BANK NEGARA MALAYSIA
CENTRAL BANK OF MALAYSIA

Bank Negara Malaysia Working Papers
WP1/2013

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

By Tng Boon Hwa

December 2013

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

Tng Boon Hwa[1]

Abstract

Using an SVAR approach, I examine spillovers of 3 external shocks in the ASEAN-5 economies – global demand, commodity price and global financial stress – and the role of domestic bank credit in the transmission of global financial stress to the real economy. I find that 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 countries' degree of trade openness. Higher commodity prices are inflationary and lead to lower output, except in Malaysia and Indonesia where output initially benefits from exports of primary food and fuel commodities. An adverse external financial shock spills over to domestic financial markets, leads to lower credit and, consequently, to lower output. In countries with large and open financial sectors, such as Singapore, an adverse external financial shock also affects output through lower profits in the financial sector from reduced intermediation activities.

JEL Classification: E30, E44, G10

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

---

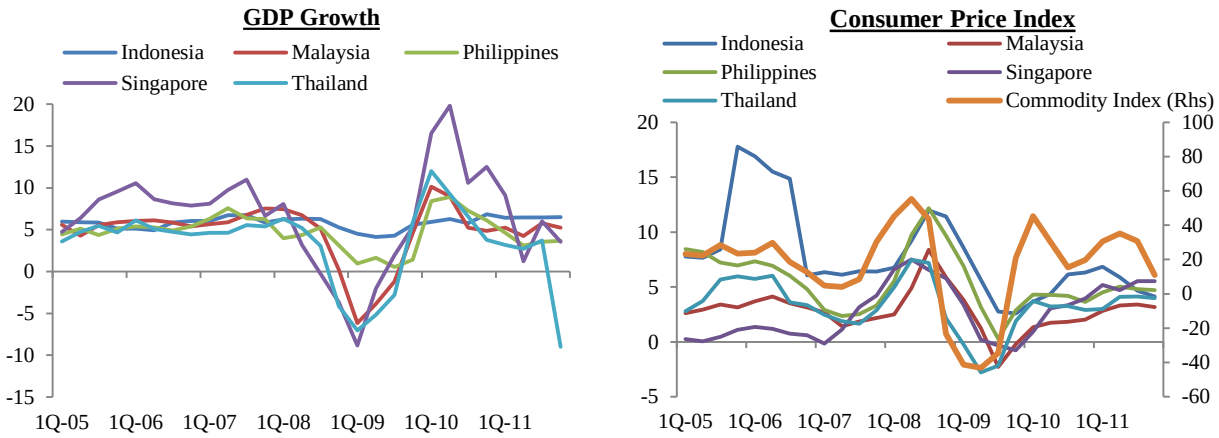
[1] An earlier version of this paper was presented at the 2012 Bank Negara Malaysia Economics Research Workshop. I would like to thank Fraziali Ismail, Ahmad Razi, Mohamad Hasni Sha'ari, Ahmad Othman and an external reviewer for helpful comments. I am also grateful to Chew Mei Lien and Lim Wei Meen for their 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 the sovereign debt crisis in the Euro Area. Secondly, commodity prices have been volatile with at least two episodes of sharp increases and moderations in the last decade. Finally, real economic activity especially in the advanced economies has been markedly slower.

As a consequence, small-open economies (SOEs) such as the ASEAN-5 countries have been affected by these aspects of the global environment, despite playing little to no role in their genesis. Figure 1.1 plots growth and inflation in the ASEAN-5 countries. It is clear that GDP growth contracted in 2008-2009 during the GFC while inflation has been volatile in tandem with the commodity price cycle. Yet, the confluence of the financial episodes, weaker external demand and high commodity prices in close succession with each other raises the question of how each of these factors have affected SOEs.

Figure 1.1. 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. For instance, the monetary policy response to slower growth caused by an 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. Thus, prescribing the

correct policies in response to external shocks requires a clear understanding of their effects on the economy and the transmission mechanisms.

This paper analyzes the spillover of three external shocks to SOEs: demand, 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 macroeconomic effects of the three external shocks and analyze their overall importance relative to country-specific domestic influences. Second, I examine more closely the role of domestic financial markets in the transmission of external financial shocks to real economic activity, and document how the size of financial markets may influence the strength of the 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 over the period studied are driven by external shocks in all the sample 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 as their output initially benefit from higher commodity prices. I argue that this is 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 the role of domestic financial stress in transmitting the effects of external financial shocks to output varies significantly across the sample economies. In addition to domestic financial markets, having a more open and larger financial sector such as in Singapore means that external financial shocks affect output more directly as well, through lower profitability of the sector arising from reduced financial intermediation activities.

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

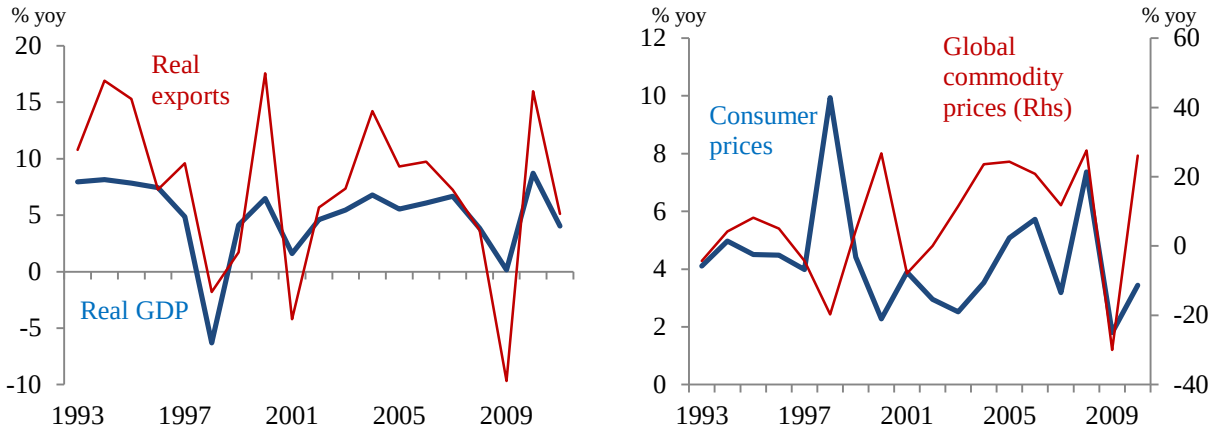
2.1 External Demand and Commodity Prices

The transmission of external demand and commodity price shocks to small-open economies (SOEs) can be gleaned through a conventional open-economy IS-LM framework. 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 higher exports. In the open economy Philips curve, inflation can be expressed 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 supply-side reasons, causes higher inflation by increasing production input costs which are passed on to the price of final goods[2].

