices plunged almost 60 percent from the 2007 peak, and financial and nonfinancial corporate spreads widened. But the economy recovered shortly after, thanks to a comprehensive set of measures taken by the government, the loose monetary policy stance imported from the U.S., and buoyant activity in Mainland China owing to a large policy stimulus.

Three years after the onset of the global financial crisis, dark clouds are again forming on the horizon. Vulnerabilities in the euro area's financial system and concerns over a hard landing in Mainland China have begun to weigh on Hong Kong SAR's growth prospects. Should these risks materialize, the Hong Kong economy would again be negatively affected.

Against this backdrop, this paper aims to quantify the trade and financial spillovers on Hong Kong SAR's economy from a downturn in Europe and in Mainland China. The analysis is based on simulations using a version of the Global Integrated Monetary and Fiscal (GIMF) model that includes a financial accelerator, and on a Global Vector Autoregression (GVAR) that includes both balance sheet and standard macroeconomic indicators. The paper discusses first the main channels through which Hong Kong SAR could be affected by a slowdown in euro area and China. Second, the paper presents briefly the frameworks used to perform the analysis. Finally, the paper discusses the scenarios and simulation results.

The main conclusions are:

- With its high dependence on external trade and many links with the global financial system, Hong Kong SAR is highly exposed to a worsening economic situation in Europe. We find that Hong Kong SAR's output growth could fall by as much as 1½ times the decline in euro area output growth. In the illustrative scenario considered, a worsening of the crisis in the euro area could push Hong Kong SAR's output by as much as 4-4½ percent below baseline during the first two years after the shock, pushing Hong Kong SAR back into recession and possibly deflation.
- Over the past decade, Hong Kong SAR's economy has become increasingly reliant on the Mainland. A hard landing in the Mainland today would create deflationary forces in Hong Kong SAR's goods, assets, and labor markets. These forces would operate through multiple channels, including trade, financial, and market confidence. In the illustrative scenario considered, the simulations suggest that Hong Kong SAR

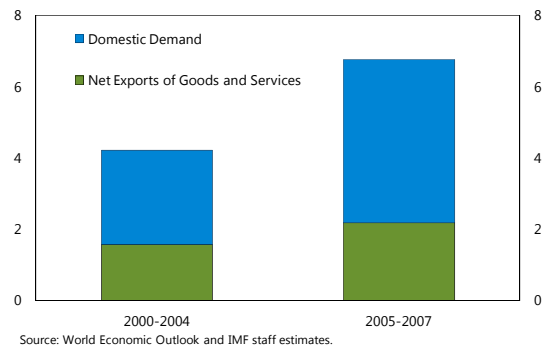
would be on a sustained downturn with output falling by about 3 percentage points below baseline in the first two years.

- Countercyclical fiscal response could help counter the impact of such shocks, though unlikely to fully offset the negative impacts of the decline in euro area and China growth envisaged in the scenarios.

II. REAL AND FINANCIAL LINKAGES

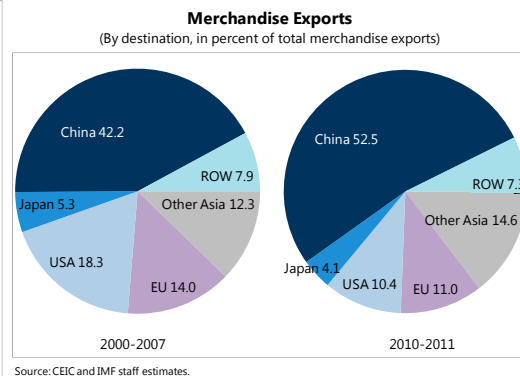
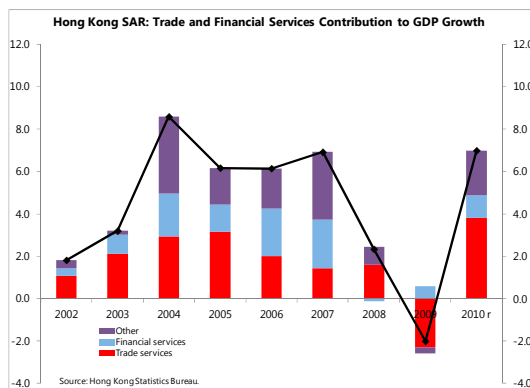
Hong Kong SAR's openness and dependence on external demand in merchandise as well as services and the financial sector mean that a recession in Europe or a hard landing in Mainland China would significantly reduce Hong Kong SAR's exports, employment, consumption, and investment. The following salient facts are used to help approximate the size of the real and financial shocks to Hong Kong SAR's economy from a downturn in Europe and Mainland China that will be fed through the models outlined in section III as well as to help inform the possible impact on the Hong Kong economy.

Hong Kong SAR: Contribution to GDP Growth (in percent)

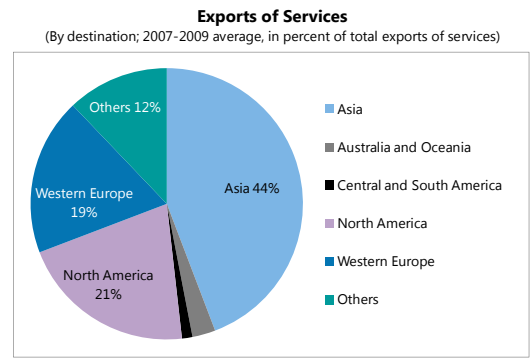


A. Real Sector

- Hong Kong SAR is a major hub for re-exports of goods from Mainland China to more advanced economies like the U.S. and the euro area. Almost all (98 percent) of merchandise exports from Hong Kong SAR are re-exports, the importance of which has also grown (to around 170 percent of GDP in 2010/11, compared with 155 percent during 2005-07). The U.S. and European Union now directly account for 21½ percent of total merchandise exports (down from 32 percent), but this share is biased down by the fact that some of Hong Kong SAR's exports to the Mainland (which makes up for 53 percent of Hong Kong SAR's total exports), are eventually destined to advanced economies. In addition, the 2010/11 figures somewhat overstate the importance of the Mainland relative to Europe or the U.S. given cyclical weaknesses in demand in these advanced economies and the stimulus that was put in place in Mainland China.



- On the services exports side, around 40 percent (mainly transportation, trade-related, and financial services) depend directly on demand from Western Europe, North America, and Australia. This share has been roughly constant over the past several years.

