

External Risks and Macro-Financial Linkages in the ASEAN-5 Economies

Tng Boon Hwa¹

Economics Department
Bank Negara Malaysia

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Abstract

Using an SVAR approach, I examine spillovers of 3 distinct external shocks in the ASEAN-5 economies – global demand, commodity price and global financial stress. I find that these external influences drive a majority of the variation in both output and prices in all the economies, although their relative importance varies across countries. An adverse external demand shock leads to lower output and prices, with the output effects proportionate to the level of trade openness. Commodity prices are inflationary and lead to lower output, except in Malaysia and Indonesia where output initially benefits from net exports of primary food and fuel commodities. An adverse external financial shock spills over to domestic financial markets, leading to a lower supply of domestically sourced funds and, consequently, to lower output and prices. In countries with large external liabilities and open financial sectors, such as Singapore, an external financial shock affects output more directly, through a lower supply of externally sourced funds and the performance of the sector itself.

JEL Classification: E30, E44, G10

Key Words: External shocks; Financial spillovers; Small-Open Economies

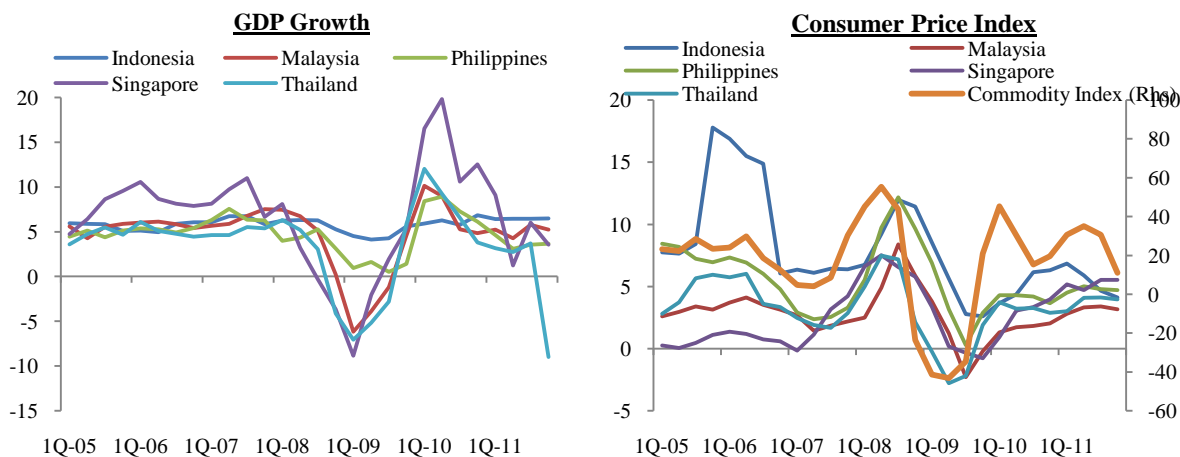
¹ This paper was prepared for the 2012 Bank Negara Malaysia Economics Research Workshop. The views expressed here are mine and do not represent those of Bank Negara Malaysia. I would like to thank Fraziali Ismail, Ahmad Razi, Mohamad Hasni Sha'ari and Ahmad Othman for helpful comments. I am also grateful to Chew Mei Lien and Lim Wei Meen for providing superb research assistance. All remaining errors and omissions are mine. Correspondence: boonhwa@bnm.gov.my

1. Introduction

The global economic environment in recent years can be characterized within three themes. First, financial markets have undergone periodic episodes of stress, notably the Global Financial Crisis (GFC) and sovereign debt related tensions in the Euro Area. Secondly, global commodity prices have been volatile with at least two episodes of sharp increases in the last decade. Finally, real growth especially in the advanced economies has been markedly slower and accompanied by bouts of higher inflation.

Small-open economies (SOEs) such as the ASEAN-5 countries have also been affected by these aspects of the global environment, despite playing little to no role in their occurrences. Figure 1 plots growth and inflation in the ASEAN-5 countries. It is clear that GDP growth contracted in 2008-2009 during the GFC and global recession while inflation has been volatile in tandem with the recent global commodity price cycle. Yet, the confluence of the financial episodes, weaker external demand and high commodity prices in such close succession with each other raises the question of how each of these factors have affected SOEs. Arguably, all three of these aspects of the external environment pose downside risks to growth.

Figure 1. GDP Growth and Inflation in the ASEAN-5 Economies (yoy, %)



Source: Haver and International Monetary Fund (IMF)

Understanding the distinct effects of each of the external risks is an ever-present concern to policymakers in SOEs. To illustrate, the monetary policy response to slower growth caused by a pure external demand shock is arguably more straightforward than if slower growth was caused

by a financial crisis in the advanced economies. Addressing risks arising from the latter scenario may require additional targeted measures to manage spillovers to domestic financial markets to complement conventional counter-cyclical policies. Therefore, prescribing the correct policies in response to external shocks requires a deep understanding of their effects on the economy and the transmission mechanisms.

This paper is motivated by the spillover of external shocks to SOEs, of which 3 are focused on: global demand, global financial and commodity prices. I adopt a Structural Vector Autoregression (SVAR) approach and use the ASEAN-5 countries as case studies to address two main issues. First, I estimate the effects of external shocks on the economy and analyze their overall importance relative to other country-specific influences in driving the performance of SOEs. Second, I examine more closely the role of financial channels in the transmission of external financial shocks to real economic activity, and document how country-specific characteristics influence the strength of different transmission mechanisms. This paper builds from the existing open-economy VAR literature by using Financial Stress Indices (FSIs), continuous indicators of stress in financial markets, to reflect financial cycles in global financial markets and in the ASEAN-5 countries. Through the FSIs, the SVAR model captures in a parsimonious manner distinct features of financial episodes, such as the underlying level of risk appetite and uncertainty, globally and domestically.

I find that a majority of the variation in output and prices are driven by external shocks in all the countries, although the individual effects and relative importance differ across countries. An external demand shock leads to lower output with effects that are proportionate to the country's level of trade openness. Commodity prices are inflationary and lead to lower output. Malaysia and Indonesia are outliers – their output initially benefit from higher commodity prices. I argue that this is jointly because these countries are net exporters of primary food and fuel commodities, and because global demand for these commodities is relatively price inelastic in the short-run. An adverse external financial shock causes domestic output and prices to decline. I find that in economies with low external liabilities relative to domestic liabilities, such as Indonesia and Malaysia, the effects of external financial shocks on domestic output manifests by spilling over to domestic financial markets and disrupting the supply of financing. In contrast, Singapore's large external exposure and the size and openness of its financial sector means that

an external shock affects output more directly, through a lower supply of externally sourced funds and the performance of the sector itself.

The remaining paper is organized as follows: Section 2 explores the transmission channels of external shocks to small-open economies. In section 3, I describe the methodology. I begin by describing the variables used before detailing the SVAR model and discussing some estimation issues. The results are presented in section 4. The last section concludes.

2. External Shocks in Small-Open Economies: The Transmission Mechanisms

2.1 External Demand and Commodity Prices

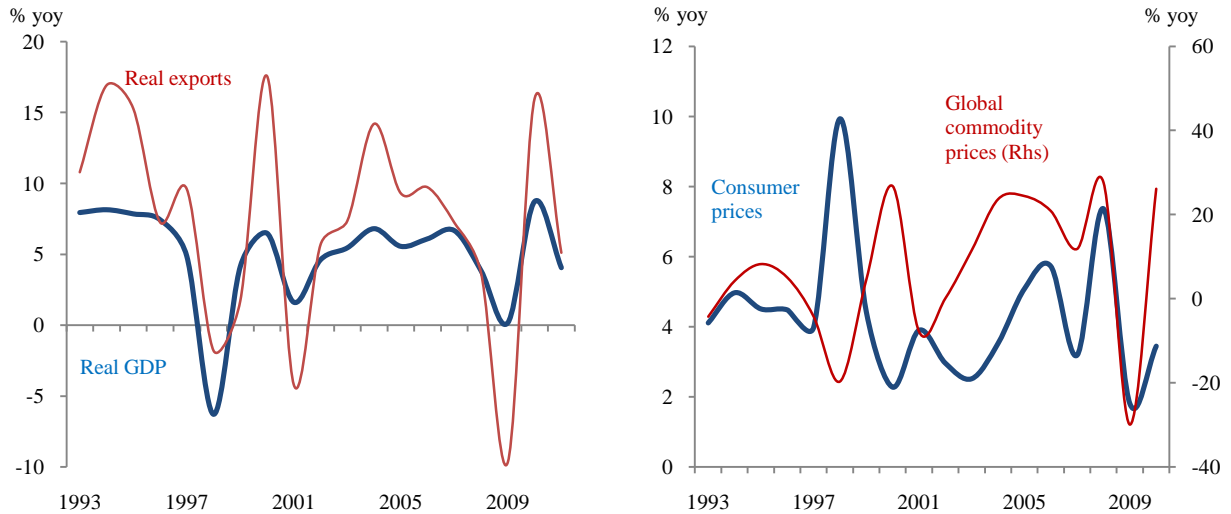
The transmission of external demand and commodity price shocks to small-open economies (SOEs) can be gleaned through conventional open-economy IS-LM frameworks. In the IS equation, output is a function of past and expected future output, the natural and real interest rate, the exchange rate and foreign demand. Output benefits from foreign demand through the exports channel. In the open economy Philips curve, inflation is modeled as a function of past and expected future inflation, output, the exchange rate and commodity prices. An increase in output leads to higher demand-driven inflationary pressures. Inflation is thus affected by external demand indirectly through its influence on domestic output. Higher commodity prices, whether driven by demand or idiosyncratic supply-side shocks, causes higher inflation by positively affecting the cost of production inputs which are passed on to the price of final goods².

Figure 2 depicts these aspects of the transmission for output (left figure) and prices (right figure) in the ASEAN-5 countries. The left figure illustrates a high degree of co-movement and pro-cyclicality between ASEAN-5 GDP and exports. Two periods of slow growth seem to coincide with noted external demand shocks – the technology bubble burst in 2001 and the Global Financial Crisis in 2008-2009. These episodes led to a recession in the US economy and the global economy as well during the latter episode. The figure on the right plots a global commodity price index consisting of fuel and non-fuel commodities with consumer prices in the ASEAN-5 countries. Again, there is a clear pro-cyclical relationship between commodity prices and consumer prices in the ASEAN-5. The exception was the Asian Financial Crisis (AFC) in

² The external influences on output and prices in open-economies are discussed in detail in Svensson (2000) and Genberg (2005)

1998 when consumer prices increased while commodity prices moderated. This was because the large exchange rate depreciations during this period led to higher imported inflation.

Figure 2. Exposure of the ASEAN-5 Economies to External Demand and Commodity Prices



Source: Haver and International Financial Statistics

Note: The variables are the average year-on-year growth of the ASEAN-5 countries. Global commodity price is an index of commodity prices that comprises of food, fuel and raw metals.

2.2 The Financial Channels

The transmission mechanisms of external financial episodes to SOEs are more numerous. External financial episodes can manifest by affecting external demand and consequently SOEs through the trade channels, as described previously. In addition, the transmission through financial markets occurs by affecting the access to financing and delays in expenditures amid higher economic uncertainty.

2.2.1 Access to Financing

Borrowing premiums can increase under financial stress due to weaker balance sheet positions and higher information asymmetries in financial markets, which exacerbate the

perverse effects of adverse selection and moral hazard³. From the perspective of borrowers, the financial accelerator mechanism posits that an adverse shock lowers their net worth and the value of their collateral. This leaves desired borrowers faced with higher financing premiums and credit rationing during episodes of financial stress (Bernanke & Gertler, 1989; Bernanke, Gertler, & Gilchrist, 1999). Meanwhile, the bank capital and lending channels emphasize the role of lenders. Adverse financial shocks erode banks' capital base through lower profits, losses on existing loans and other assets on their balance sheets, and forcing them to reduce lending (Bernanke & Gertler, 1992; Kashyap & Stein, 1995; Van Den Heuvel, 2002). Through these mechanisms, higher borrowing costs resulting from weaker balance sheet positions during periods of financial stress reduces the supply of funds from the banking system. This forces firms to reduce capital expenditures and households to reduce spending on durable goods⁴. Moreover, since the balance sheet positions (of lenders and borrowers) are focal points in these mechanisms, they apply similarly to bond markets and non-depository lending intermediaries as well.

In equity markets, the Tobin's q mechanism depicts how financial stress can affect the cost of equity and suppress economic activity (Tobin, 1969). This mechanism establishes a positive link between equity prices and capital investments by relating the market value of firms to the replacement cost of capital goods. Since stock prices decline during periods of stress, the market value of firms relative to their cost of capital goods also declines. As a result, firms need to issue more stocks relative to other periods when their market value is higher. This depresses fund raising in equity markets and leads to a concurrent decline in capital investments.