Figure 2.1 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 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 recessions in the US and the global economy as well during the latter episode. The right figure 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. The exception is during the Asian Financial Crisis (AFC) in 1998 when consumer prices increased while commodity prices moderated. This is attributable to the large exchange rate depreciations in the sample countries during this period, which led to higher imported inflation.

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

Figure 2.1. 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 channels of external financial episodes to SOEs are more numerous. External financial episodes can manifest by affecting external demand and consequently SOEs through the trade channel, as described previously. In addition, the transmission through domestic financial markets occurs by adversely affecting domestic financing conditions and by inducing firms and consumers to delay expenditures amid higher economic uncertainty during episodes of financial stress.

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 hazard[3]. From borrowers' perspectives, the financial accelerator mechanism posits that financing premiums increase when an adverse shock, such as an external financial shock, leads to deteriorating balance sheet positions

[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).

(Bernanke & Gertler, 1989; Bernanke, Gertler, & Gilchrist, 1999). The higher cost of finance then leads to a decline in spending that is more persistent compared to the initial size of the shock. Meanwhile, the bank capital and bank 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, which force 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[4]. Since the balance sheet positions of lenders and borrowers are the focal points in these mechanisms, they apply similarly to bond markets and non-depository lending financial institutions as well.

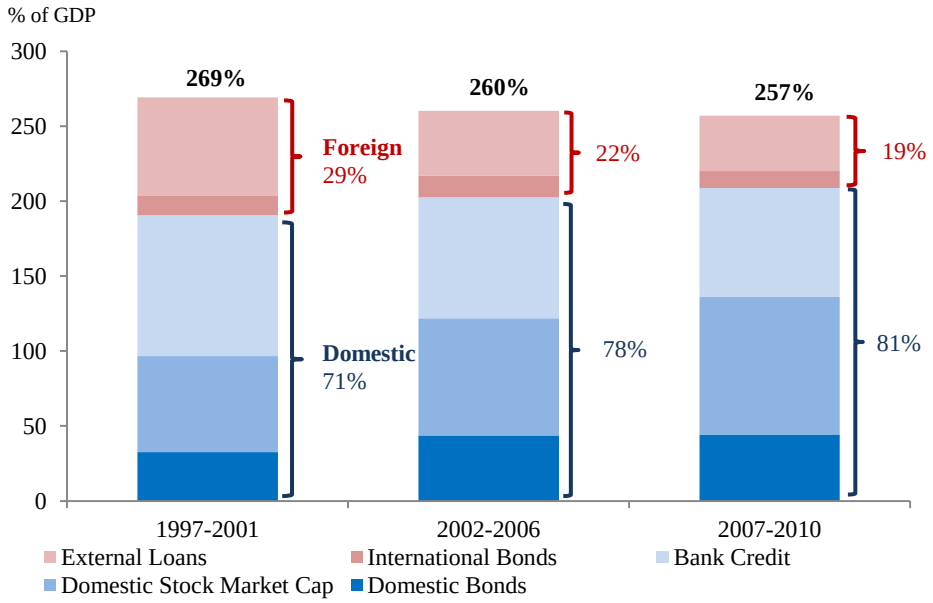
In equity markets, the Tobin's q mechanism depicts how financial stress can affect the cost of equity and suppress economic activity (Tobin, 1969). This mechanism establishes a positive link between equity prices and investments by relating the market value of firms to the replacement cost of capital goods. Since equity prices decline during stress episodes, the market value of firms relative to their cost of capital goods also declines. As a result, firms need to issue more equity relative to periods when their market value is higher. This depresses fund raising in equity markets which leads to a decline in 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 an external shock spills over to domestic financial markets, the supply of funds is potentially affected as well through similar channels, within the domestic financial market. Figure 2.2 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 declined, 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 the *direct* exposure does not necessarily imply a

[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.

lower total exposure of financing conditions to the external environment. This is because the *indirect* exposures through domestic capital markets have increased with the higher volume of foreign capital inflows vis-à-vis foreign participation in domestic capital markets. This is illustrated in the increase in external portfolio liabilities in the ASEAN-5 economies over the past decade, with the exception of the Philippines (Figure 2.3). Through this indirect channel, an external financial shock that triggers capital outflows from domestic capital markets will result in a deterioration in financing conditions as domestic asset prices decline.

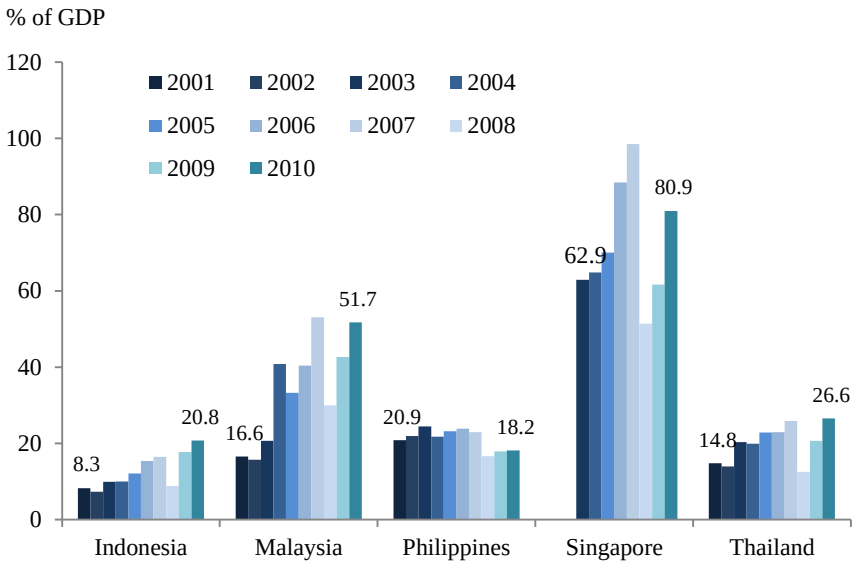
Figure 2.2. Major Sources of Funds in the ASEAN-5 Economies



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



Source: Haver

2.2.2 Uncertainty

Financial stress can also be transmitted to the economy through higher uncertainty in financial markets and the economic outlook. Hakkio and Keaton (2009) distinguish 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 volatility reflects uncertainty, higher financial stress thus 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 effect on the US economy from a reduced form VAR model and a structural firm level model of investment. In both cases, he finds a sharp fall, a rebound and an overshoot in employment, output and productivity[5]. He explains that hiring and investment levels initially fall rapidly as firms hold back on planned projects and adopt a wait-and-see approach. Lower employment and investment by high productivity

[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.

firms cause a fall in productivity. As the uncertainty dissipates, an overshoot occurs as firms react to pent-up demand for capital and labor, hence causing an overshoot in productivity. From a household perspective, Lee, Rabanal and Sandri (2010) estimate a 3 variable VAR and find that uncertainty shocks lead to a hump-shaped decline in household wealth and consumption over approximately two years.