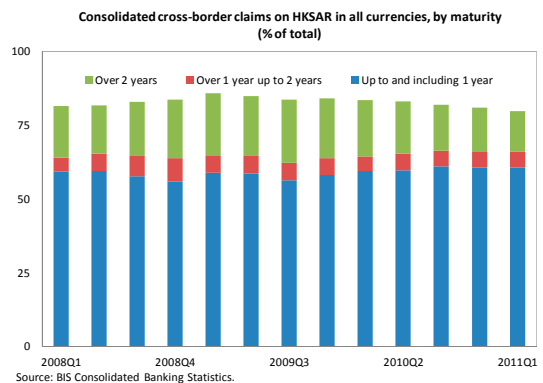
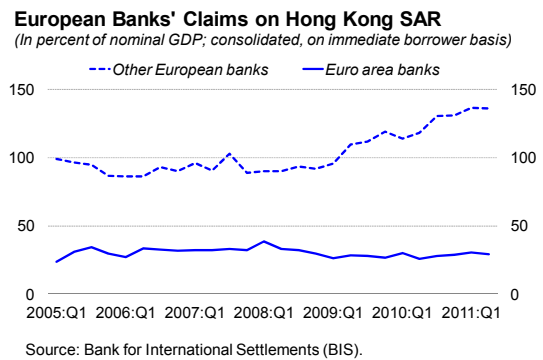


Source: CEIC.

B. Financial Channel

Hong Kong SAR's international financial center status leaves it exposed to shocks that originate in other financial systems.¹

- Total foreign bank claims on Hong Kong SAR's economy are very large, representing 270 percent of GDP in 2011Q2. Meanwhile, Hong Kong banks' claims on other economies are about 380 percent of GDP. Of these foreign bank claims, some are local claims in nonlocal currencies. True international (or cross-border) bank claims on Hong Kong SAR are estimated at around 120 percent of GDP.
- While total European bank claims account for 165 percent of Hong Kong SAR's GDP, the lion share of them belong to UK banks (around 128 percent of GDP as of 2011Q2). Euro area and U.S. bank claims amount to around 30 percent and 26 percent of GDP, respectively.
- Among European banks, those from the euro area have maintained a relatively stable exposure to Hong Kong SAR in recent years. The bulk of foreign banks' international claims on Hong Kong SAR has a short-term maturity.²
- Other European banks have expanded their presence, especially since the

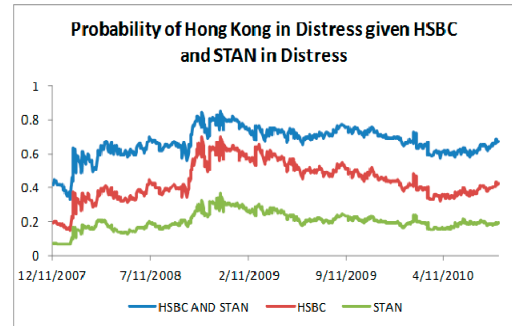


¹ Consolidated foreign bank claims and international claims data are taken from Tables 9A and 9B in BIS (2011).

² About 60 percent of foreign claims are at a one year or less maturity and 6 percent between one and two years. Judging from the maturity of these claims, they are likely to be mostly related to trade credit activities.

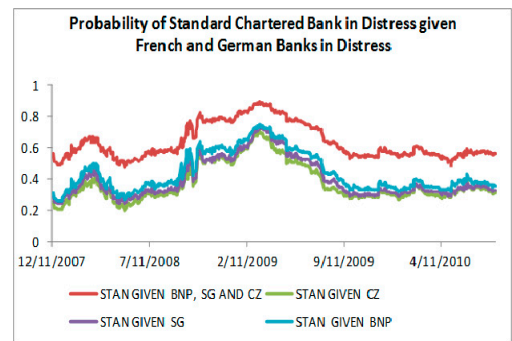
outbreak of the global financial crisis. Of these European banks, UK banks' role has increased the most, especially since the global financial crisis (by over 40 percent of GDP), reflecting the growing importance of large financial institutions, such as HSBC and Standard Chartered. While the majority of their funding sources are local, their importance underscores Hong Kong SAR's vulnerability to shocks that can either originate from or transmit through the UK financial system.

- Analysis of conditional and joint probability of distress based on the methodology developed by Segoviano (2006a and 2006b) and Segoviano and Goodhart (2009) shows a high probability of distress of Hong Kong financial system in the event of distress in large UK financial institutions (IMF, 2010). At the same time, UK banks appear vulnerable to financial distress in core euro area countries, more than they are to financial distress in the periphery.

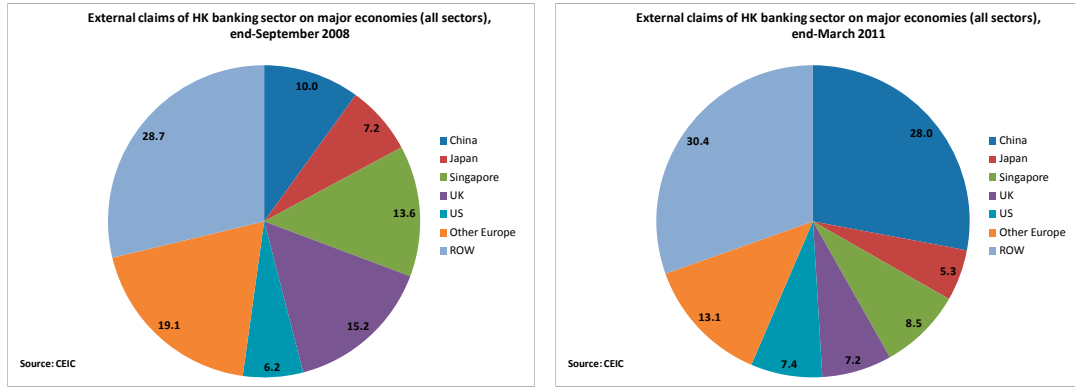


Source: IMF (2010).

- The level of interconnectedness is succinctly displayed in the high correlation of the CDS spreads of systemic banks in Hong Kong SAR, for example Bank of China (Hong Kong) and to a lesser extent HSBC and Standard Chartered, with those of other global banks from the U.S. and euro area.