Since funds can be sourced from domestic and foreign financial markets, economies with higher external liabilities (reliance on international financial markets for funds) are more vulnerable through these channels during external financial episodes. If the external shock spills over to domestic financial markets, the supply of domestic funds is potentially affected as well

³ Adverse selection occurs when investors demand a rate of return equivalent to the average observable credit risk. This prices out more credit worthy borrowers and leaving only "low-quality" borrowers in the market (Stiglitz & Weiss, 1981). Moral hazard arises when lenders cannot observe how the borrowed funds are going to be used. If potential creditors think that firms will use borrowed funds for high risk investments that benefit shareholders in good outcomes but hurt them (creditors) in bad outcomes, they will demand a higher rate of return commensurate with the excess risk-taking that creditors think borrowers will potentially undertake (Jensen & Meckling, 1976).

⁴ See Dell'Ariccia, Detragiache and Rajan (2008) and Mendoza and Terrones (2008) for other selected examples of empirical studies that address the relationship between credit and real economy.

through similar channels within the domestic economy. Figure 3 shows how the size and composition of financing in the ASEAN-5 economies have evolved since the AFC in 1997. The corresponding country-specific figures are presented in Appendix 1. Two broad trends are worth noting here: First, total financing as a percentage of GDP has been declining, from an average of 269% of GDP during 1997-2001 to 257% of GDP during the most recent period of 2007- 2010. Second, the region's *direct* exposure to external financial markets has been declining, from an average of 29% of total financing from 1997-2001 to 19% from 2007-2010. Note, however, that a decline in *direct* exposure does not necessarily imply a lower total exposure of financing conditions to the external environment, as *indirect* exposures through domestic capital markets have increased in tandem with higher foreign capital inflows vis-à-vis foreign participation in domestic capital markets. This is illustrated in Figure 4 showing an increase in portfolio liabilities in the ASEAN-5 economies over the past decade, with the exception of Philippines. Through this indirect channel, an external financial shock that triggers capital outflows from domestic capital markets will result in a deterioration of financing conditions as domestic asset prices decline and bond yields increase.

Uncertainty

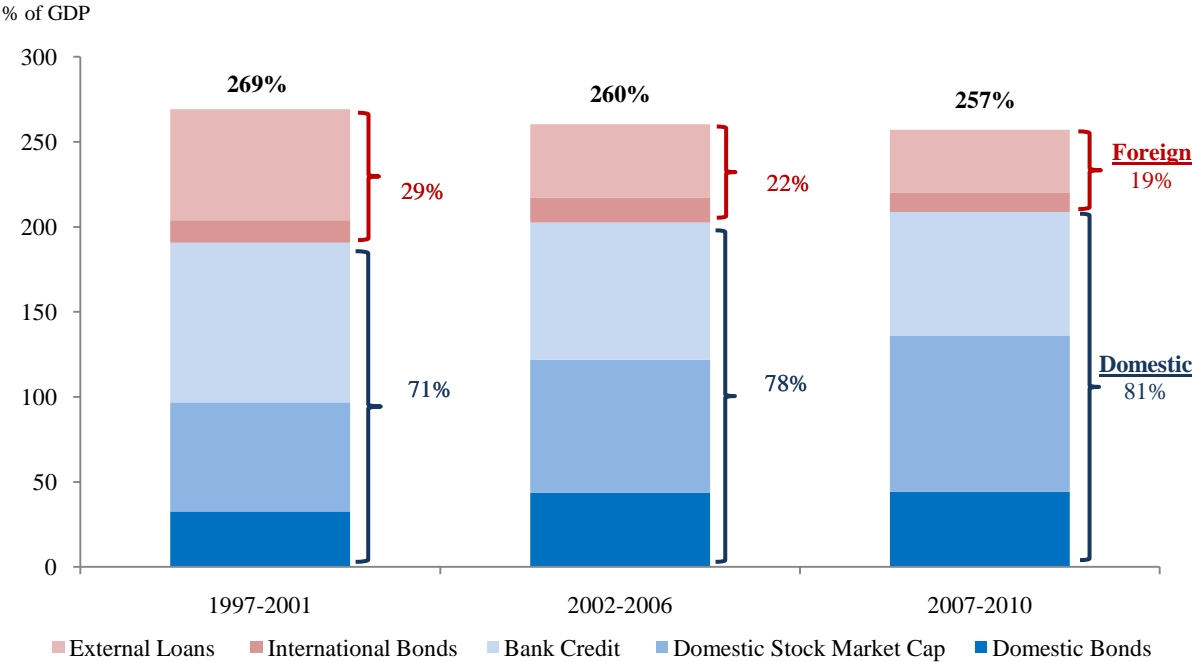
Financial stress can also be transmitted to the economy through higher uncertainty in financial markets and the economic outlook. Hakkio and Keaton (2009) distinguishes between two types of uncertainties – uncertainty over the fundamental value of financial assets and uncertainty over the behavior of other investors – and note that they are reflected in higher asset price volatility which increase with financial stress. To the extent that this volatility reflects economic uncertainties, financial stress induces firms to delay hiring and investing amid uncertain demand conditions, and consumers to delay spending amid uncertain employment and wealth statuses.

Bloom (2009) measures uncertainty shocks using actual and implied volatility of the Standard & Poor's index, and estimates its effects on the US economy in an unrestricted VAR and a structural model of firm investment. In both cases, he finds a sharp fall, a rebound and an overshoot in employment, output and productivity⁵. He explains that hiring and investment levels

⁵ For instance, industrial production falls rapidly for 4 months, rebounds after 7 months and subsequently overshoots before its effects gradually dissipates approximately 3 years after the uncertainty shock.

initially fall rapidly as firms hold back on planned projects and adopt a wait-and-see approach. Lower employment and investment by the high productivity firms then cause a corresponding fall in productivity. As uncertainties dissipate, an overshoot occurs as firms react to pent-up demand for capital and labor, causing an overshoot in productivity as well. From a household perspective, Lee, Rabanal and Sandri (2010) estimate a 3 variable VAR and find that uncertainty shocks lead to hump-shaped declines in household wealth and consumption over approximately two years.

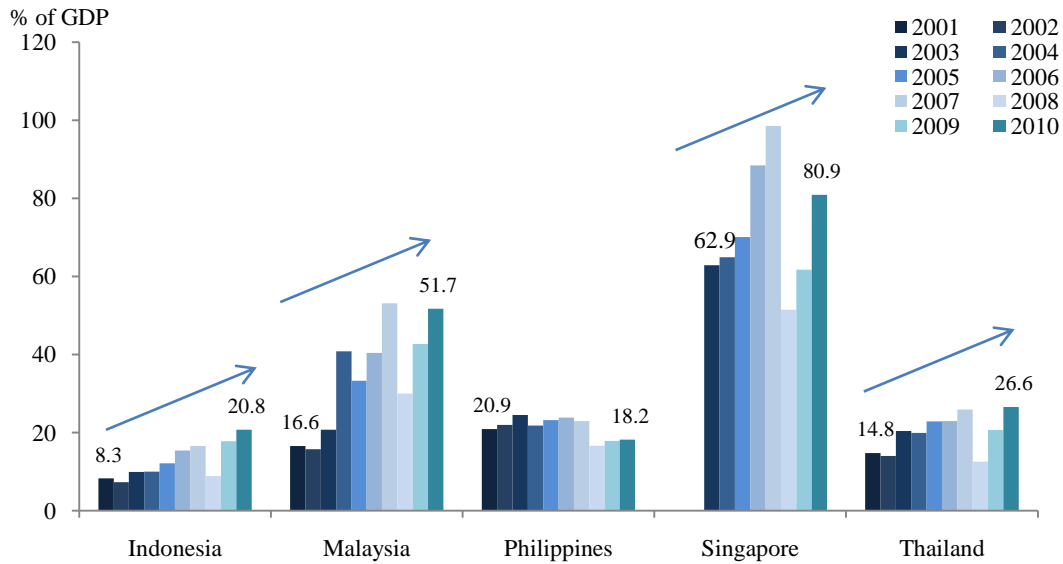
Figure 3. Major Sources of Funds in the ASEAN-5 Economies



Source: Author’s calculations based on data from International Financial Statistics, World Federation of Exchanges, Bank for International Settlements

Note: Figures in black are total outstanding funds as a percentage of GDP. Figures in red and blue on the side of the bar charts are the relative sizes of funds sourced from foreign and domestic markets.

Figure 4. External Portfolio Liabilities in the ASEAN-5 Economies (International Investment Position)



Source: Haver

3. Methodology

This study adopts a Structural Vector Autoregression (SVAR) approach and draws from recent efforts that study the linkages between financial stress and economic activity. Representative papers are Li and St-Amant (2010), Davig and Hakkio (2010), Hollo, Kremer and Duca (2011), Mallick and Sousa (2011) and Roye (2011). Here, composite indices are used to reflect underlying conditions in financial markets. The indices used vary across studies, but all reflect stress in major segments of financial markets through a decline in asset prices, higher volatility in asset prices and higher bond yields/spreads. Using these indices, the authors then estimate the effects of financial stress on the economy through VAR models. However, this analysis has thus far concentrated on large developed economies, particularly the Euro Area countries and United States, perhaps unsurprisingly given the recent financial episodes there. I extend from this literature to a small-open economy setting for the case of the ASEAN-5 countries of Indonesia, Malaysia, Philippines, Singapore and Thailand. Specifically, I include both external and country-specific variables to account for the exposure of small-open economies to the external environment.

3.1 Data

The variables used for econometric analysis are listed in Table 1. Three variables characterize the external environment: A global commodity price index (GCP), a world industrial production index (IPI_w) and a financial stress index for the US economy (FSI_{us}). GCP measures global commodity prices in the food, fuel and metal categories. IPI_w measures world industrial production to capture the global demand conditions. This global measure is preferred to the more commonly used US focused indicator (either US industrial production or GDP) to implicitly account for the diversification ASEAN-5 trade away from the US economy over the past decade. In addition, focusing on US demand alone risks erroneous identification of the commodity shocks, as high commodity prices are increasingly being attributed to strong demand from large emerging markets such as China.

Table 1. List of Variables used for Estimation

| Variable | Abbreviation | Definition | Source |
|------------------------|--------------|---|---|
| <u>External</u> | | | |
| Commodity prices | GCP | Commodity price index (sa, log) | International Monetary Fund |
| World output | IPI_w | World industrial production index (sa, log) | CPB Netherlands Bureau for Economic Policy Analysis |
| US Financial stress | FSI_{US} | US Financial stress index | Hakkio and Keaton (2009) |
| <u>Domestic</u> | | | |
| Output | IPI | Industrial production index (sa, log) | International Financial Statistics |
| Prices | CPI | Consumer price index (sa, log) | International Financial Statistics |
| Interest rate | IR | Short-term interest rate | International Financial Statistics |
| Real credit | C | Bank credit, deflated by CPI (sa, log) | International Financial Statistics |
| Exchange rate | EX | Nominal effective exchange rate (log) | Bank for International Settlements |
| Financial stress | FSI | Financial stress index | Tng, Kwek and Sheng (2011) |

The final external variable is an index of financial stress for the US economy, FSI_{us} , which proxies for global financial conditions. Financial episodes do occur in other countries as well, especially in emerging markets. However, Kaminsky and Reinhart (2003) find that financial episodes commonly remain confined within their regions unless they first spillover to the major financial centers. This suggests that financial markets in the ASEAN-5 countries are unaffected by financial episodes that originate outside from the region, and that spillovers to the region only

occur to the extent that major financial markets are affected. Therefore, I do not measure financial stress in other emerging markets and assume that stress in US financial markets aptly reflect global financial conditions.

The remaining six variables characterize the domestic environment: the industrial production index (IPI) captures real economic activity, the consumer price index (CPI) reflects the price level, the short-term interest rate (IR) is the monetary policy instrument, Credit (C) is claims from the domestic banking system, and the exchange rate (EX) is the nominal effective exchange rate. The last variable, an index of financial stress (FSI), is a summary indicator of stress in financial markets and follows from the methodology in Tng, Kwek and Sheng (2012)⁶. This index comprises of indicators of stress in major segments of domestic financial markets – the banking sector, foreign exchange market, bond market and equity market. The market-specific indicators of stress are then weighted according to their markets' relative sizes, as reflected by the amount of financing outstanding in each of the market segments.