3. Methodology

In this study, I use a Structural Vector Autoregression (SVAR) framework to assess the impact of external shocks. This approach draws from recent efforts to study linkages between financial markets and economic activity through VAR based models. Representative papers are Li and St-Amant (2010), Davig and Hakkio (2010), Hollo, Kremer and Duca (2011), Mallick and Sousa (2011) and Roye (2011). These studies use composite indices to measure underlying conditions in financial markets. Although the indices used vary with studies, all reflect stress in financial markets through declining and volatile asset prices, and higher bond yields/spreads. Existing analyses have thus far focused on large developed economies, particularly in the Euro area and United States, perhaps unsurprisingly given the recent financial episodes there. I contribute to this literature by adapting the model structure to become suited for application to small-open economies by including external variables to explicitly account for their large exposures to the foreign environment.

3.1 Data

The sample consists of the ASEAN-5 countries of Indonesia, Malaysia, Philippines, Singapore and Thailand. The variables used in the econometric analysis are in monthly frequency and are listed in Table 3.1. 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 captures prices of food, fuel and metal commodities. IPI_w captures global economic conditions. This global measure is preferred to the more commonly used US focused indicator (either US industrial production or GDP) as it implicitly accounts for the diversification of ASEAN-5 economies' trade away from the US economy. In addition, focusing on US demand alone risks erroneous identification of commodity price shocks, as high commodity prices are increasingly being attributed to demand from large emerging markets such as China.

Table 3.1. List of Variables used for Estimation

Variable	Abbreviation	Definition	Source
External			
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)
Domestic			
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 (2012)

The final external variable is an index of financial stress for the US economy, FSI_{us}, to proxy for global financial conditions. To be sure, financial episodes occur in other countries as well, especially in emerging markets. However, Kaminsky and Reinhart (2003) finds that financial episodes tend to remain confined within their regions unless they first spill over to major financial centers. This suggests that ASEAN-5 financial markets should remain unaffected by financial episodes which originate from outside the region, and that financial spillovers to the region only occur when major financial markets are affected. Therefore, I do not attempt to measure global financial stress and assume that stress in US financial markets aptly reflect global financial conditions.

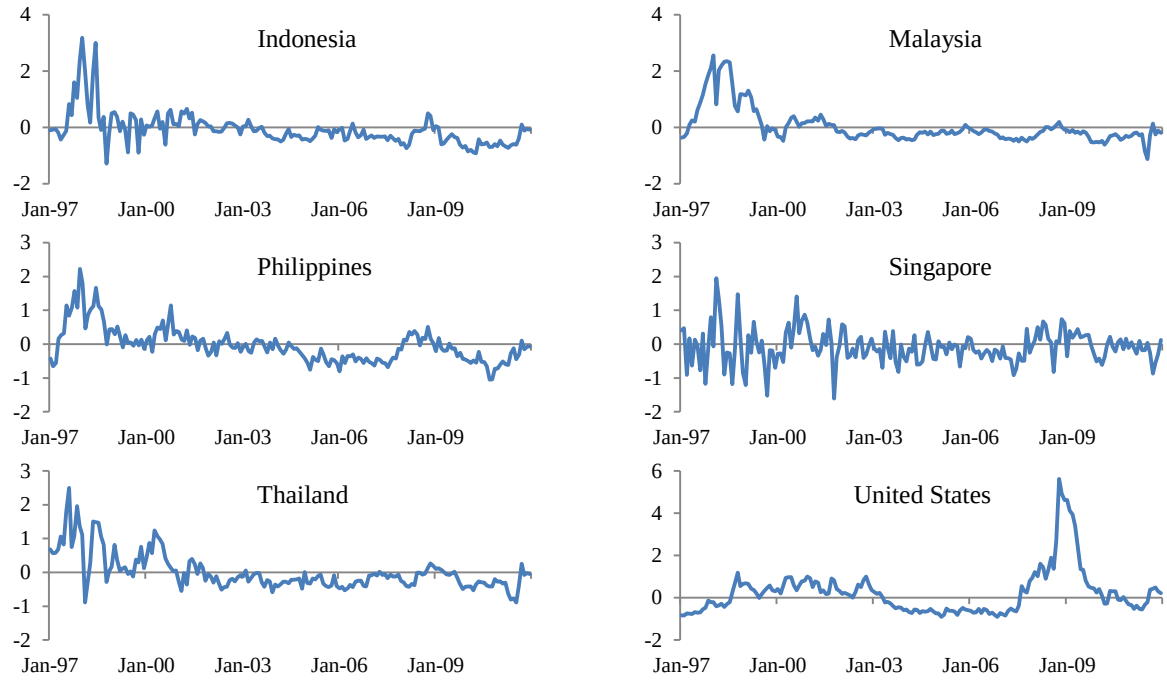
The remaining six variables characterize the domestic environment: the industrial production index (IPI) captures real economic activity, the consumer price index (CPI) reflects the price level, the short-term interest rate (IR) is the monetary policy instrument, Credit (C) is claims from domestic banks, 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 from Tng, Kwek and Sheng (2012)[6]. This index comprises of indicators of stress in four major segments of domestic financial markets: the banking sector, foreign exchange market, bond market and equity market. The market-specific indicators of

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

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 3.1. 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/buoyance in financial markets. The FSIs indicate that higher stress in the ASEAN-5 countries is 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 are external in origin, while the AFC was a country-specific and regional episode[7].

Figure 3.1. Financial Stress in the ASEAN-5 Economies (1997-2011)



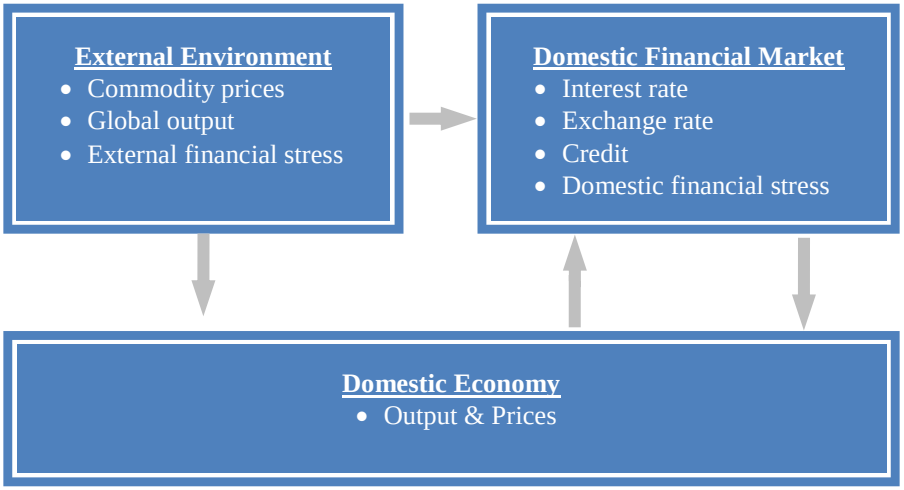
Source: Author's calculation, Hakkio and Keaton (2009)

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

3.2 The SVAR Model

A schematic summarizing the structure and causality assumptions of the SVAR model is illustrated in Figure 3.2. Output and prices are influenced by two groups of variables: The first group reflects the external environment, consisting of commodity prices, world demand and global financial conditions. The second group characterizes domestic financial markets with a short-term interest rate, the exchange rate, credit and an index of financial stress.