- On the other hand, Hong Kong banks have reduced their direct exposure to Europe quite substantially since 2008, with claims falling from about 35 percent to about 20 percent of total claims (or 77 percent of GDP). This shift in the composition of Hong Kong banks assets also reflects the growing importance of Mainland China and its offshore credit needs. As of the first half of 2011, Hong Kong banks' total exposure to Mainland China is estimated at around 200 percent of GDP, up from about 67 percent of GDP in 2007. Banking for China's dynamic financial and corporate sectors is a fast growth business for Hong Kong banks. Between the end of 2010 and June 2011, for example, the growth rate of gross Mainland China credit exposure came in at just under 40 percent after it nearly doubled in 2010 (see Fitch Ratings, 2011).
- Hong Kong banks' increased exposure to the Mainland make them vulnerable to a hard landing in China, but tight credit underwriting standard and an extensive credit risk mitigation mechanism should help mitigate the risks to the banking system. For example, a sizable fraction of the foreign currency lending to Mainland entities are guaranteed by some of the largest Mainland banks or collateralized in the form of funds deposited at Mainland banks (including the subsidiaries of the Hong Kong bank that undertook the lending).



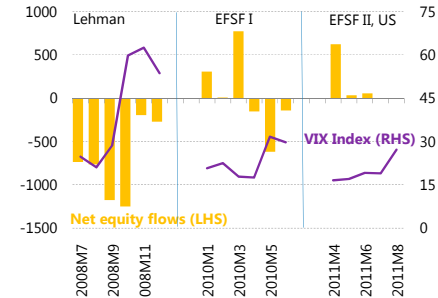
To sum up, while tighter financial conditions in the euro area would spill over to Hong Kong SAR, there are a few mitigating factors, e.g., (i) euro area banks are not systemic lenders in Hong Kong SAR, (ii) some retrenchment in euro area banks' activities has already been observed in the region, particularly in the loan syndication market, (iii) lending in Hong Kong SAR is largely funded locally with a relatively low loan-to-deposit ratio, and iv) where specialization is not critical, other regional (and Mainland) lenders would likely step in to provide credit but at higher spreads. Nevertheless, it is likely that a worsening of the European situation would affect Hong Kong banks largely through its impact on global funding markets. For instance, some banks in Hong Kong SAR could face disruptions to their dollar funding base and would have to shrink their business accordingly (particularly foreign agency lending), potentially leading to a reduction in credit. This is similar to what happened in 2008–09. To prepare against the possibility of a liquidity crunch, Hong Kong regulators have already required some banks to more closely match the tenor of their loan portfolio with their funding sources.

Portfolio Flows

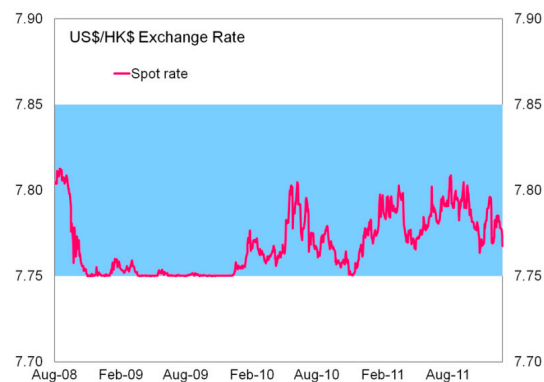
Predicting the direction of capital flows in the event of a crisis in the euro area is not a straightforward exercise. But, the Lehman episodes as well as the EFSFI and EFSFII episodes could provide some insights.

Net Equity Flows: ETFs and Mutual Funds

(USD million)

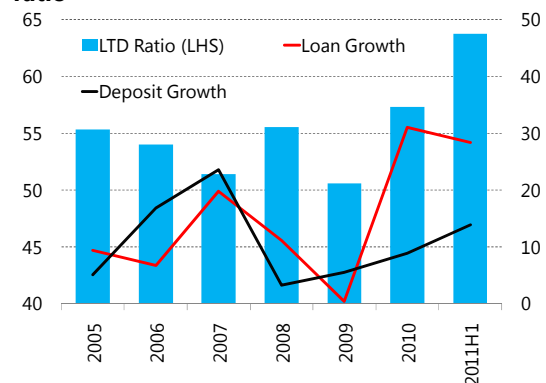


Sources: CEIC; and Bloomberg.



- In the summer of the Lehman collapse, there were large net portfolio inflows into Hong Kong SAR, and the exchange rate was trading around the middle of the convertibility zone (of 7.75 to 7.85). The financial turmoil that followed the demise of Lehman was then marked by a large episode of portfolio outflows, reducing net inflows by over \$700 billion from 2008Q4 to 2009Q4. At the same time, other inflows (i.e., mostly bank-related) saw an increase of HKD 1.15 trillion, part of which were related to the extraordinary monetary policy measures taken by the U.S. federal reserve to stem the effects of the Lehman shock. These inflows caused the Hong Kong dollar to hit the strong side of the convertibility zone.
- The most recent periods of intense financial turmoil (EFSFI and EFSFII), where the Fed's role was less prominent, confirms the story for portfolio flows: Hong Kong SAR would likely experience large portfolio outflows when global risk aversion spikes, barring further extraordinary liquidity measures. The main challenges going forward are not only limited room to further policy easing (both fiscal and monetary) in the U.S. and in Europe, but the heightened risks of a slowdown in the Mainland from a property market correction and the hangover from the extraordinary credit expansion of the past three years. Although the VIX index is still below the levels of 2008Q4 or 2010Q2, equity flows have already slowed appreciably.
- Lower equity prices could affect investment and consumption through wealth and balance sheets effects. In fact, estimates of these effects could be economically significant. For example, Kuralbayeva and N'Diaye (2006) find that in Hong Kong SAR every one dollar decline in share prices reduces private consumption by approximately two cents through wealth effects; while Peltonen, et al. (2009) find based on panel of 14 economies (including Hong Kong SAR) that a 10 percent decrease in stock prices is associated with a 0.29 to 0.35 percent increase in consumption.

Licensed Banks: Deposit and loan growth (year-on-year percent change) and Loan-to-deposit ratio

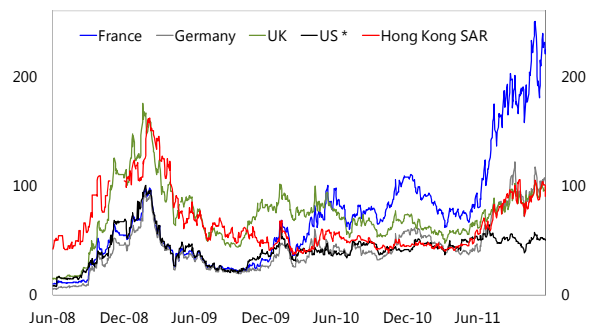


Source: CEIC.