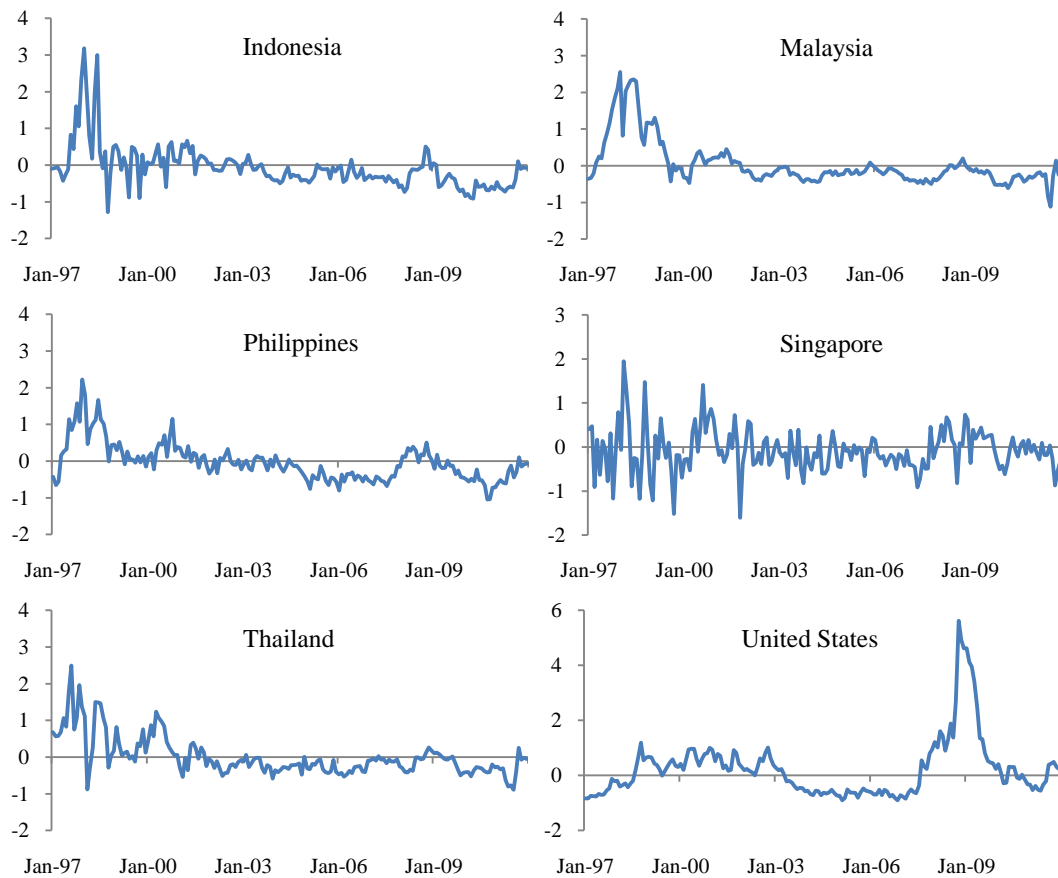
The FSIs for the ASEAN-5 economies and the United States are depicted in Figure 5. The variables are standardized prior to aggregation. Thus, a value of 0 reflects neutral financial conditions, high values reflect financial stress and low values reflect tranquility in financial markets. The FSIs show that higher stress in the ASEAN-5 countries was historically seen during three periods. In order of severity, they are the Asian Financial Crisis (1997-1998), the technology bubble burst in the US (2000-2001) and the recent Global Financial Crisis (GFC) (2008-2009). Compared with the FSI_{us} , the regional FSIs suggest that the latter two episodes were external in origin, while the AFC was a country-specific and regional episode⁷. Recently, financial stress in the ASEAN-5 economies all displayed tentative yet noticeable increases of stress at the end of 2011, coinciding with events in the US and the Euro region that may have spilled over to the region's financial markets⁸.

⁶ The only difference is the weights are updated every quarter instead of annually.

⁷ See Tng, Kwek and Sheng (2012) for a discussion of financial stress in the ASEAN-5 economies during these three financial episodes.

⁸ For instance, US Congress agreed at the last minute to raise the government's debt ceiling to US\$2.4 trillion to prevent a default on US sovereign debt in August 2011. Despite this development, the credit rating of US sovereign debt was still downgraded by Standard & Poor's in the same month. In the Euro Area, stresses in the second half of 2011 revolved around a loss of confidence by markets on the Euro Area policymakers to resolve the debt crisis. Some events of significance include the 109 billion Euro bailout package plan for Greece in July, and the agreement amongst the European Union countries to a 50% write-down of Greek debt and the increased leverage of the European Financial Stability Fund to 1 trillion Euros.

Figure 5. Financial Stress in the ASEAN-5 Economies (1997-2011)



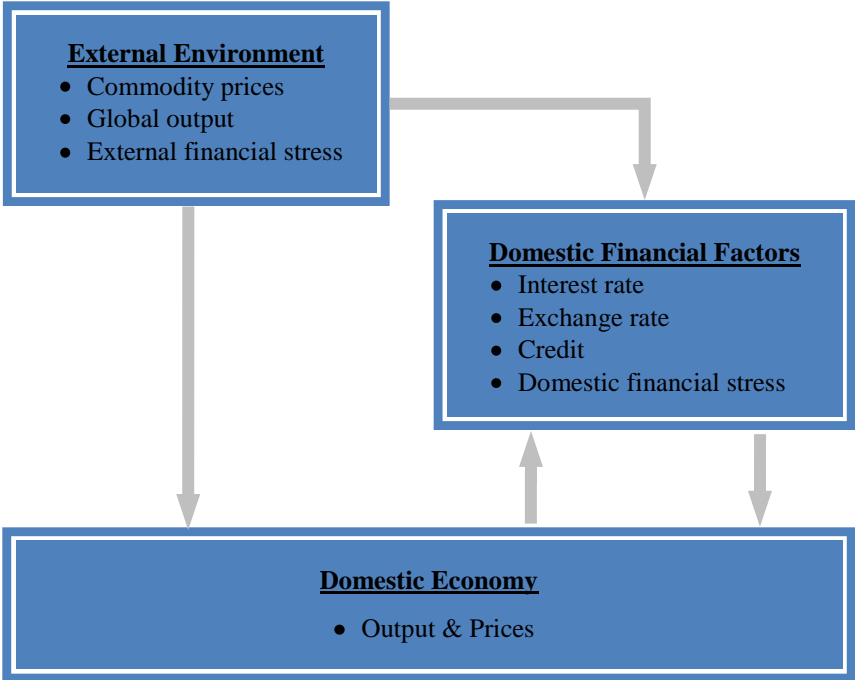
Source: Author's calculation

3.2 The Econometric Model

A Structural Vector Autoregression (SVAR) approach is used to assess the influence and transmission mechanisms of external shocks in the ASEAN-5 countries. A schematic of the structure and causality assumptions of the estimation framework is illustrated in Figure 6. Output and prices in small-open economies are influenced by two groups of determinants. The first group reflects the external environment and is represented by commodity prices, global demand and global financial conditions. The second group of determinants characterizes domestic financial markets, which is represented by a short-term interest rate, the exchange rate, credit and an indicator of financial stress. Since the countries are small-open economies, they are assumed to be affected by but do not affect the external environment.

Domestic output and prices are directly affected by the external environment through the trade and price channels. There are also indirect effects through domestic financial markets. Monetary policy, as reflected by the interest rate, may react to external conditions, which in turn affect domestic financial conditions, output and prices. Meanwhile, movements in capital flows influenced by external financial episodes may induce changes in the exchange rate and domestic asset prices. This consequently affects the terms of trade, wealth and financing conditions, which all have effects on prices and real economic activity. The financial accelerator mechanism also operates to amplify the initial direct effects of external shocks through interactions between the real economy and domestic financial markets. To illustrate, a firm, whose profits and net worth have deteriorated due to an adverse external shock, may experience a lower access to desired funds through higher financing premiums. Similarly, an adverse external shock that reduces the wealth of a household may also leave it faced with higher premiums. In both cases, the inability to obtain desired funds leads to lower investment activities and purchases of durable goods.

Figure 6. Schematic Illustration of the Causality Assumptions in the SVAR Model



The following SVAR model is estimated individually for each of the ASEAN-5 economies:

$$AX_t = B(L)X_{t-1} + \varepsilon_t$$

X is a vector of variables with a similar ordering as Table 1. The matrix A contains the contemporaneous structural parameters. $B(L)$ is a matrix polynomial in the lag operator, L . ε_t is the vector of structural disturbances, such that:

$$\varepsilon_t = Ae_t$$

e_t is a vector of residuals from the corresponding reduced-form VAR. The equations can be organized into the external and domestic blocks. Structural shocks are identified using the approach suggested by Sims (1986), Bernanke (1986) and applied by many others thereafter, by placing restrictions on the contemporaneous parameters. That is, restrictions are placed on the matrix A to identify the disturbances and parameters of the underlying structural model from the reduced-form VAR. The assumptions made on A are:

$$\begin{bmatrix} \varepsilon_{GCP} \\ \varepsilon_{IPIw} \\ \varepsilon_{FSIus} \\ \varepsilon_{IPI} \\ \varepsilon_{CPI} \\ \varepsilon_{IR} \\ \varepsilon_C \\ \varepsilon_{Ex} \\ \varepsilon_{FSI} \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ a_{21} & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ a_{31} & a_{32} & 1 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & a_{54} & 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & a_{64} & a_{74} & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & a_{74} & a_{75} & a_{76} & 1 & 0 & 0 \\ a_{81} & a_{82} & a_{83} & a_{84} & a_{85} & a_{86} & a_{87} & 1 & 0 \\ a_{91} & a_{92} & a_{93} & a_{94} & a_{95} & a_{96} & a_{97} & a_{98} & 1 \end{bmatrix} \begin{bmatrix} e_{GCP} \\ e_{IPIw} \\ e_{FSIus} \\ e_{IPI} \\ e_{CPI} \\ e_{IR} \\ e_C \\ e_{Ex} \\ e_{FSI} \end{bmatrix}$$

Global commodity prices are contemporaneously exogenous to the other variables. World output and US financial stress are identified recursively by assuming the former is contemporaneously affected by commodity prices, while US financial stress is contemporaneously affected by both commodity prices and world industrial production. All the external variables are not affected contemporaneously by the country-specific variables.

The domestic block consists of IPI, CPI, IR, C, EX and the FSI. The first 4 variables are ordered recursively and are contemporaneously unaffected by the external variables. The short-term interest rate is assumed to broadly follow a Taylor Rule principle as it reacts

contemporaneously to economic activity (IPI) and prices (CPI)⁹. The exchange rate, EX, and financial stress, FSI, are allowed to react contemporaneously to the external and domestic variables. The exchange rate is ordered before financial stress to model the narrative that a financial shock may trigger capital outflows and consequently affect the exchange rate with a lag.

Block-exogeneity restrictions are also imposed on the domestic variables in the external equations to strictly impose the small-open economy assumption for the ASEAN-5 countries. Specifically, the external variables are allowed to affect each other, but are assumed to be unaffected by the domestic variables in lags (as well as contemporaneously). This follows from Cushman and Zha (1997), Genberg (2005) and Maćkowiak (2007). The block-exogeneity restrictions translate to the following structure on the matrix of lagged coefficients, $B(L)$, with the variables ordered similar to Table 2:

$$B(L) = \begin{bmatrix} 1 & b_{12} & b_{13} & 0 & 0 & 0 & 0 & 0 & 0 \\ b_{21} & 1 & b_{23} & 0 & 0 & 0 & 0 & 0 & 0 \\ b_{31} & b_{32} & 1 & 0 & 0 & 0 & 0 & 0 & 0 \\ b_{41} & b_{42} & b_{43} & 1 & b_{45} & b_{46} & b_{47} & b_{48} & b_{49} \\ b_{51} & b_{52} & b_{53} & b_{54} & 1 & b_{56} & b_{57} & b_{58} & b_{59} \\ b_{61} & b_{62} & b_{63} & b_{64} & b_{65} & 1 & b_{67} & b_{68} & b_{69} \\ b_{71} & b_{72} & b_{73} & b_{74} & b_{75} & b_{76} & 1 & b_{78} & b_{79} \\ b_{81} & b_{82} & b_{83} & b_{84} & b_{85} & b_{86} & b_{87} & 1 & b_{89} \\ b_{91} & b_{92} & b_{93} & b_{94} & b_{95} & b_{96} & b_{97} & b_{98} & 1 \end{bmatrix}$$

3.3 Estimation Issues

The first issue concerns the estimation of the reduced-form VAR. The system is estimated by Seemingly Unrelated Regression (SUR) since the VAR's regressors are not identical due to the block exogeneity restrictions. Another issue is whether to estimate the SVAR in levels, first-differences or with error-correction terms (if diagnostic tests suggest cointegration exists). Sims, Stock and Watson (1990) and Ramaswamy and Sloek (1997), among others, recommend estimating the VAR in levels. They argue that differencing discards information about the inter-

⁹ This reaction function is not exactly the same as the one originally suggested in Taylor (1993) as the other variables enter the function in lags.

relationships among the variables. Moreover, the parameter estimates are not commonly focused on in VARs since they are usually over-parameterized. Nonetheless, the parameter estimates are consistent with standard asymptotic distributions while the impulse response functions in VARs with non-stationary and possibly cointegrated variables are consistent estimates of the true functions in short- and medium-term horizons. However, this is not true in the long-run (Phillips, 1998). The impulse response functions can thus be reliably used for inference over short- and medium-term horizons. This is true even in the presence of cointegrated variables as the VAR implicitly accounts for these relationships (Sims et al., 1990). Thus, I estimate the SVAR in levels since I am interested in the short- and medium run dynamics of the impulse responses.