Figure 3.2. Schematic Illustration of the Causality Assumptions in the SVAR Model



The sample countries are taken to be small-open economies and are thus assumed to be affected by, but do not affect external conditions. The external variables directly affect domestic output and prices through the trade and price channels. They also have indirect effects through domestic financial markets. External conditions may influence monetary policy, as reflected by the interest rate, which in turn affect domestic financial conditions, output and prices. Meanwhile, external conditions may affect the exchange rate and domestic asset prices through cross-border capital flow movements. This consequently affects the terms of trade, wealth and financing conditions, which in turn affect output and prices. The financial accelerator mechanism may also amplify the direct effects of external shocks through a feedback effect from interactions between the real economy and financial markets. For example, when faced with an adverse external demand shock, the lower profits and deteriorating balance sheet positions of export-oriented companies' potentially leave them

faced with higher borrowing premiums and a lower access to desired funds. This consequently causes a moderation in investment and credit-financed trade activities.

To empirically characterize these channels, consider the following Structural VAR (SVAR) model 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. A is a matrix of the contemporaneous coefficients in structural form. $B(L)$ is a matrix polynomial in the lag operator, L. ε_t is a 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 sub-blocks. The 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 coefficients. That is, restrictions are placed on *A* to identify the disturbances and parameters of the underlying structural model from the reduced-form VAR. The assumptions made on *A* are:

$$\begin{bmatrix} \varepsilon_{GCP} \\ \varepsilon_{IPIw} \\ \varepsilon_{FSIus} \\ \varepsilon_{IPI} \\ \varepsilon_{CPI} \\ \varepsilon_{IR} \\ \varepsilon_{C} \\ \varepsilon_{Ex} \\ \varepsilon_{FSI} \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ a_{2\,1} & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ a_{3\,1} & a_{32} & 1 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & a_{5\,4} & 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & a_{6\,4} & a_{7\,4} & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & a_{7\,4} & a_{7\,5} & a_{7\,6} & 1 & 0 & 0 \\ a_{8\,1} & a_{8\,2} & a_{8\,3} & a_{8\,4} & a_{85} & a_{86} & a_{87} & 1 & 0 \\ a_{9\,1} & a_{9\,2} & a_{9\,3} & a_{94} & a_{95} & a_{96} & a_{97} & a_{98} & 1 \end{bmatrix} \begin{bmatrix} e_{GCP} \\ e_{IPIw} \\ e_{FSIus} \\ e_{IPI} \\ e_{CPI} \\ e_{IR} \\ e_{C} \\ e_{Ex} \\ e_{FSI} \end{bmatrix}$$

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. The external variables are not affected contemporaneously by the country-specific variables. The first 4 variables in the domestic block – IPI, CPI, IR, C, EX and the FSI – are ordered

recursively and are contemporaneously unaffected by the external variables. The short-term interest rate broadly follows a "Taylor Rule" principle as it reacts contemporaneously to economic activity (IPI) and prices (CPI)[8]. 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 affect the exchange rate with a lag. A VAR model with 9 variables requires 36 ($(9^2 - 9)/2 = 36$) restrictions for exact identification. The current specification thus leads to over-identifying restrictions imposed on A[9].

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 all allowed to affect each other in lags, 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), Maćkowiak (2007) and Raghavan, Silvapulle and Athanasopoulos (2012). 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. I estimate this system by Seemingly Unrelated Regression (SUR) since the VAR's regressors are not identical due

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

[9] This model makes 48 restrictions.

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-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 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). I therefore estimate the SVAR in levels since I am interested in the short- and medium run dynamics of the impulse responses.

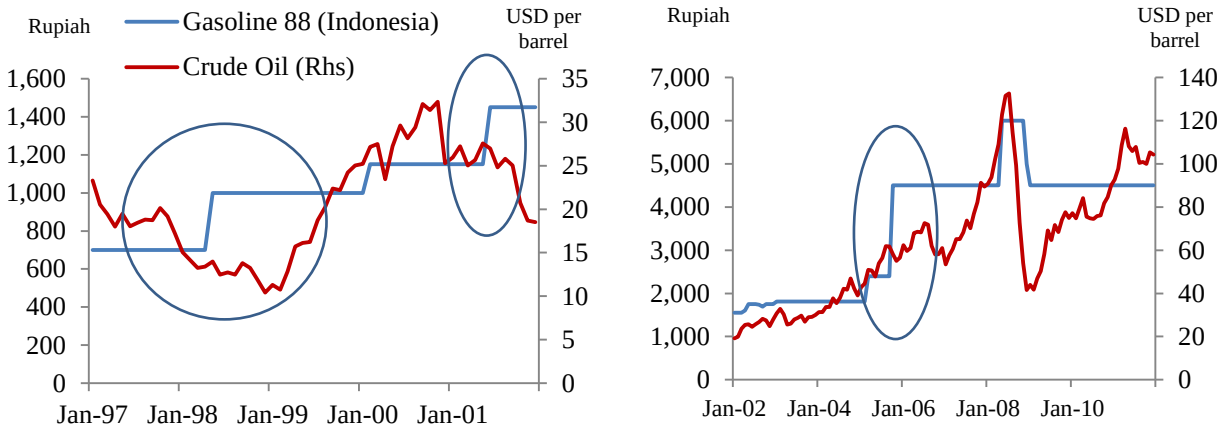
The estimations are carried out with 4 lags. The Akaike Information Criterion and Schwarz Criterion selected between 1 and 4 lags depending on the country. The ceiling within this subset was chosen to capture as much of the underlying interactions as possible. The data used for estimations range from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

Country-specific characteristics warranted a change in the baseline specification in Indonesia's model. In Indonesia, government administered petrol prices were adjusted counter to crude oil prices several times between 1997 and 2001, while the magnitude of the upward adjustment in October 2005 was disproportionate relative to the trend of crude oil prices during that period (Figure 3.3). Not accounting for this discrepancy may lead to a specification error, resulting in erroneous inference on the effects of global commodity prices on domestic prices. To address this, I incorporate a series of administered petrol prices into Indonesia's model[10]. This variable is modeled to be affected contemporaneously and in lags by global oil prices and by itself in lags. It does not affect external demand, global commodity prices and global financial conditions. The domestic variables are only affected

[10] Domestic petrol prices in Malaysia and Thailand are subsidized as well. 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.

by this series in lags except for the exchange rate and financial stress, which are allowed to react in the same period to this series.