Sovereign Contagion

Hong Kong SAR's public sector balance sheet has been consistently strong, reflecting the city's conservative approach to fiscal policy. Fiscal surpluses have averaged around 2½ percent of GDP over the past 5 fiscal years without a single year in deficit (even during fiscal year 2008/09). This performance mainly reflects Hong Kong SAR's ability to control expenditure in the face of high

Sovereign CDS spread
(In bps, 5-year Senior, USD)



Note: * EUR denominated
Sources: Bloomberg

revenue volatility (given heavy reliance on investment income and revenue from land sale). Despite Hong Kong SAR's healthy fiscal position, its sovereign CDS spreads have spiked during the recent crisis episodes and tracked those of the UK rather closely, most likely reflecting high degree of interconnectedness to UK banks.

The propagation of shocks through the trade and financial channels will be captured in the general equilibrium simulations presented below. These simulation models are calibrated based upon the historical patterns of financial and trade spillovers between the country blocks in the model. While disruptions to the dollar funding base are not explicitly featured in the frameworks used for the simulations, the effects such disruptions could have on Hong Kong credit markets and financial conditions are captured by widening the spreads in Hong Kong SAR in response to the tighter financial conditions in the euro area. This financial linkage across regions is present in the data, as displayed above, and we calibrate the credit spread response from past correlations.

III. FRAMEWORKS

Two frameworks are used to gauge the potential spillovers to Hong Kong SAR of a downturn in Europe and Mainland China: the GIMF and the GVAR.

A. Overview of the GIMF

Details of the model's equations are available in Kumhof and Laxton (2009), but we provide a brief summary of the main features.

The model includes unions, manufacturers, capital, investment and consumption goods producers, distributors, households, the government, and banks. Each economy is populated with two types of households: overlapping-generations households and liquidity-constrained households. The main difference between these two types of households is that the latter do not have access to financial markets, and hence are unable to consume more than their after-tax income each period. Both types of households consume retail outputs and supply labor to unions. Households with access to financial markets hold domestic currency denominated bonds issued by their government or banks, and foreign currency denominated bonds.

Labor Market

There is a wide variety of labor supplied by unions. Unions buy labor services from households and sell them to manufacturers at a premium. Imperfect substitutability between the varieties of labor provides the unions with market power over manufacturing firms. Unions face nominal rigidities in their price setting behavior.

Goods Market and Trade

The production of final consumption and investment goods starts with manufacturers producing tradables and nontradable goods using physical capital rented from entrepreneurs, labor from unions, and energy from global market. The manufacturing goods are then sold to domestic distributors and import agents who operate in foreign economies—this is the first layer of multilateral trade (intermediary goods). Distributors combine domestic and foreign-

produced tradable goods with public infrastructure to produce an output that will be used in the production of domestic consumption and investment goods, and will be exported abroad—this is the second layer of multilateral trade (final goods). Investment goods producers sell their final composite to entrepreneurs and the government; consumption goods producers sell their final composite to the government; and retailers sell their output to households.

Manufacturers and distributors face nominal rigidity in price setting, while retailers and importers are subject to real rigidities since it is costly to rapidly adjust their sales volume. Manufacturers are also subject to real rigidities in capital accumulation.³ The model's wide range of rigidities in labor and product markets implies that prices are higher than they would be under a more competitive environment (prices are set as a markup over marginal costs in these markets).

Entrepreneurs and Banks

Entrepreneurs purchase a capital stock from capital producers, who are subject to investment adjustment costs, and they then rent this capital to manufacturers. Entrepreneurs finance their capital holdings using a combination of external and internal financing—that is with loans from banks and their own cash flow. They are subject to a capital income tax, face idiosyncratic shocks that affect the value of their capital at each period, and decide of the level of capital utilization. Entrepreneurs that encounter adverse shocks can have the value of their capital fall beyond a certain level, finding themselves unable to service the loans that they contracted to buy the capital. Those entrepreneurs are considered bankrupt. In such a case, banks recover only a proportion of the value of their assets, with a recovery rate that is stochastic.

Capital producers produce the capital stock that entrepreneurs rent to manufacturers in the non tradable and tradable sectors. Capital producers pay dividends to households in the form of lump sum transfers from their profits. To produce the capital stock these capital producers buy previously installed capital from entrepreneurs and increment it by the flow increase in the capital stock provided by investment goods producers. The previously installed capital stock that they use each period depends on the capacity utilization rate that entrepreneurs have chosen to employ.

Financial Sector

Banks lend funds to entrepreneurs by borrowing from households (through deposits) and charging entrepreneurs a premium—the external finance premium or spread—depending on their riskiness and the perceived state of the economy. A lower external finance premium reduces the cost of capital and, thus, increases the demand for loans from banks. The total amount of capital that is purchased by entrepreneurs increases leading to higher profits and more dividends paid to households. This, in turn, raises private consumption. At the same time, the higher capital utilization rate, the lower cost of financing, and the increased net

³ For more details, see N'Diaye, Zhang and Zhang (2010).

worth of the entrepreneurs feeds through into higher aggregate investment. The higher path for output, net worth, and asset prices further lowers the external finance premium creating a feedback process to increased credit growth, higher asset prices and faster output. This is at the core of the financial accelerator mechanism in this modeling framework.

Monetary Policy

Monetary policy is characterized in two ways: either there is a clear commitment to stabilizing output growth and inflation under a flexible exchange rate regime (employing a Taylor rule approach to setting short-term interest rates; or the monetary authority maintains a managed float exchange rate regime whereby smoothing exchange rate fluctuations becomes an additional objective of monetary policy. At the extreme under a fixed rate regime, such a monetary policy can be directed at stabilizing the exchange rate (as in the case of Hong Kong SAR). Monetary policy has real effects in this model because of the layers of nominal rigidities that are assumed. These nominal rigidities are compounded by real rigidities in labor hiring, capital investment, imports of investment and consumption goods, distribution, and retail sales.