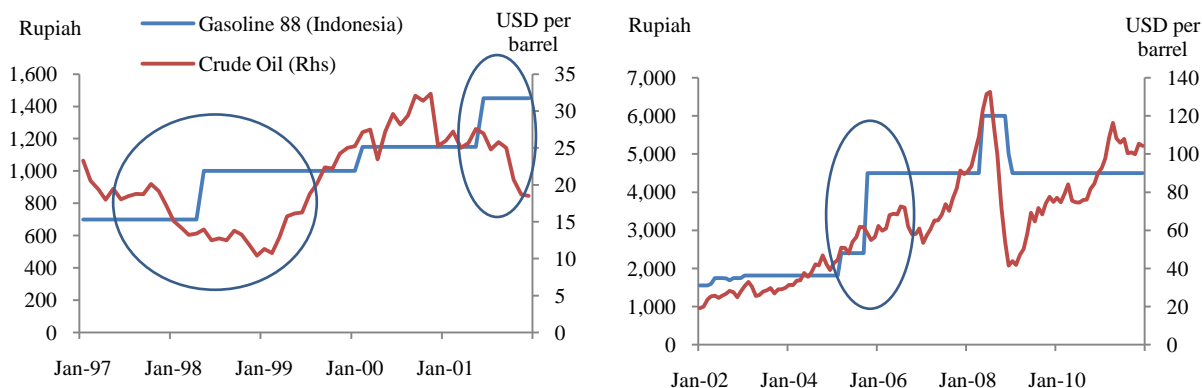
Estimations were carried out with 4 lags. The Akaike Information Criterion and Schwarz Criterion selected between 1 and 4 lags, depending on the country. The ceiling within this subset was chosen to capture as much of the underlying interactions as possible. The data used for estimations range from 1997-2011 unless stated otherwise.

Country-specific characteristics, events and data limitations warranted changes from the baseline specification in two cases. In Indonesia, administered petrol prices were adjusted counter to global crude oil prices several times between 1997 and 2001, while the magnitude of the upward adjustment in October 2005 was significantly disproportionate relative to trends in global crude oil prices during that period (Figure 7). Not accounting for this discrepancy will lead to a specification error resulting in erroneous inference especially on the effects of global commodity prices on domestic prices. To address this issue, I incorporate the administered petrol price series into Indonesia's model¹⁰. This variable is assumed to be affected contemporaneously as well as in lags by global oil prices and itself, and do not affect external demand and global financial conditions. The domestic variables are only affected by this series in lags except for the exchange rate and domestic financial conditions, which are allowed to react to this series within the same period. There were also other unique events in 1998 and 1999 such as the (ultimately temporary) abrupt removal of large food subsidies, social unrest, political uncertainty resulting from a change in leadership and delayed disbursements of IMF aid on several occasions that all

¹⁰ Domestic petrol prices in Malaysia and Thailand are also subsidized. In Malaysia's case, the trend of petrol prices tracked crude oil prices with less volatility. In Thailand, petrol prices moved in lockstep with crude oil prices. In both cases, over the period studied, domestic petrol prices were never adjusted counter to the global trend. The global commodity price index is therefore seen as an appropriate proxy to capture domestic petrol prices in these countries.

potentially affected the macroeconomic performance of the country. These events should be but are difficult to account for in the empirical model. As such, estimations for Indonesia are conducted using data from 2000 onwards.

Figure 7. Domestic Petrol and Global Oil Prices



Source: CEIC and International Monetary Fund

Note: Price of crude oil is the average of price of Brent, Dubai and WTI benchmarks

In Thailand, there were likely significant changes in the intermediation of credit to the economy between 1997 and 1999, brought forth by the closure of over 40 finance companies and 2 changes in monetary policy regime ending with its current inflation targeting framework introduced in 2000. I sidestep these possible structural breaks by using data from 2000 onwards to conduct estimations for Thailand.

4. Results

4.1 The Impact of External Shocks

This section presents the estimation results and discusses the exposures of the ASEAN-5 countries to the 3 external shocks. Impulse response functions are analyzed over a 3 year period after the shocks and displayed with 90th percentile bootstrap confidence intervals¹¹.

¹¹ The bootstrap methodology applied is from Hall (1992) using 100 replications. Increasing the number of replications to 500 does not materially change the results.

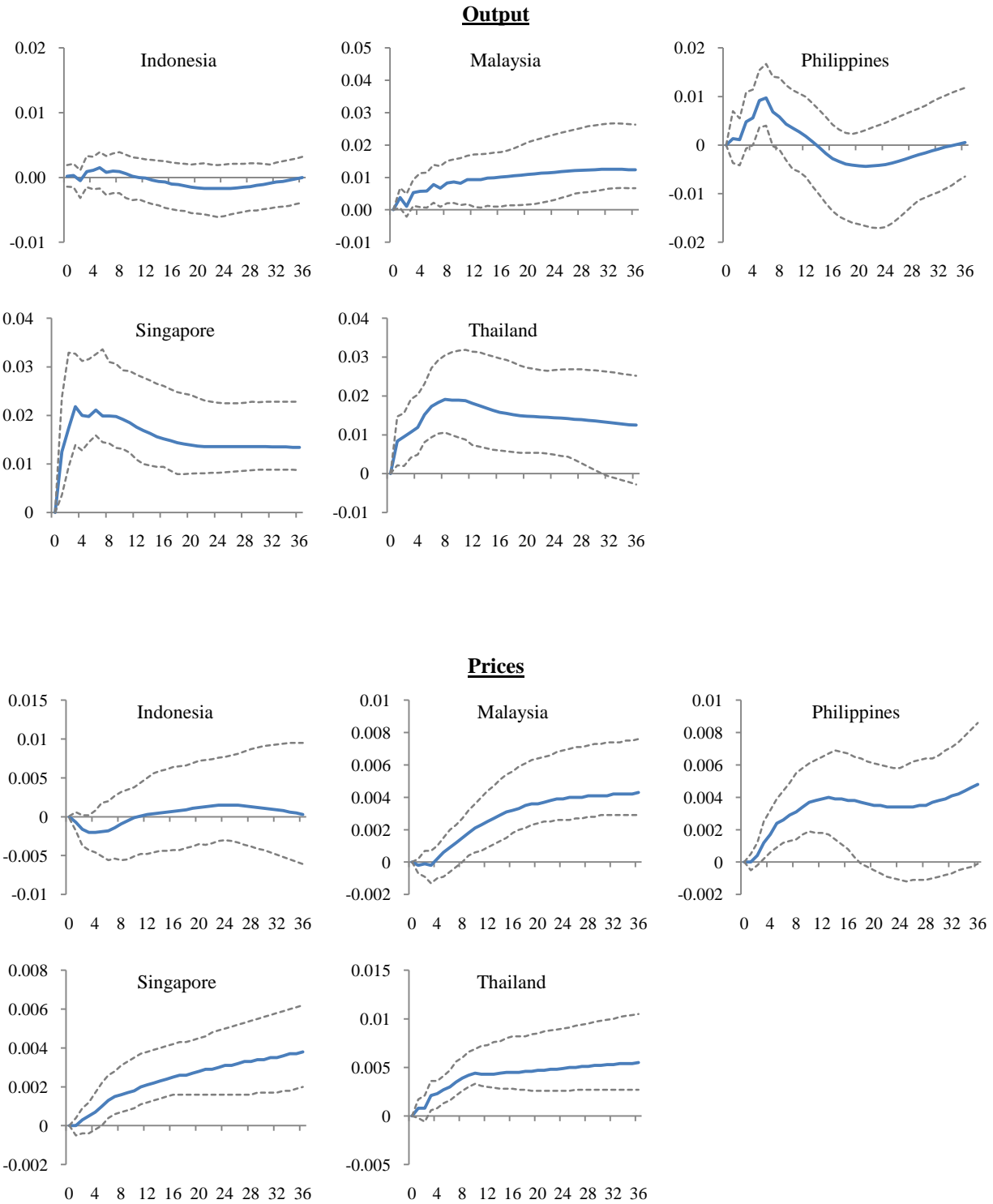
4.1.1 The Impact of External Demand Shocks

Figure 8 illustrates the responses of IPI in the ASEAN-5 countries to a one standard deviation shock in global output. Broadly, domestic output increases in response to a positive external demand shock, with the largest effects experienced during the initial 6 months. There are, however, differences in the profile of the responses across the countries. Output in Malaysia, Singapore and Thailand increase immediately and persistently after the shock. The effects are statistically significant almost throughout the 3 year period. In the Philippines, a positive external demand shock leads to an increase in domestic output. The effect, however, is transitory with the benefits dissipating after about 1 year after the shock. The response of output is the most muted in Indonesia, implying the country is the most resilient compared to its regional neighbors to external demand shocks. Output increases from 4-8 months after the positive shock, but the magnitude of the response is small and never statistically significant throughout the 3 year period. The observed variations in the responses are in line with the countries' reliance on external demand, as reflected by exports as a percentage of GDP. Using this metric indicates, similarly, that Singapore is the most exposed to external demand conditions, followed by Malaysia, Thailand, Philippines and, finally, Indonesia¹².

The response of consumer prices to a positive external demand shock is much more uniform. In all of the countries, except for Indonesia, consumer prices increase likely reflecting positive spillovers from export demand to the domestic-oriented sectors of the economy and resulting in higher demand-driven inflationary pressures.

¹² The ratios of exports of goods and services to GDP from 2000-2010 for Singapore, Malaysia, Thailand, Philippines and Indonesia averaged at 211.3%, 109.2%, 70.0%, 43.6% and 31.7%, respectively.

Figure 8. Responses of Output and Prices to an External Demand Shock



4.1.2 The Impact of Commodity Price Shocks

Movements in global commodity prices represent exogenous supply-side shocks to the ASEAN-5 economies to the extent that they do not possess sufficient market size to influence global prices¹³. The inflation response to global commodity price shocks depends on a wide range of country-specific factors – from the composition of the CPI basket, monetary policy responses to such shocks, the exchange rate policy, and government price controls/subsidies on food and energy commodities. This last aspect, in particular, is not captured in the estimations due to the often eclectic nature in which these policies are undertaken. But to the extent that these policies suppress the true market price and at least partially reflect a lagged response to the market prices, the estimated responses of global commodity prices to inflation will be lower in magnitude, less volatile compared to the flexible price scenario and passed-through with longer lags. All of these aspects differ with varying degrees across the 5 sample countries, suggesting a diverse mix in the responses of inflation to a common commodity price shock¹⁴.

The results confirm this *a priori* prediction. Figure 9 displays the responses of consumer prices and output to a one standard deviation increase in global commodity prices. The initial phase of the response of consumer prices is similar for all the sample countries – consumer prices increase the most during the first 4-6 months after the shock. However, the observed dynamics thereafter differ substantially. In Indonesia and Malaysia, the response of consumer prices eventually begin to dissipate but this adjustment is significantly more persistent compared to the other economies. The inflationary effect of a commodity price shock in Thailand persists for about a year, while this effect is present for 1.5-2 years in the Philippines and Singapore.

The effects of a commodity price shock on output also differ. Overall, higher prices lead to lower output with a lag of about 6 months after the shock. The downward response of output is statistically significant in the Philippines and Thailand, while the position of the error bands suggest that this is likely the case in Singapore as well. Malaysia and Indonesia initially benefit from higher commodity prices during the first 6 months after the shock. The output benefits in

¹³ Possible exceptions are crude palm oil for Indonesia and Malaysia, and rubber for Malaysia. Both commodities carry a small weight of 0.7% and 0.5% in the index used.

¹⁴ Running the estimations on core inflation (inflation excluding food and energy) results in a more persistent but with similar cross-country differences in the dynamics in the responses of core inflation to a global commodity price shock. Details of these results are available upon request.