Figure 3.3. Domestic Petrol Prices in Indonesia and Global Crude Oil Prices



Source: CEIC and International Monetary Fund

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

4. Results

4.1 The Impact of External Shocks

This section presents the baseline estimation results and discusses the exposure of the ASEAN-5 countries to the 3 external shocks. Impulse response functions are analyzed over 3 years after the shocks with 95th percentile bootstrapped confidence intervals[11].

4.1.1 The Impact of External Demand Shocks

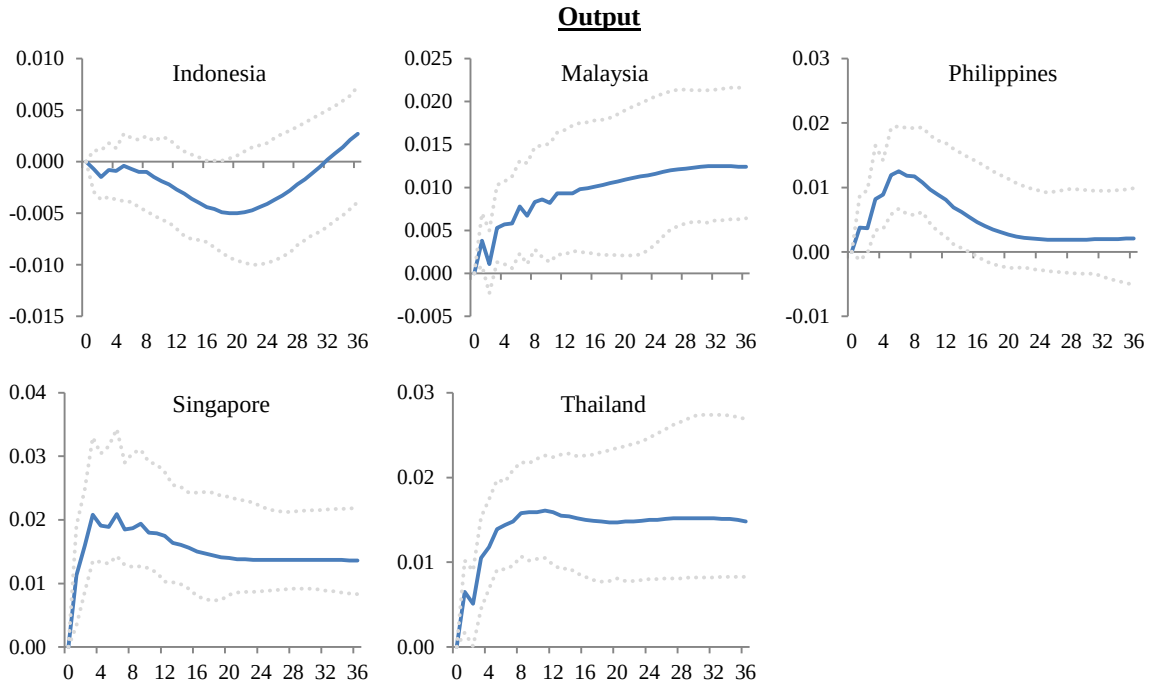
Figure 4.1 illustrates the responses of IPI in the ASEAN-5 countries to a one standard deviation shock in global output. Broadly, domestic output increases in response to a positive external demand shock with the largest effects experienced in the first 6 months. There are, however, differences in the profile of the responses across 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

[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.

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 in Indonesia is the most muted as it remains insignificant throughout the 3 year period. This implies that Indonesia is the most resilient to external demand shocks compared to the other sample countries.

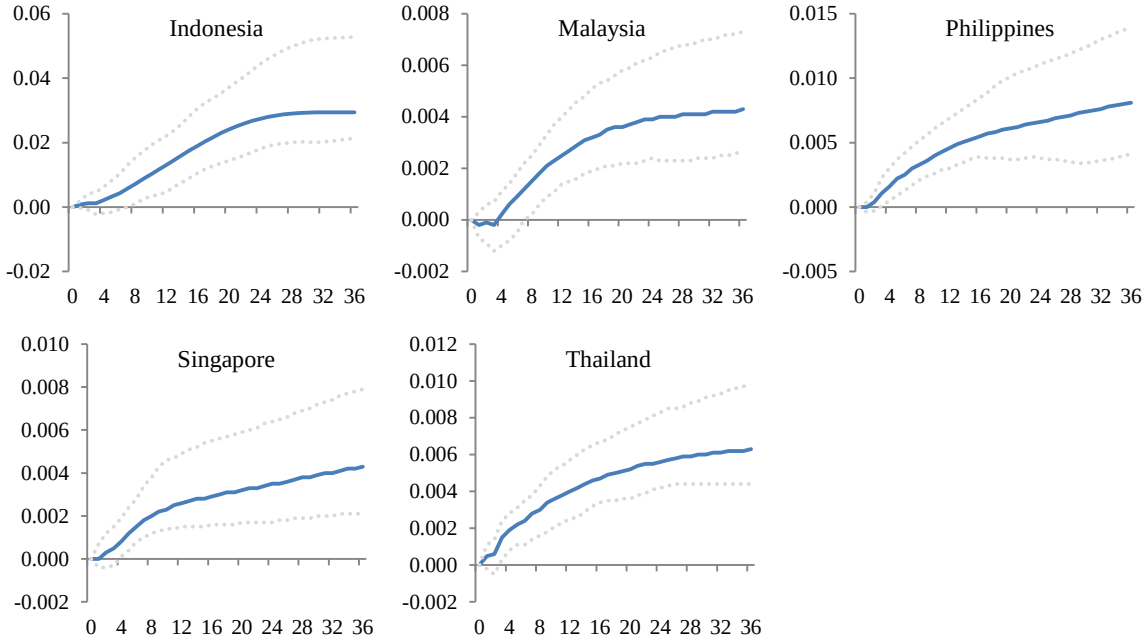
These responses are in line with the countries' reliance on external demand, as reflected by exports as a percentage of GDP. Using this metric indicates that Singapore is the most exposed to external demand, followed by Malaysia, Thailand, Philippines and Indonesia[12]. The response of consumer prices to a positive external demand shock is more uniform. Consumer prices increase in all of the countries. This likely reflects positive spillovers from export demand to the domestic-oriented sectors in the economy, resulting in higher demand-driven inflationary pressures.