Fiscal Policy

Fiscal policy matters both in the short term and in the longer term in the GIMF because the model has four key assumptions that imply non-Ricardian features: (i) households have finite economic lifetime which makes them incorporate in their spending decisions only the effects of fiscal policies that are likely to occur during their lifetime; (ii) some of the households are liquidity constrained and are forced to consume all their after-tax income every period; (iii) households' labor productivity declines with age, which implies a higher discount rate for future labor income tax than otherwise; and (iv) labor and consumption taxes are distortionary because they affect labor effort and spending behavior. Fiscal policy aims at stabilizing the debt-to-GDP ratio over the long term by controlling spending or levying taxes. Public spending on investment is productive, providing longer-term output benefits. Governments levy lump-sum taxes, a consumption tax, a labor income tax, and a capital income tax.

Calibration

The model has been calibrated building on the work done in conjunction with HKMA staff.⁴ In terms of the monetary framework, it is assumed that emerging Asian countries block peg their currencies to the U.S. dollar, while all other regions follow a floating exchange rate regime. For economies where the exchange rate is allowed to float, monetary policy aims at stabilizing output and inflation.

⁴ See N'Diaye, Zhang, and Zhang (2010) for more details.

B. GVAR

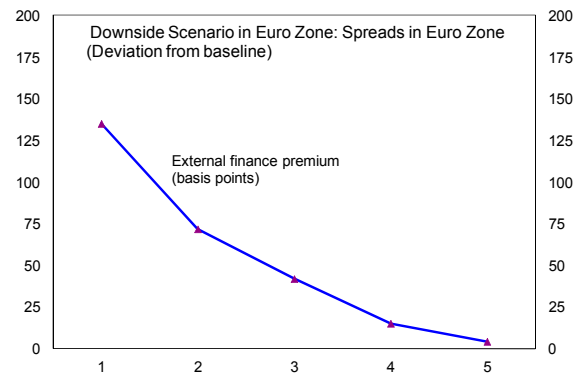
The GVAR provides a dynamic multi-country framework suitable for the analysis of interdependence and international transmission of shocks. The GVAR model comprises 30 countries—21 advanced and 9 emerging—and is based on Chen et al. (2010). The model has real and financial variables: industrial production (a proxy for GDP), real effective exchange rate, real money market rate, real share prices, and a measure of potential financial stress (the asset-weighted average expected default frequency of banks and nonfinancial corporates). The latter captures the role of credit in the transmission of financial and real sector shocks. Monthly data are used (Jan 1996–Dec 2008). Given China’s rapidly changing economic structure, an estimated model like the one used here cannot speak to the long-term impact of shocks or changing policies. Balance sheet quality is captured through estimated default probabilities (EDFs); the EDFs have predictive power on the strength of credit growth one year ahead (the unconditional correlation between credit growth and one-year lagged EDF is around -0.5), even though credit is highly influenced by official actions in China.

IV. SCENARIOS

Two scenarios are envisaged: (i) a downturn in euro area activity owing to a further deterioration in the European sovereign debt crisis and (ii) a hard landing in Mainland China.

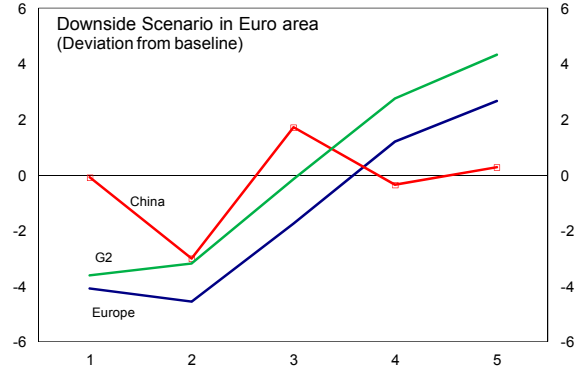
A. Illustrative Scenario of Euro Area Financial Distress

This illustrative scenario assumes that euro area economies are unable to restore confidence and banks are forced to realize losses from holdings of public debt and general macroeconomic fallout. These losses would erode capital and to restore it, banks would be forced to contract credit by about \$250 billion reflected in average credit spreads increasing by about 150 basis points relative to baseline (with some countries at the periphery facing larger increases in spreads than others in the core of the euro area).⁵ This tightening in financial conditions and further deterioration in the business environment in the Euro Area would persist for two years and then fade away gradually over the following three years as balance sheets adjust and deleveraging works through the financial system. Widening spreads in Europe will affect the rest of world given the global financial inter-linkages. Credit spreads increase in the U.S. by about 50 basis points (about a third of the rise in European spreads) because of the relatively limited net exposure of U.S. banks to European banks.



⁵ The assumed decline in credit and associated rise in credit spread is about half the amount assumed in the WEO 2012 update downside scenario.

With interest rates near zero in many advanced economies, it is assumed that policy interest rates have little room to react in the euro area and in the United States. In addition, the deterioration in fiscal positions following the 2008–09 response to the global financial crisis means that there is also no room for additional discretionary fiscal policy response. In China, on the other hand, there is ample room to loosen fiscal policy. The scenario assumes that the Chinese authorities implement a fiscal stimulus of around 3½ percent of GDP for the first two years and gradually unwind that stimulus during the following three years. Despite this fiscal response China’s growth still falls by 3 percentage points below the baseline in the second year following the shock.



In the euro area, tighter financial conditions and deteriorating business environment would initially lead firms to lower investment spending and shed labor. Private consumption would drop as labor market conditions worsen. Euro area’s import demand from the rest of the world would therefore decline. The rest of the world demand for the euro area’s exports also falls as global trade slumps and the Euro appreciates in real effective terms. Financial conditions tighten in the U.S. as banks curtail lending in order to protect their balance sheets.

Weaker growth in the euro area and deteriorating prospects for future profits reduces the net worth of firms—reflected in falling stock prices—which in turn depresses their collateral value and further lowers domestic demand in an adverse feedback loop.

The impact on Hong Kong SAR’s trading partners’ growth would be substantial. Output would fall by around 4 percent below baseline during the first two years in the euro area alone. G2 output would decline by 3 percent from baseline during the same period. Meanwhile, China’s output would be insulated the first year as government spending helps cushion the impact of the downturn in the euro area. In the second year, however, output contracts by around 3 percent below baseline as we assume no new stimulus is put in place while growth in euro area and the rest of the world remains depressed. Part of the contraction in output growth in China would stem from lower demand for China’s exports and part from weaker domestic demand, particularly investment. Investment in China weakens because the outlook for manufacturing firms activity and future profits worsen, their net worth deteriorate, the risk premium rises, and financial conditions tighten. Weaker growth prospects feed through to lower employment and hence consumption.