Malaysia are especially large and statistically significant. These initial benefits may in part be explained by its degree of self reliance on food and fuel commodities (Figure 10). Indonesia and Malaysia are the only net exporters of both food and fuel while Thailand, the Philippines and Singapore are net importers of these commodities. Thus, Malaysia and Indonesia are able to initially benefit from higher commodity prices as these commodities are likely price inelastic in the short-run. However, these initial benefits eventually wear off, presumably due to slower global growth caused by the higher prices.

Figure 9. Responses of Consumer Prices and Output to a Commodity Price Shock

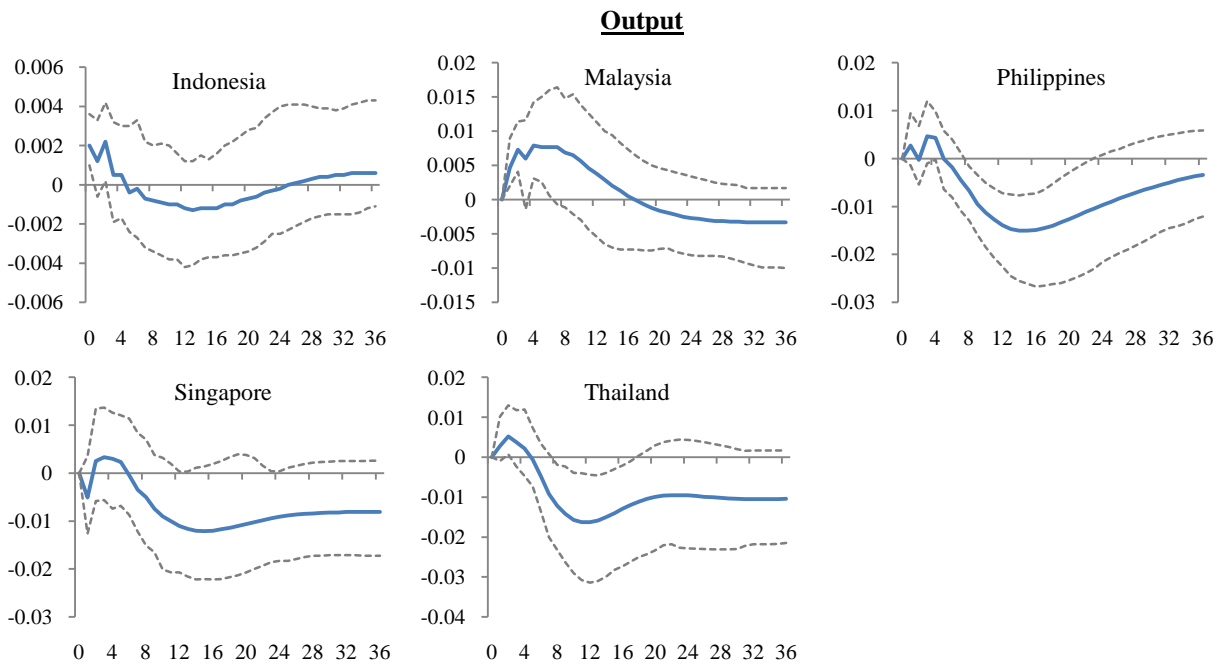


Figure 9. (Continued)

Consumer Prices

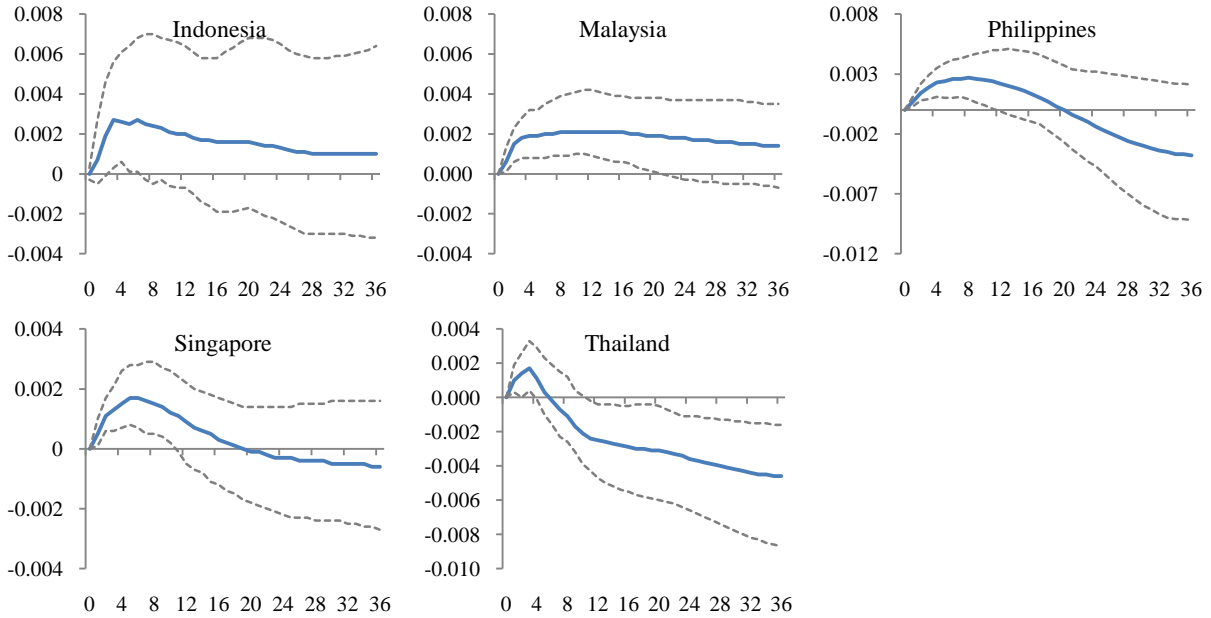
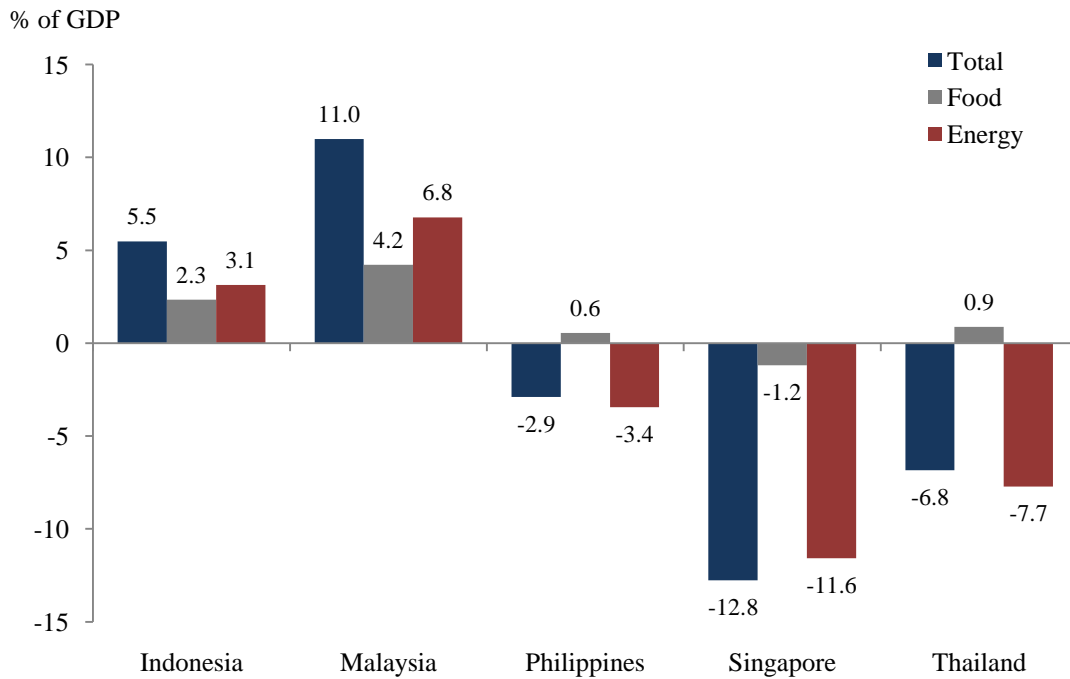


Figure 10. Net Trade Position of Food and Fuel Commodities (Avg. 2001-2010, % of GDP)



Source: World Trade Atlas

Note: Energy includes crude oil and gas. Food includes all food items in crude & non-processed form, and oil derived from vegetables & animals

4.1.3 The Effects of External Financial Shocks

Figure 11 displays the responses of output and prices to an external financial shock. Output declines after the shock in a similar pattern in all the countries. The initial decline during the first 6 months are the steepest and remain persistently below the pre-shock levels thereafter with the effects being statistically significant most often during the first 12 months. The exception is Indonesia, where output displays a response similar to the other countries but the effects are never statistically significant. Meanwhile, consumer prices decline continuously in all the countries immediately after an external financial shock except during the initial increase in the Philippines. However, the error bands tend to be relatively wide in many of the countries, making inference difficult in some cases. The position of the error bands nonetheless strongly suggests a persistently negative response of prices in Malaysia and Thailand, and in the Philippines during the third year.

Figure 11. Responses of Output and Prices to an External Financial Shock

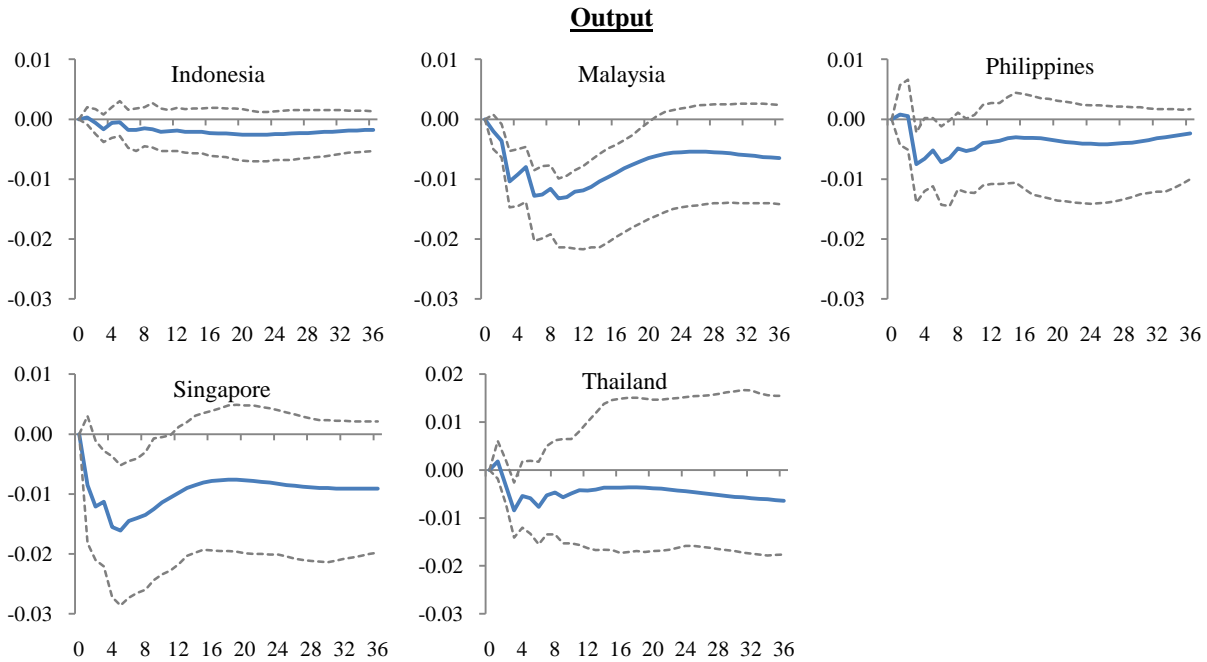
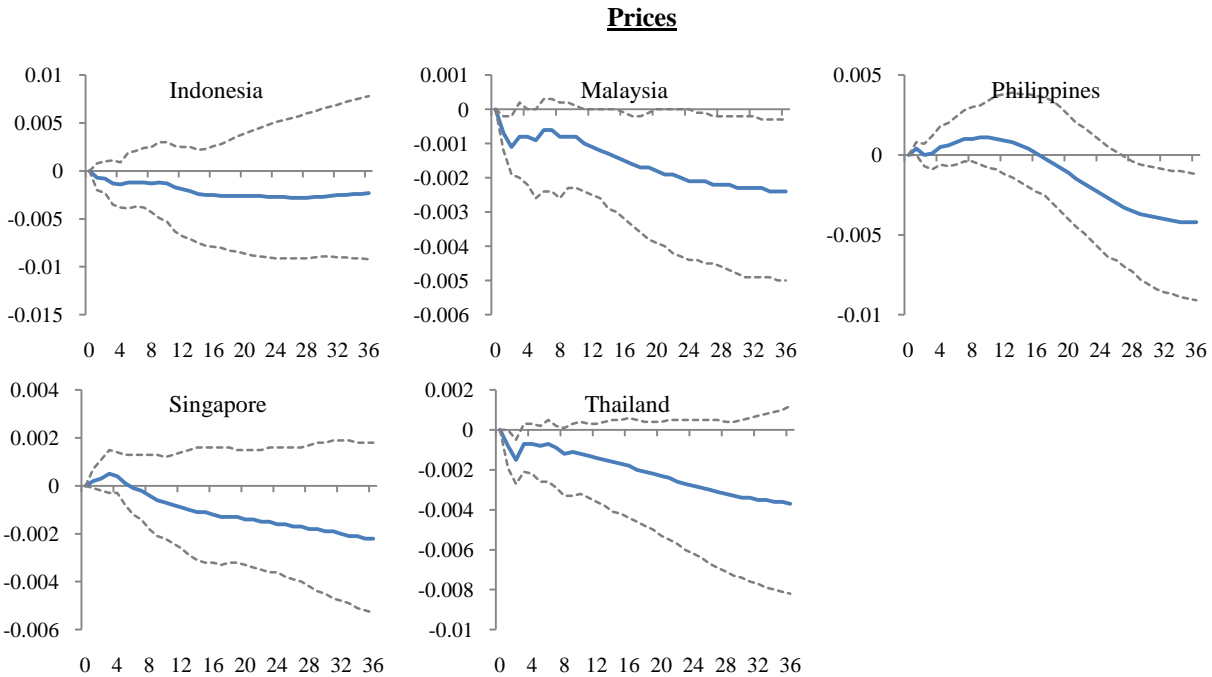