Figure 4.1. Responses of Output and Prices to an External Demand Shock



[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 4.1. (Continued)
Prices



Source: Author's estimates

4.1.2 The Impact of Commodity Price Shocks

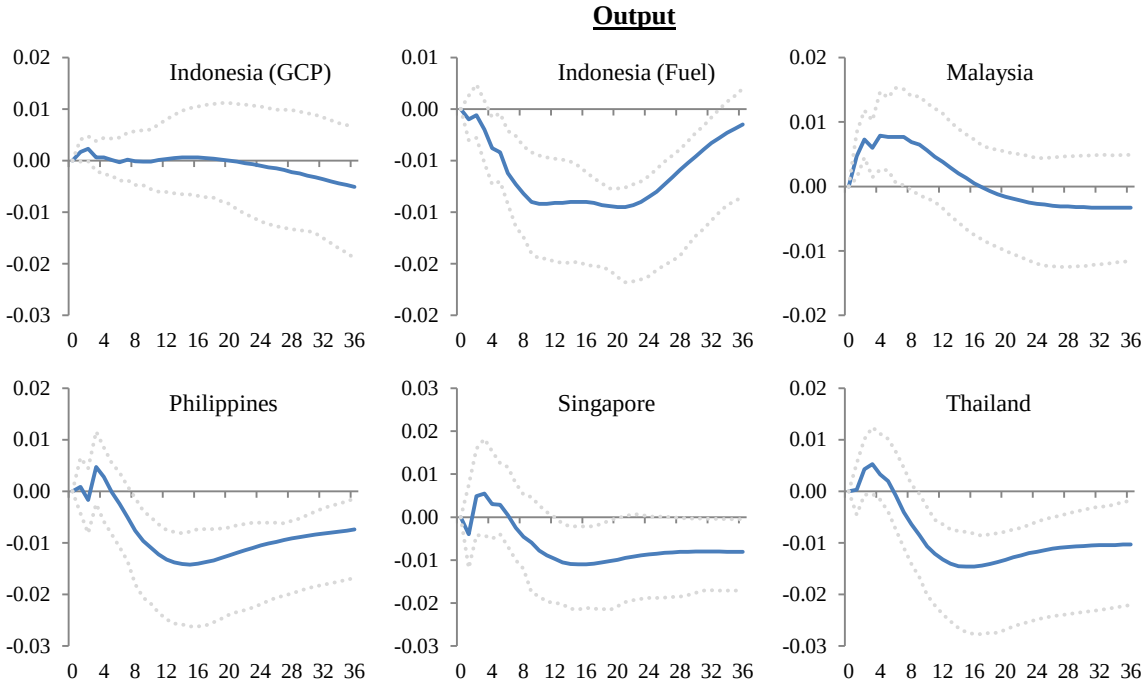
Movements in commodity prices represent exogenous shocks to the ASEAN-5 economies to the extent that they do not possess sufficient market size to influence global prices[13]. The inflation response to commodity price shocks depends on many possible country-specific factors, ranging from the composition of the CPI basket, monetary policy responses to such shocks, the exchange rate policy, and government administered price controls/subsidies on food and energy commodities. The last aspect, in particular, is not captured in the estimations due to the sometimes eclectic nature in which these policies are undertaken. But to the extent that these policies suppress the true market price and reflect a lagged and partial response to market prices, the estimated responses of global commodity prices to inflation will potentially be lower in magnitude, less volatile and passed-through with longer lags compared to the flexible price scenario. All these aspects differ with varying degrees across

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

the 5 sample countries, suggesting a diverse mix in the responses of inflation to a common commodity price shock[14].

The results confirm this *a priori* prediction. Figure 4.2 displays the responses of consumer prices and output to a one standard deviation increase in global commodity prices. For Indonesia, I also show the consumer price and output responses to a shock in domestic fuel prices[15]. The initial response of consumer prices to a commodity price shock is similar for all the sample countries except Indonesia – consumer prices increase the most 4-6 months after the shock. However, the dynamics thereafter differ substantially. In Malaysia, the impact on consumer prices eventually dissipate but the adjustment is more persistent compared to the other economies. The inflationary effect of higher commodity prices in Thailand persists for about a year, while this effect is present for 1-3 years in the Philippines, Indonesia (for fuel) Singapore.

Figure 4.2. Responses of Consumer Prices and Output to a Commodity Price Shock

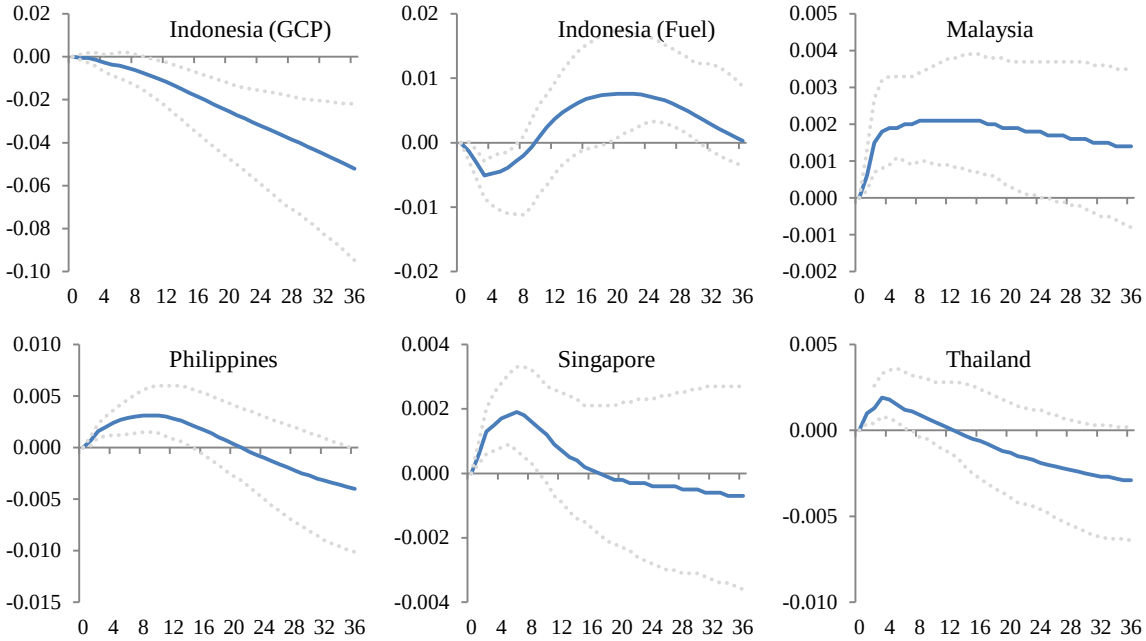


[14] Running the estimations on core inflation (inflation excluding food and energy) results in a more persistent but with similar cross-country differences in the dynamics in the responses of core inflation to a global commodity price shock. Details of these results are available upon request.

[15] As mentioned earlier, the domestic fuel price is controlled by the government and has, over the sample period, been adjusted counter to the world oil price. Shocks from this variable are thus arguably a better measure of a price shock compared to global commodity prices.