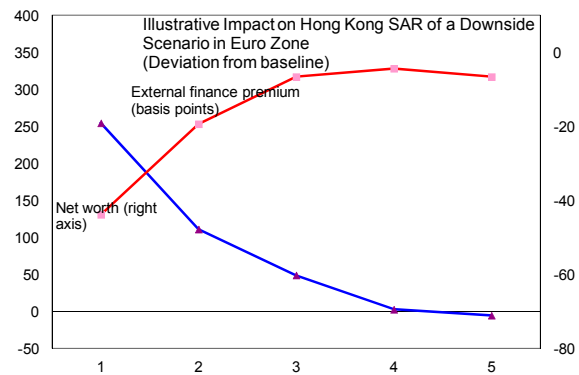
Spillover to Hong Kong SAR

Financial distress in the euro area would spill over to Hong Kong SAR both through the trade channel and the financial channel. While the transmission through the trade channel is fully captured in the model, the financial transmission channel is less so. In the GIMF, external shocks to trade affect domestic financial conditions through the impact trade has on growth, profit opportunities, employment, and hence corporates and households net worth. But this

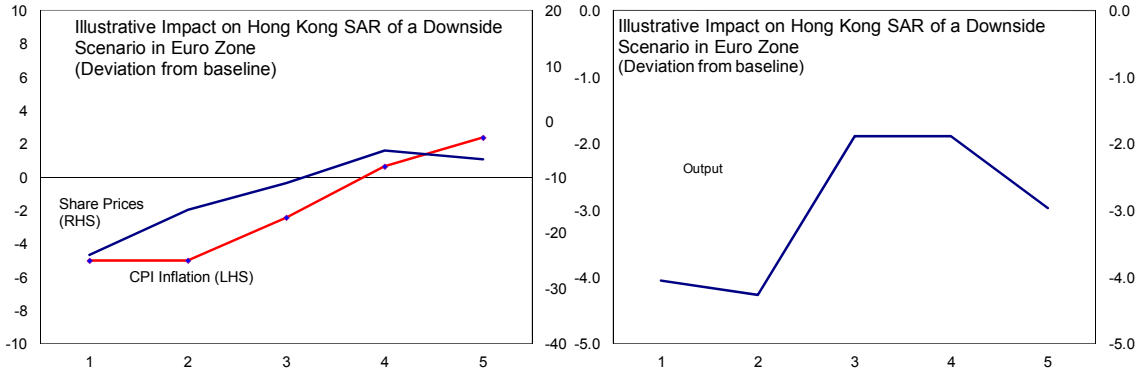
channel is an indirect one. Direct impacts of exchange rates and interest rates fluctuations on wealth—valuation effects—are also captured. However the model does not capture general confidence effects associated with financial disruptions and correlation across asset market that typically rise during times of distress. To capture this, we assume the shocks are correlated across regions with the correlation coefficient determined by the size of the financial linkages (exposure to euro area) between regions. The model does not however capture the impact tighter interbank markets conditions could have on credit conditions faced by corporates.

Lower demand for Hong Kong SAR's exports to the euro area and other trading partners would cause Hong Kong SAR's investment, profits, labor market and private consumption to fall. Imports would collapse (by about 10 percent below baseline) as a consequence. This initial shock would then be amplified through a financial accelerator mechanism. The

expectation of a fall in future profit and growth would reduce the corporate sector's net worth by about 40 percent below baseline in the first year, depressing stock prices by 20 percent and with it the value of the corporate sector's collateral. This reduced availability of collateral, in turn, further decreases credit leading to lower domestic demand, particularly for investment. Falling stock prices also weigh down on private consumption through the standard wealth effect. Falling demand then leads consumer price inflation to decline by as much as 5 percentage points below baseline, effectively pushing the economy into deflation.



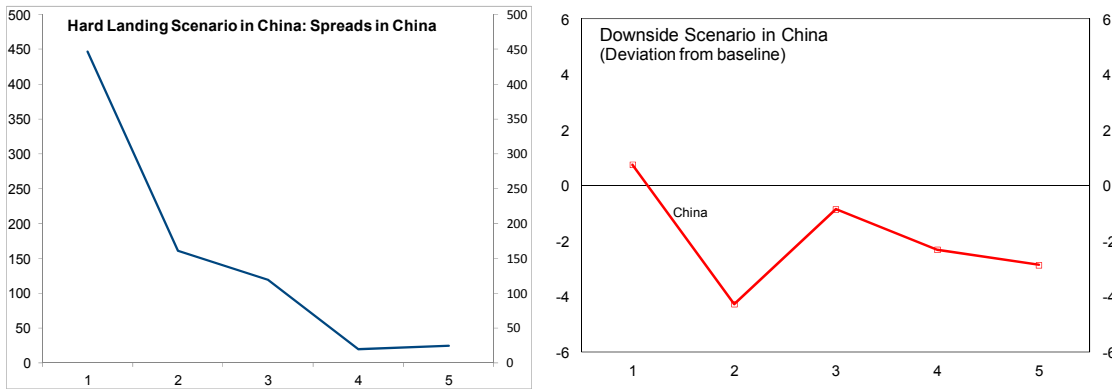
Without policy response, Hong Kong SAR's output loss would be significant at 4-4½ percent below baseline during the first two years, pushing Hong Kong SAR back into recession for the second time in three years. Even five years later Hong Kong SAR would not get back to pre-crisis output levels. The process of adjustment back toward steady state during the first five years takes place rather speedily for private consumption and investment, but weaknesses in trading partners' activity delays the complete return to trend growth. Adjustment would be quicker if the Hong Kong government were able to put in place a substantial fiscal policy response, similar to the one implemented in the aftermath of the 08/09 global financial crisis, to boost domestic demand and compensate for sluggish external growth. The size of the response would depend on whether the rest of the world implements a fiscal package or not given Hong Kong SAR's high openness. It is likely many emerging economies would have enough fiscal space to put in place a package in response to the slowdown while advanced economies outside of the euro area will likely not have room.