Figure 11. (Continued)



The selected impulse responses discussed thus far point to both similarities and differences in the effects of the regional economies to common external shocks. The responses of output to external demand shocks are positive and proportionate to the economies' dependence on exports. Singapore stands out as the most exposed in this respect. Higher commodity price shocks are inflationary, but there are differences in the magnitude and persistence of the pass-through to consumer prices, likely reflecting cross-country differences in policy responses and the level of government subsidies on food and fuel items. Meanwhile, a global financial shock has a persistent contractionary effect on output and a deflationary effect on prices. In all 5 countries, output declines steeply during the initial months and persistently remains below the pre-shock levels while prices decline continuously after the shock.

In general, the impulse response analyses establish that the external influences studied affect small open-economies in an intuitive and plausible manner. But it nonetheless still begs the question of their overall influence relative to the domestic factors on the macroeconomic performance of these economies. It may be that external shocks have large effects on growth and inflation, but explain only a small fraction of the overall variation in the domestic macroeconomic aggregates because these shocks occur infrequently.

I next analyze the decomposition of the forecast error variances of IPI and CPI to provide an insight to the overall importance of external influences in these economies. The results of the decompositions at the 24- and 36-month horizons are presented in Table 2. This analysis reveals that a majority of the variation in output in all the individual countries can be attributed to common external factors, accounting for an average of 63% and 70% of the total variation in output at the 24- and 36-month horizons. The only instance when this is not the case is Indonesia at the 24-month horizon. On average, external demand and commodity prices emerge as more dominant factors compared to global financial stress. These observations are similar for consumer prices as well.

Meanwhile, domestic financial factors – comprising of the interest rate, credit, exchange rate and financial stress – contribute an average of 13% and 11% of the variation in output, and 16% of the variation in consumer prices at the 24- and 36-month horizons. However, these regional averages mask the substantial cross-country variation in the contributions. Consider the following examples at either end of the spectrum: In Indonesia, domestic financial factors contribute respective shares of 33% and 30% of the movements in output and inflation at the 24-month horizon. In contrast, domestic financial factors in Thailand account for merely 2% of the movements in both output and inflation. Comparing the shares attributed to global financial stress and the domestic financial factors illustrate that output in Malaysia, Singapore and Thailand have been affected more by external financial conditions while the reverse is true for Indonesia and the Philippines.

Table 2. Decomposition of the Forecast Error Variance of Output and Consumer Prices (%)

| Output (IPI) | | | | | | |
|------------------------------|------------------|-----------------|-------------------------|-------------------|-----------------------|-----------------|
| Total External | of which due to | | | | Total Domestic | of which due to |
| | Commodity Prices | External Demand | Global Financial Stress | Financial Factors | | |
| 24 months | | | | | | |
| Indonesia | 38 | 26 | 3 | 9 | 62 | 33 |
| Malaysia | 74 | 9 | 30 | 35 | 26 | 8 |
| Philippines | 51 | 38 | 7 | 6 | 49 | 19 |
| Singapore | 73 | 12 | 44 | 17 | 27 | 1 |
| Thailand | 79 | 25 | 50 | 4 | 21 | 2 |
| Average | 63 | 22 | 27 | 14 | 37 | 13 |
| 36 months | | | | | | |
| Indonesia | 58 | 45 | 3 | 10 | 42 | 22 |
| Malaysia | 79 | 8 | 42 | 29 | 21 | 8 |
| Philippines | 51 | 38 | 6 | 7 | 49 | 22 |
| Singapore | 78 | 14 | 46 | 18 | 22 | 1 |
| Thailand | 82 | 26 | 50 | 6 | 18 | 2 |
| Average | 70 | 26 | 29 | 14 | 30 | 11 |
| Consumer Prices (CPI) | | | | | | |
| Total External | of which due to | | | | Total Domestic | of which due to |
| | Commodity Prices | External Demand | Global Financial Stress | Financial Factors | | |
| 24 months | | | | | | |
| Indonesia | 57 | 53 | 1 | 3 | 43 | 30 |
| Malaysia | 74 | 9 | 30 | 35 | 26 | 5 |
| Philippines | 53 | 12 | 38 | 3 | 47 | 33 |
| Singapore | 48 | 8 | 33 | 7 | 52 | 11 |
| Thailand | 88 | 21 | 57 | 10 | 12 | 2 |
| Average | 64 | 21 | 32 | 12 | 36 | 16 |
| 36 months | | | | | | |
| Indonesia | 52 | 47 | 1 | 4 | 48 | 35 |
| Malaysia | 79 | 8 | 42 | 29 | 21 | 4 |
| Philippines | 62 | 14 | 34 | 14 | 38 | 30 |
| Singapore | 57 | 4 | 42 | 11 | 43 | 10 |
| Thailand | 93 | 26 | 52 | 15 | 7 | 1 |
| Average | 69 | 20 | 34 | 15 | 31 | 16 |

Note: Financial factors refer to the total contributions from the interest rate, real credit, domestic financial stress and the NEER

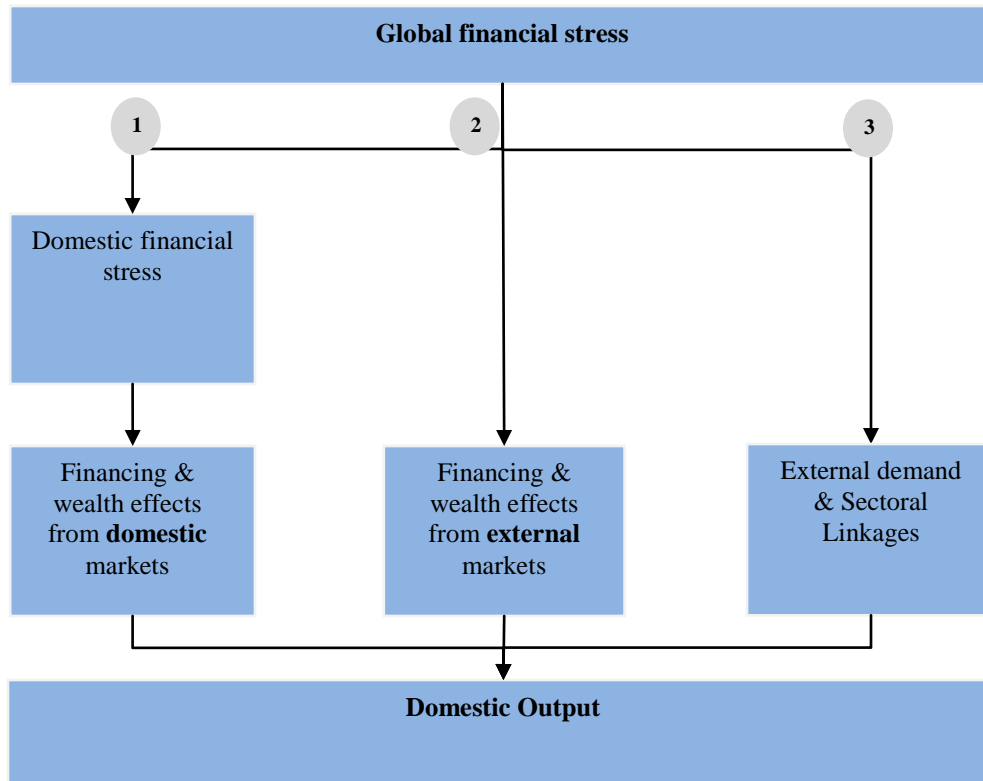
4.2 Domestic Financial Markets as a Conduit in the Transmission of External Financial Shocks

The wide range of contributions by domestic financial factors in driving the overall output dynamics hints at an equally wide range in the role of domestic financial markets in transmitting the effects of external financial shocks to output. As explained earlier, external financial shocks can be transmitted directly through the economy's reliance on foreign markets for financing and wealth effects through balance sheet exposures to foreign asset prices. And if the external financial shock spills over to domestic financial markets, the consequent deterioration of financing conditions and decline in asset prices domestically will exert further downward pressure on the performance of the real economy. In this section, I provide some insight into the role of domestic financial markets as a mechanism in transmitting the effects of external financial shocks to domestic output. The schematic in Figure 12 outlines 3 main transmission channels¹⁵.

In the first path of transmission, an adverse external financial shock spills over to domestic financial markets. The resulting volatility and decline in domestic asset prices leads to a deterioration in domestic financing conditions, negative wealth effects and lower real economic activity. The second mechanism is similar to the first, except that the external financial shock affects resident firms and households with direct financing and wealth exposures to foreign financial markets. In the last mechanism, an external financial shock leads to lower external demand and a decline in financial market activities, and passes through to the domestic economy through lower exports and profits in financial markets. In reality, the transmission likely occurs through a combination of the three depicted scenarios.

¹⁵ This schematic abstracts from second round effects for simplicity purposes.

Figure 12. Transmission Channels of the Impact of External Financial Shocks to Output



Figures 13 and 14 provide insight into the first path of transmission. Figure 13 provides evidence of financial spillovers from external to domestic financial markets by depicting the impulse responses of an external financial shock on domestic financial stress. Figure 14 shows the adverse effects on credit when spillovers occur, by illustrating the response of credit to an adverse domestic financial shock. Domestic financial stress increases during the first 6-9 months after the shock and reverts back to its mean within one year. The transmission in Thailand and Malaysia are consistently statistically significant from 4-12 months after the shock. In contrast, the responses of domestic financial stress in Singapore, Indonesia and the Philippines are insignificant over most of the period studied, although stress increases during the initial months. Thus, domestic financial stress in all 5 countries displays some spillover from external financial markets during the initial months after the shock. There is, however, a substantial variation over the 3 year horizon with the extent of spillover the lowest in Singapore. Meanwhile, Figure 14

shows that higher domestic financial stress has a negative effect on credit. The effects are statistically significant in all cases except in Indonesia.