Figure 4.2. (Continued)

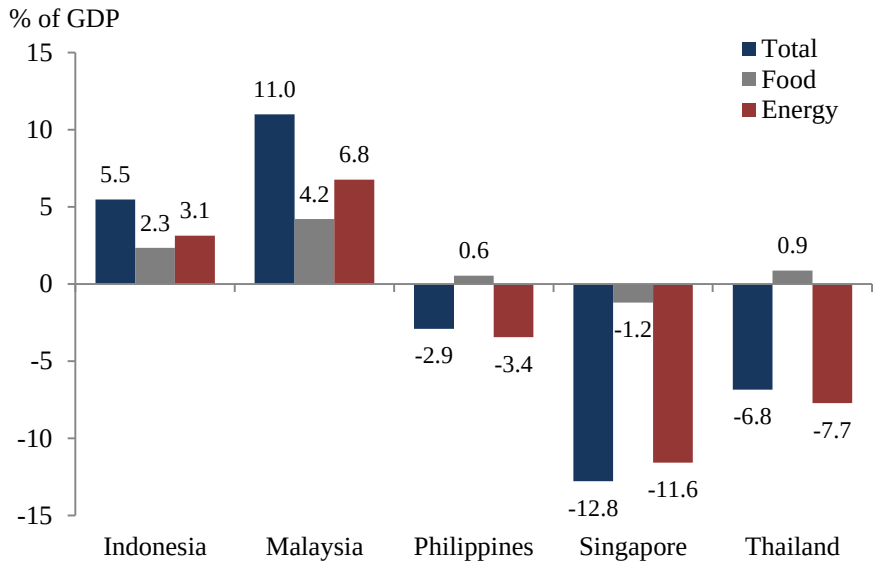
Consumer Prices



Source: Author's estimates

The effects of a commodity price shock on output also differ. Overall, higher commodity prices leads to lower output with a lag. The downward response of output is statistically significant in the Philippines and Thailand, while the position of the error bands suggests that this is likely the case in Singapore as well. In the initial months after the price shock, Indonesia's output remains stable while Malaysia's output increases during the first 6 months after the shock. The output benefits in Malaysia are especially large and statistically significant. These initial responses may be in part explained by the trade position on food and fuel commodities (Figure 4.3). Indonesia and Malaysia are net exporters of food and fuel, while Thailand, the Philippines and Singapore are net importers of these commodities. Thus, Malaysia initially benefits from higher global commodity prices as the demand for these commodities are likely price inelastic in the short-run. However, the initial benefits eventually wear off, presumably due to slower global growth caused by the higher prices. In Indonesia's case, the resilience of output to global price shocks is shown clearly by comparing its output responses to commodity price shocks and to domestic fuel price shocks. The initial resilience of output disappears when the shock is changed from an external (GCP) to a domestic price shock (Fuel).

Figure 4.3. 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

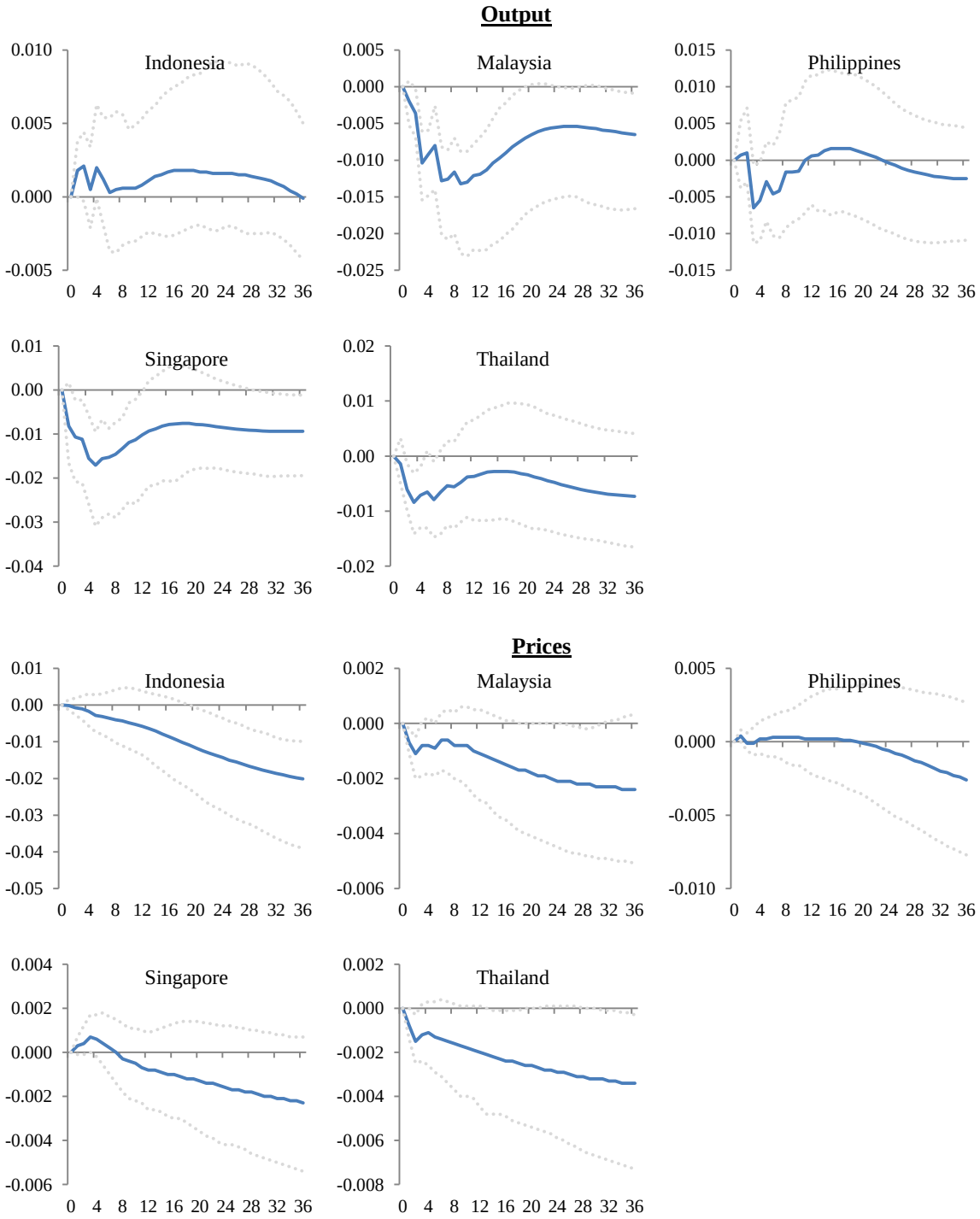
4.1.3 The Effects of External Financial Shocks

Figure 4.4 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, except in Indonesia where the effect is insignificant. In the remaining 4 sample economies, the decline is steepest in the first 6 months. Meanwhile, consumer prices decline continuously in all the countries after an external financial shock. However, the error bands tend to be large in many of the countries, making inference difficult. The position of the error bands nonetheless suggests a negative response of prices in Indonesia, Malaysia and Thailand.