B. Illustrative Scenario of Mainland Hard Landing

GIMF Model

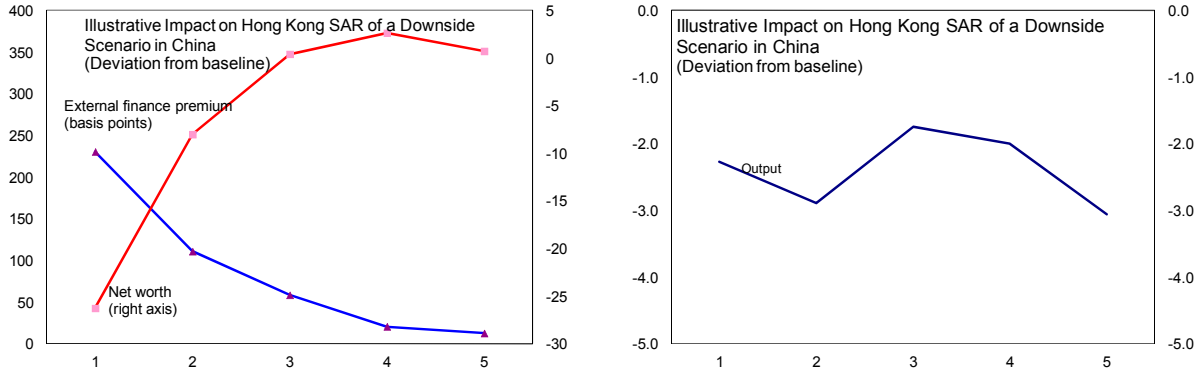
In this scenario, a collapse of the property market causes a sizable portion of credit to local government financial platforms, the real estate sector, and small and medium enterprises to become impaired. As a result of such losses, financial conditions tighten in China with credit spreads surging by 450 basis points. This initial shock lasts for two years and fades away gradually over time. It is also assumed that the Chinese government’s ability to respond through credit pump priming is limited during the first two years, owing to worsening bank balance sheets. The end-result of these credit losses would be to cause the Mainland economy to contract by roughly 4¼ percent by the second year.



Such a weakening of activity in the Mainland would have significant effects on activity in Hong Kong SAR both through the trade and the financial channels. Through trade, the mechanism at play would be similar to the one described in the scenario where an external shock emanate from Europe with the exception that services trade (not captured in the GIMF) would also be hit. Spillovers from financial channels would be compounded by the fact that Hong Kong SAR’s financial institutions have a large presence on the Mainland and provide services to Mainland corporations, the quality of which is likely to deteriorate markedly under this hard landing scenario.

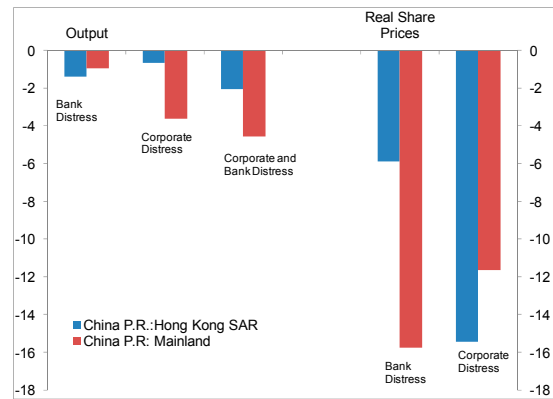
Worsening growth prospects in Hong Kong SAR would depress employment, consumption, investment, and credit demand from households and corporations in both Hong Kong SAR

and the Mainland entities. Hong Kong Corporations’ net worth and equity markets would decline, which would further depress private consumption and investment spending. Overall, Hong Kong SAR would be on a sustained downturn with output falling by about 3 percentage points below baseline in the first two years.



GVAR

The GVAR sheds further light on the potential impact financial distress in China’s corporate sector could have on Hong Kong SAR’s economy in the short term.⁶ Indeed, a deterioration in the quality of Chinese nonfinancial and financial corporations could have substantial effects on Hong Kong SAR, with the ultimate impact on Hong Kong output possibly 1¼ times larger than the effect such shocks could have on China’s output (in the case of financial corporation distress). Share prices would also be affected in both economies. These results highlight the strong trade and financial linkages between the two economies.



V. CONCLUSIONS

The analysis above has shown that a renewed global slowdown or hard landing in Mainland China pose significant risks to Hong Kong SAR’s economy. As a highly open, international financial center, Hong Kong SAR would be hit hard, possibly falling into recession and deflation, as such shocks spill through both trade and financial channels. Nevertheless, Hong Kong SAR’ strong fundamentals including its sizable fiscal reserves, proactive financial regulatory environment, and prudently managed banks leave it well placed to handle even very large shocks.

⁶ The large size of the services sector reduces somewhat the appropriateness of industrial production as a proxy for output in Hong Kong SAR. Nevertheless, the correlation between GDP growth and industrial production growth remains high at about 0.82 (during 2006-2011).

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APPENDIX. STRUCTURE OF GVAR

The structure of the GVAR model can be summarized as the follows.⁷ Consider $N+1$ economies, indexed by $i = 0, 1, 2, \dots, N$, and a vector \mathbf{x}_{it} of k_i domestic variables for each economy. Stacking the vectors of country-specific variables,

$$\mathbf{x}_t = \begin{pmatrix} \mathbf{x}_{0t}' & \mathbf{x}_{1t}' & \dots & \mathbf{x}_{Nt}' \end{pmatrix}, \quad (1)$$

a VAR in \mathbf{x}_t would contain too many parameters to be estimated if the time dimension T of the data is not much larger than the number of economy N . Instead of regressing $\mathbf{x}_{i,t}$ on

$$\mathbf{x}_{-i,t} = \begin{pmatrix} \mathbf{x}_{0t}' & \mathbf{x}_{1t}' & \dots & \mathbf{x}_{i-1,t}' & \mathbf{x}_{i+1,t}' & \dots & \mathbf{x}_{Nt}' \end{pmatrix}, \quad (2)$$

without restriction, the GVAR links $\mathbf{x}_{i,t}$ to a $k_i^* \times 1$ vector $\mathbf{x}_{i,t}^*$, where

$$x_{\ell it}^* = \sum_{j=0}^N \omega_{\ell ij} x_{\ell jt}, \quad \ell = 1, 2, \dots, k_i^*. \quad (3)$$