Figure 13. Effects of an External Financial Shock on Domestic Financial Stress

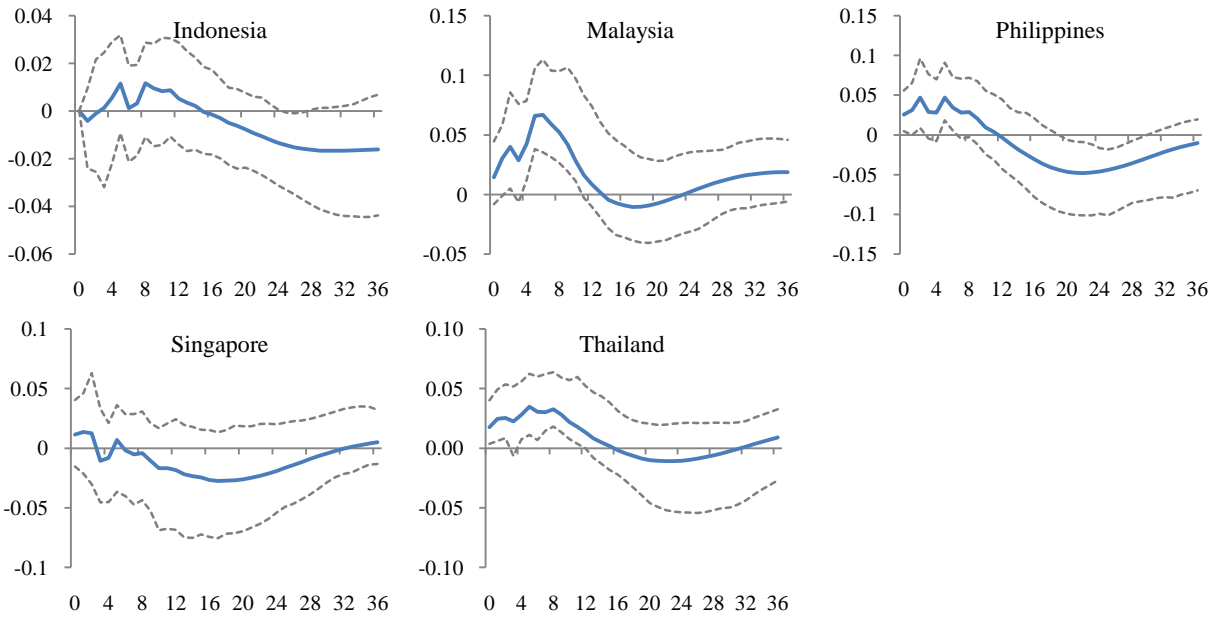
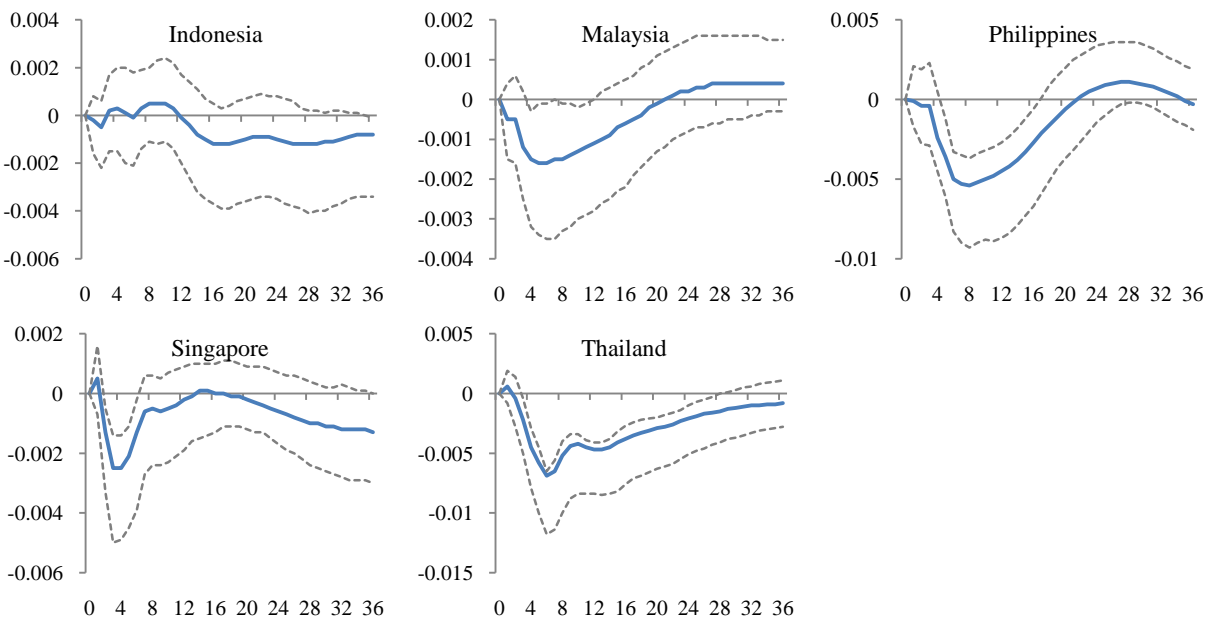


Figure 14. Effects of a Domestic Financial Shock on Credit



Given the evidence of financial spillovers, I now try to distinguish between the first from the second and third paths of transmission shown in Figure 12, by quantifying the quantum of the effects of an external financial shock on domestic output that passes through domestic financial markets. I begin by re-estimating a restricted version of the baseline model – one with domestic financial stress (FSI) as an exogenous variable (with 4 lags). The remaining contemporaneous and block-exogeneity assumptions remain similar to the baseline specification. In doing so, I block off the responses of output to the external financial shock that passes-through the FSI variable. I then compare the resulting impulse responses of output to an external financial shock from the restricted VAR with the corresponding impulse responses from the baseline specification. The extent to which the impulse responses from the restricted specification are smaller reflects the degree of the pass-through via domestic financial markets (Chow, 2004; Morsink & Bayoumi, 2001). To characterize the degree of the pass-through via domestic financial markets, I compute the difference between the accumulated responses of output from the baseline and restricted specifications over 36 months, expressed as a percentage of the accumulated response from the baseline.

The results are presented in Figure 15. A comparison between the associated impulse responses of output to an external financial shock from the baseline and restricted SVARs are shown in Appendix 2. There are substantial cross-country differences in the degree of the pass-through. In Malaysia and Indonesia, almost half (47.8% and 45.7% respectively) of the effects of external financial shocks on their real economies occur through domestic financial markets (i.e. the first path in the schematic in Figure 12). Perhaps surprisingly, the pass-through for Singapore is -2.4%. This implies that all of the effects of an external financial shock are transmitted through mechanisms that are distinct from the financial/credit channels in domestic financial markets.

There are two potential reasons for this observation that are briefly explored separate from the SVAR model. First, this result could in part reflect the economies' differing degrees of reliance on domestic versus external markets to obtain funds. Figure 16 shows a clear positive relationship between the pass-through coefficients and the amount of funds that are sourced from domestic relative to external financial markets. This relationship suggests that the real effects of external financial shocks operate more through the credit/financing channels via domestic markets for economies such as Indonesia and Malaysia. In contrast, in economies that are reliant on external markets for funds, such as Singapore, the credit/financial channels operate

predominantly through the residents’ ability to access funds from foreign financial markets. The second reason is that the performances of financial sectors are affected directly during financial episodes through lower transactions, fee-based income and profits. This channel applies most to Singapore as it operates as a financial centre in the region. Its finance sector also comprises the largest share of GDP compared to the other 4 countries. Shocks that affect the performance of the sector therefore have the largest bearing on the overall growth of the economy. Figure 17 shows the size and performance of the financial sectors in the ASEAN-5 economies. Singapore’s financial market is the largest and was most affected during the GFC. Thus, within the context of the schematic in Figure 12, the second and third channels matter more for Singapore while the first channel features more prominently in Malaysia and Indonesia.

There are, nonetheless, likely many other reasons that explain why domestic financial markets play such diverse roles in the transmission of external financial shocks, and warrant future research. For example, one aspect that is not captured in the estimations and in this section are the policies aside from conventional fiscal and monetary that were undertaken during the external financial episodes. Such “unconventional” policies no doubt vary across the ASEAN-5 countries and warrant more in-depth country-specific analysis to uncover their roles in influencing this transmission.

Figure 15. Pass-through of External Financial Shocks to Output through Domestic Financial Markets (%)

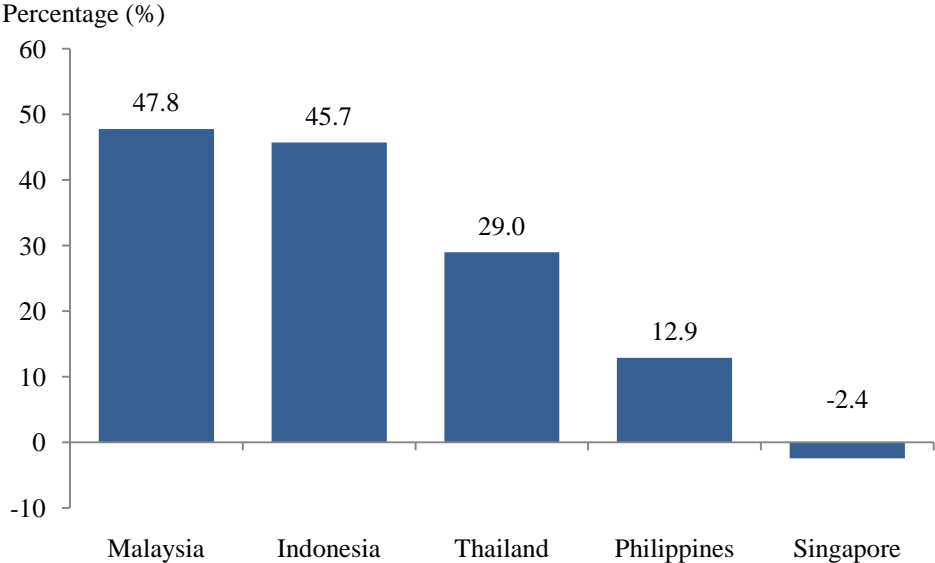


Figure 16. Positive Relationship between Pass-through via Domestic Financial Markets and Financing Reliance on Domestic Financial Markets

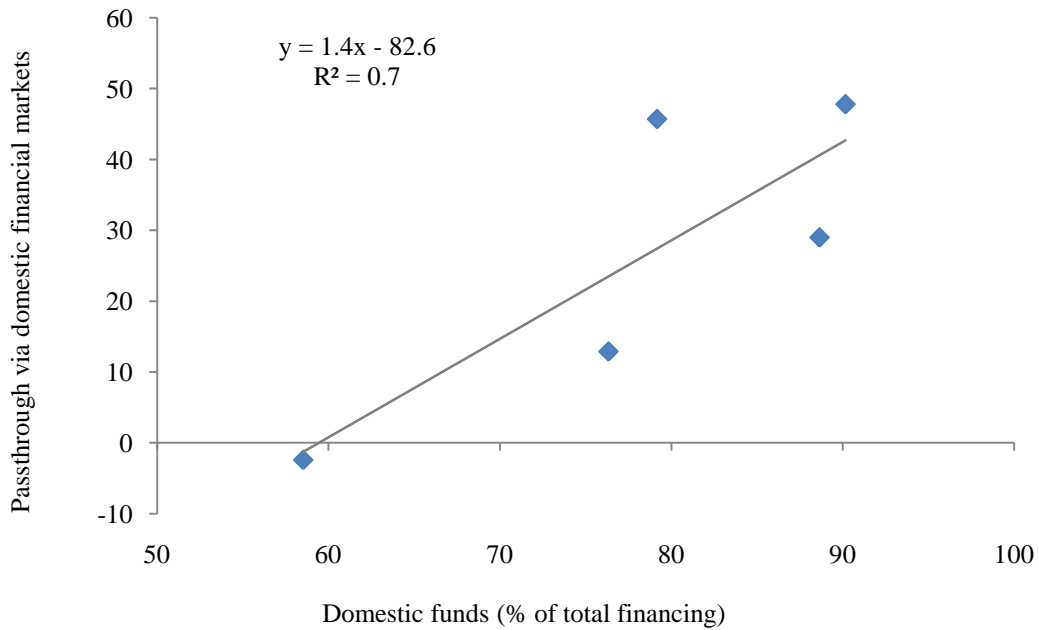
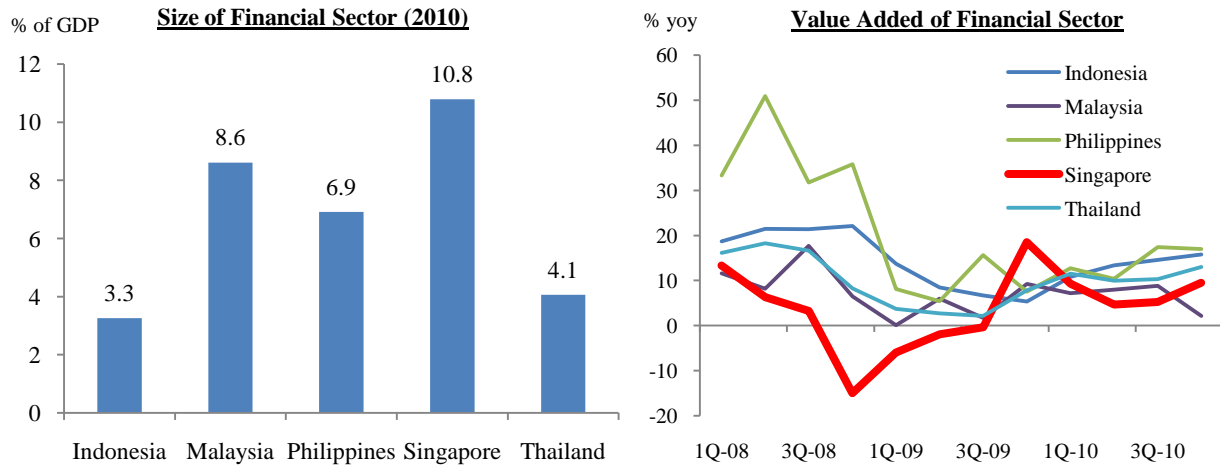


Figure 17. Size and Performance of Financial Sectors in the ASEAN-5 Economies



5. Conclusion

Global economic conditions in recent years can be framed within three themes: volatile global commodity prices, slower global growth and persistent stresses in financial markets. This paper estimates a series of SVARs to provide insight into the exposure of the ASEAN-5 economies to these facets of the economic environment. Broadly, external demand emerges as the most important driver of domestic output and prices, followed by commodity prices and global financial conditions.

In all cases, more than half of the output and price dynamics are driven by developments in the external environment, although the relative importance among the three external variables differs across countries. Countries with a higher dependence on exports are proportionately more sensitive to external demand shocks. Higher commodity price shocks are found to be inflationary. They also lead to a decline in output, except in Indonesia and Malaysia where output initially increases. I argue that this is because these economies initially benefit from higher commodity prices through the trade channel, as reflected in their positive net trade positions in primary food and fuel commodities, and the short-run inelasticity in the global demand for these commodities.

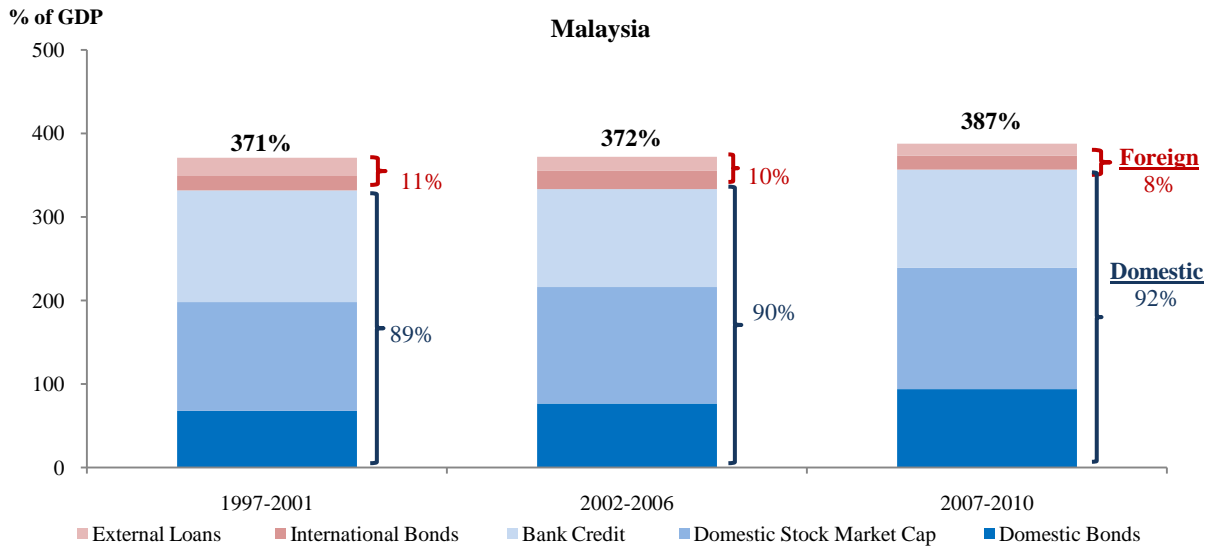
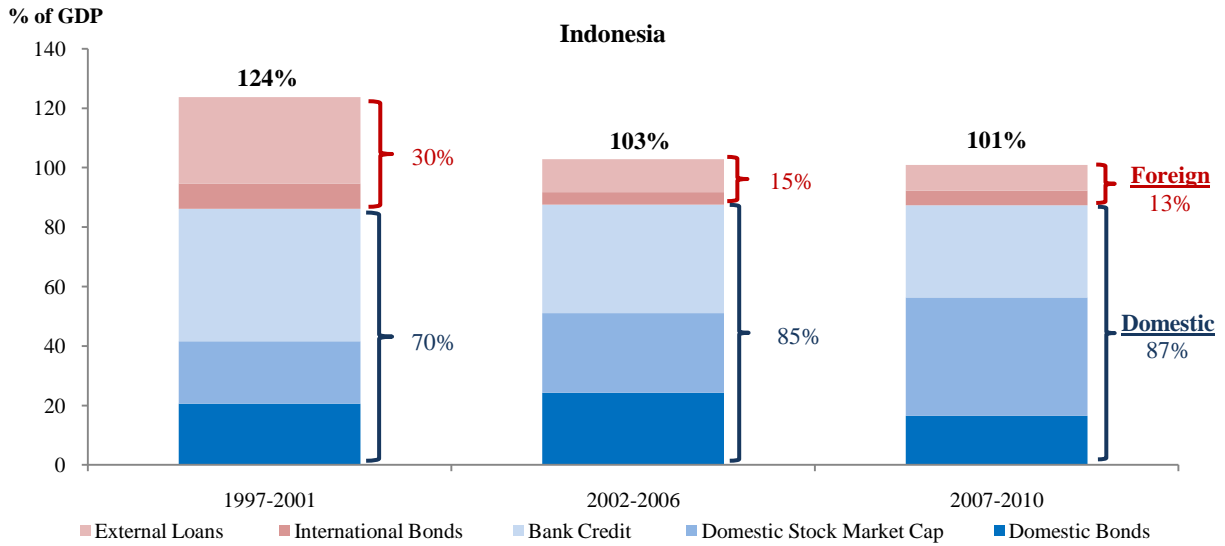
Finally, adverse external financial shocks are found to spillover to domestic financial markets and cause output and prices to decline. However, the role of domestic financial markets in the transmission from higher global financial stress to lower domestic output differs greatly. I contend that output in economies with higher external financing exposures are found to be affected in a more direct manner, where adverse external conditions lead to a lower supply of funds, thus causing output to decline. In contrast, in economies where financing is predominantly sourced from domestic markets, external financial conditions first spill over to domestic financial markets, consequently leading to a deterioration in domestic financing conditions, lower wealth and a decline in output.

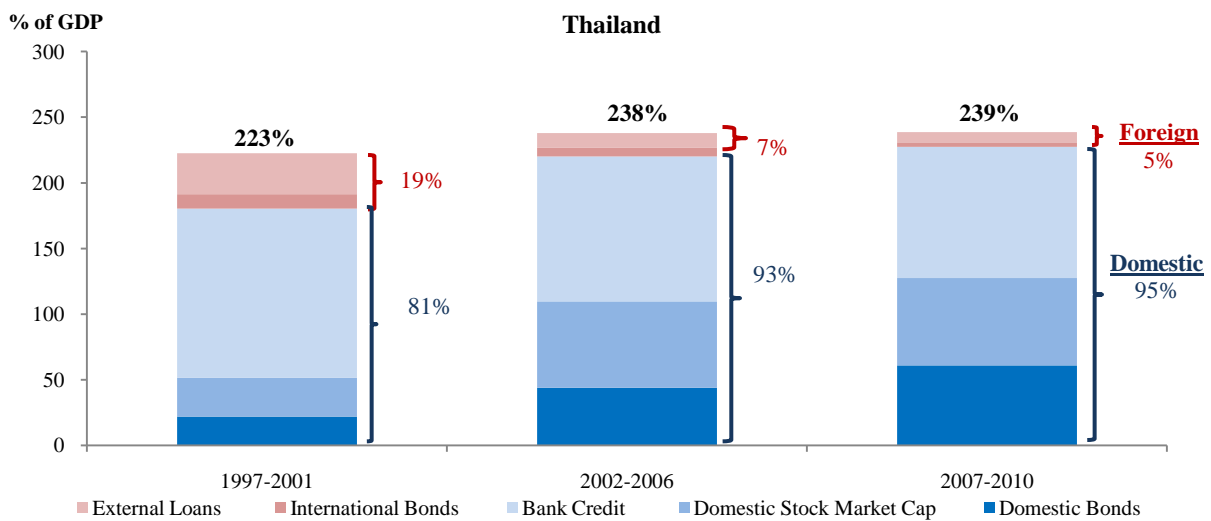
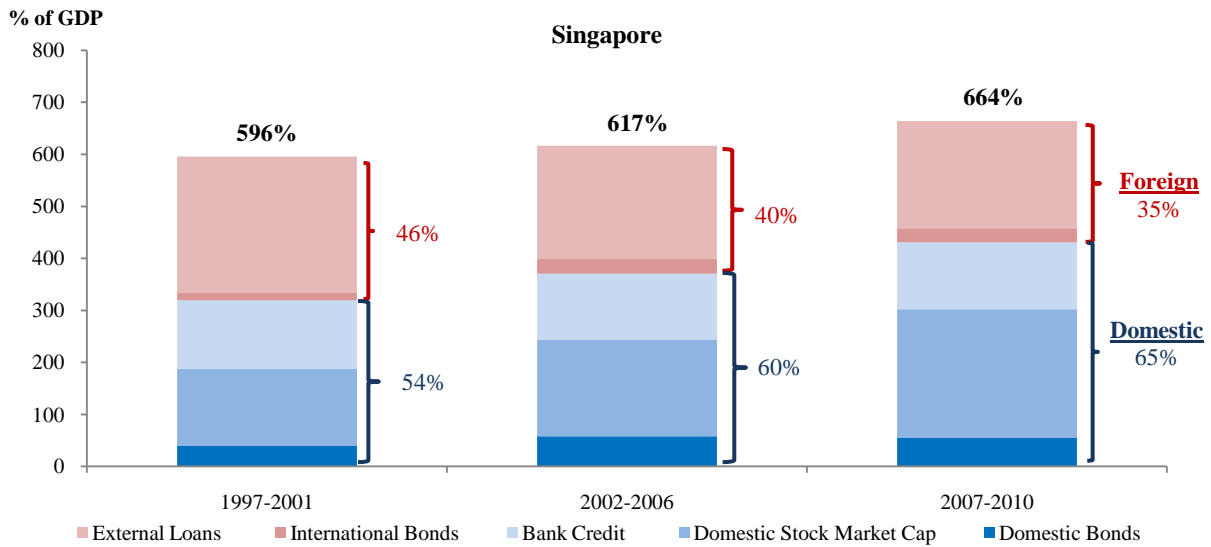
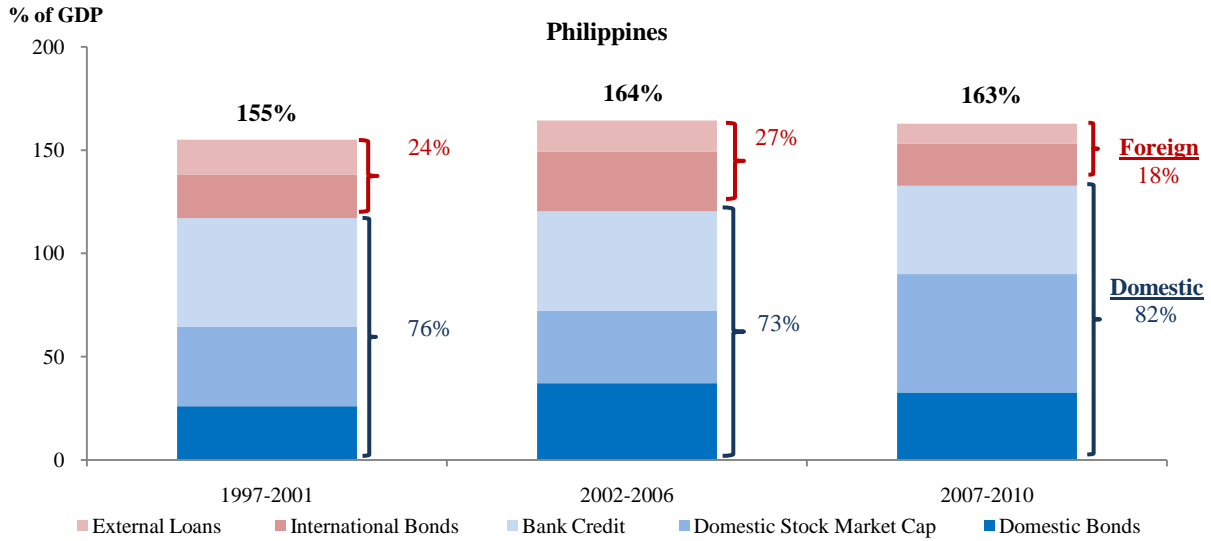
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Appendix 1: Composition of the Major Sources of Financing in the ASEAN-5 Countries





Appendix 2: Impulse Response of Output to a 1 Standard Deviation External Financial Shock from the Baseline and Restricted SVARs