The weight ω_{ij} captures the spillover effect of variable l of foreign economy j on variable l of domestic economy i . Since ω_{ij} measures the relative importance of economy j to economy i , the spillover effect of variable l is in proportion to the weight chosen to measure the relative importance. Therefore, each economy's component of GVAR is given as a VARX* (p_i, q_i) :

$$\mathbf{x}_{it} = \mathbf{a}_{i0} + \mathbf{a}_{i1} \cdot t + \sum_{s=1}^{p_i} \mathbf{\Phi}_{is} \mathbf{x}_{i,t-s} + \sum_{s=0}^{q_i} \mathbf{\Lambda}_{is} \mathbf{x}_{i,t-s}^* + \sum_{s=0}^{r_i} \mathbf{\Psi}_{is} \mathbf{d}_{t-s} + \mathbf{u}_{it} \quad (4)$$

$$\text{with } u_{it} \sim \left(0, \sum_i\right)^{iid},$$

where \mathbf{d}_{t-s} is the observed common factor of $q \times 1$ dimension and $\mathbf{\epsilon}_{it}$ is *iid* across time.

Country-specific vector $\mathbf{x}_{i,t-s}^*$ reflects interdependence among economies and serves as a proxy for the unobserved common effects across economies. The country-specific foreign variables and common factors are treated as weakly exogenous (if confirmed by statistical tests), i.e., they are “long-run forcing” country-specific domestic variables. The term “long-

⁷ Based on Chen and al. (2010).

run forcing” means that in the equations for foreign variables, the coefficients on the error-correction terms are set to zero. The dynamics of foreign variables are not influenced by deviations from the long-run equilibrium path, in contrast to the dynamics of domestic variables.

The VARX* can be estimated economy by economy using the ordinary least squares (OLS) method or rank-reduced approach if the cross-dependence of the idiosyncratic shock is sufficiently small, that is:

$$\sum_{j=0}^N Cov(\varepsilon_{lit}, \varepsilon_{sjt}) / N \rightarrow 0, \quad (5)$$

all $i \neq j$, l and s .

From equation (3), it can be seen that

$$\mathbf{z}_{it} = \mathbf{W}_i \mathbf{x}_t \quad i = 1, 2, \dots, N \quad (6)$$

Where $\mathbf{z}_{it} = (\mathbf{x}'_{it} \quad \mathbf{x}^*_{it})$ and \mathbf{W}_i is an appropriately defined weighting scheme. Thus, stacking (4) across i , the endogenous variables can be solved for in a global system:

$$\mathbf{G} \mathbf{x}_t = \mathbf{a}_{i0} + \mathbf{a}_{i1} \cdot t + \sum_{s=1}^p \Phi_s \mathbf{x}_{t-s} + \sum_{s=0}^r \Psi_s \mathbf{d}_{t-s} + \mathbf{u}_t \quad (7)$$

thus

$$\mathbf{x}_t = \mathbf{G}^{-1} \mathbf{a}_{i0} + \mathbf{G}^{-1} \mathbf{a}_{i1} \cdot t + \mathbf{G}^{-1} \sum_{s=1}^p \Phi_s \mathbf{x}_{t-s} + \mathbf{G}^{-1} \sum_{s=0}^r \Psi_s \mathbf{d}_{t-s} + \mathbf{G}^{-1} \mathbf{u}_t \quad (8)$$

Where $p = \max\{p_i, q_i\}$, $r = \max\{r_i\}$, and

$$\mathbf{G} = \begin{pmatrix} A_0 W_0 \\ A_1 W_1 \\ \vdots \\ A_N W_N \end{pmatrix}, \quad \mathbf{H}_s = \begin{pmatrix} B_{s,0} W_0 \\ B_{s,1} W_1 \\ \vdots \\ B_{s,N} W_N \end{pmatrix}, \quad \mathbf{u}_t = \begin{pmatrix} u_{0,t} \\ u_{1,t} \\ \vdots \\ u_{N,t} \end{pmatrix}. \quad (9)$$

Equation (8) is a VAR for the complete set of domestic variables for all economies.

The advantage of the GVAR model is that it makes the estimation of (8) feasible by accounting for interdependence among economies and then estimating the partial system on a economy-by-economy basis, which implies allowing for modeling a large number of economies. The impulse response is computed based on (8).

The vector for domestic variables is given by:

$$\mathbf{x}_{it} = \left(edfb_{it} \quad edfn_{it} \quad r_{it} \quad y_{it} \quad p_{it}^s \quad q_{it} \right)$$

(10)

where $edfb_{it}$ denotes the logarithm of asset-weighted average expected default frequency (EDF) of banks and $edfn_{it}$ for (nonfinancial) corporates, r_{it} is the real money market rate, y_{it} is the logarithm of industrial production, p_{it}^s the logarithm of real share price index, and q_{it} is the logarithm of the real effective exchange rate.

The vector for foreign variables for each economy except the U.S. is given by:

$$\mathbf{x}_{it}^* = \left(edfb_{it}^* \quad edfn_{it}^* \quad r_{it}^* \quad y_{it}^* \quad p_{it}^{s*} \right) \quad (11)$$

We do not construct foreign effective exchange rates to minimize the number of parameters to be estimated, since information about foreign economies' currency is captured in the (trade-weighted) real effective exchange rate q_{it} .

The foreign variable for the U.S. is constructed as:

$$\mathbf{x}_{us,t}^* = y_{us,t}^* \quad (12)$$

Given the large influence of the U.S. financial variables on global markets, the U.S. foreign financial variables are less likely to be weakly exogenous for the U.S. domestic variables. That is the main reason we do not include the U.S. foreign financial variables in the equations for the United States.

The spot oil price is included as a common factor d_{t-s} to remove the common component in the reduced form residuals. Another candidate for inclusion as a common factor could be the index of global stock price volatility VIX, to ensure that the EDF shocks are purely idiosyncratic. However, because the VIX is driven by volatility in U.S. share prices, it is not weakly exogenous to the U.S. variables. Adding it separately will not augment the information content of the model.

Equations (3) and (4) show that the spillover effect of a foreign variable on a domestic variable is proportional to the weight ω_{ij} , which measures the relative importance of economy i to economy j in the transmission. Since the transmission channels for financial variables are likely to be different from the transmission channels for the variables measuring real activity, we use financial weights to construct foreign financial variables—EDFs, real money market rate, share price index and real effective exchange rate—and trade weights for industrial production.