The impulse responses illustrated thus far point to 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. This likely reflects cross-country differences in the policy responses and nature of government subsidies on food and fuel. Meanwhile, a global financial shock has a contractionary effect on output. In all 5 countries, output declines

steeply during the initial months and persistently remains below the pre-shock levels while prices decline after the shock.

Figure 4.4. Responses of Output and Prices to an External Financial Shock



Source: Author's estimates

In general, the impulse response analyses establish that the external influences analyzed here affect small open-economies in an intuitive and plausible manner. But it still begs the question of their overall influence relative to domestic factors on the macroeconomic performance of these economies. External shocks may materially affect growth and inflation, but explain only a small fraction of their overall variation if they occur infrequently. I analyze a decomposition of the forecast error variances of IPI and CPI to provide 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 4.1. A majority of the variation in output can be attributed to common external factors, accounting for an average of 68% and 71% of the total variation in output at the 24- and 36-month horizons. On average, external demand and commodity prices emerge as more dominant factors compared to global financial stress. These observations are similar for consumer prices.

Meanwhile, domestic financial factors – the interest rate, real domestic credit, the exchange rate and financial stress – contribute an average of 9% and 11% of the variation in output, and 13% and 10% of the variation in consumer prices at the 24- and 36-month horizons. However, these averages mask the substantial cross-country variations in the contributions. For example, domestic financial factors contribute 21% and 14% of the movements in output and inflation at the 24-month horizon in Indonesia. In comparison, domestic financial factors in Thailand account for merely 3% and 10% of the movements in output and inflation. A comparison of the shares attributed to global financial stress and the domestic financial factors illustrate that output in Malaysia and Singapore have been affected significantly more by external financial conditions, while the reverse is true for Indonesia and the Philippines.

4.2 Domestic Financial Stress as a Conduit in Transmitting External Financial Shocks

The wide range across countries in the contributions of domestic financial factors in driving output hints at a varied role of domestic financial markets in transmitting the effects of external shocks to the economy. In this section, I provide insight into the role of domestic financial markets in transmitting the effects of external financial shocks to domestic output.

Table 4.1. Decomposition of the Forecast Error Variance of Output and Consumer Prices (%)

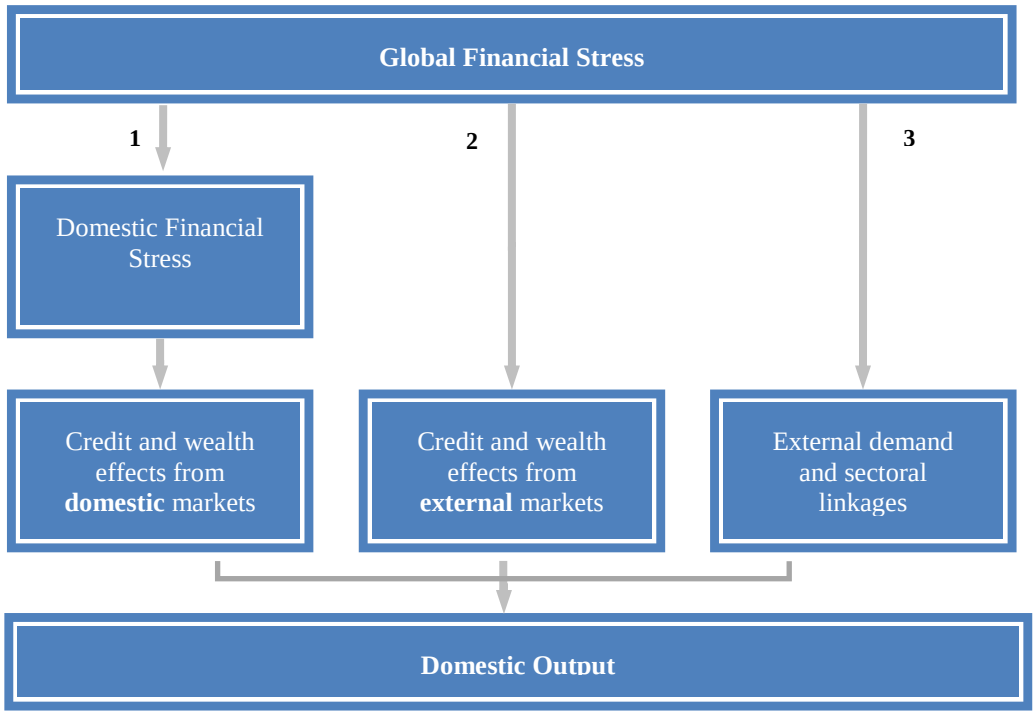
Output (IPI)						
		of which due to				of which due to
	Total External	Commodity Prices	External Demand	Global Financial Stress	**Total Domestic**	Financial Factors
24 months						
Indonesia	64	53	9	2	36	21
Malaysia	74	9	30	35	26	8
Philippines	54	34	18	2	46	13
Singapore	72	10	43	19	28	2
Thailand	76	26	45	5	24	3
Average	68	26	29	13	32	9
36 months						
Indonesia	61	51	8	2	39	27
Malaysia	79	8	42	29	21	8
Philippines	55	38	15	2	45	14
Singapore	78	12	46	20	22	1
Thailand	83	27	49	7	17	3
Average	71	27	32	12	29	11
Consumer Prices (CPI)						
		of which due to				of which due to
	Total External	Commodity Prices	External Demand	Global Financial Stress	**Total Domestic**	Financial Factors
24 months						
Indonesia	83	41	34	8	17	14
Malaysia	80	25	44	11	20	5
Philippines	64	12	52	0	36	28
Singapore	50	7	38	5	50	9
Thailand	77	5	57	15	23	10
Average	71	18	45	8	29	13
36 months						
Indonesia	95	54	31	10	6	6
Malaysia	87	18	54	15	13	4
Philippines	71	10	59	2	29	25
Singapore	59	4	46	9	41	8
Thailand	87	8	62	17	13	5
Average	80	19	50	11	20	10

Source: Author's estimates

Note: Financial factors refer to the total contributions from the interest rate, real credit, domestic financial stress and the NEER. Percentages may not add to 100 due to rounding errors.

The schematic in Figure 4.5 outlines 3 main channels in which global financial episodes may affect output beyond the direct trade effects[16]. In the first channel, an adverse external financial shock spills over to domestic financial markets. The resulting volatility and decline in domestic asset prices causes deterioration in domestic financing conditions in capital markets, negative wealth effects and hence lower real economic activity. Domestic credit conditions also become more restrictive as balance sheets of firms/households and the economic outlook deteriorate. The second channel is similar to the first, except that the external financial shock affects resident firms/households with direct financing, credit and wealth exposures to foreign banks and capital markets. Finally, an external financial shock leads to lower profitability in the financial sector through a decline in financial market activities. In reality, the transmission likely occurs through a combination of these three depicted scenarios.

Figure 4.5. Transmission Channels of the Impact of External Financial Shocks to Output

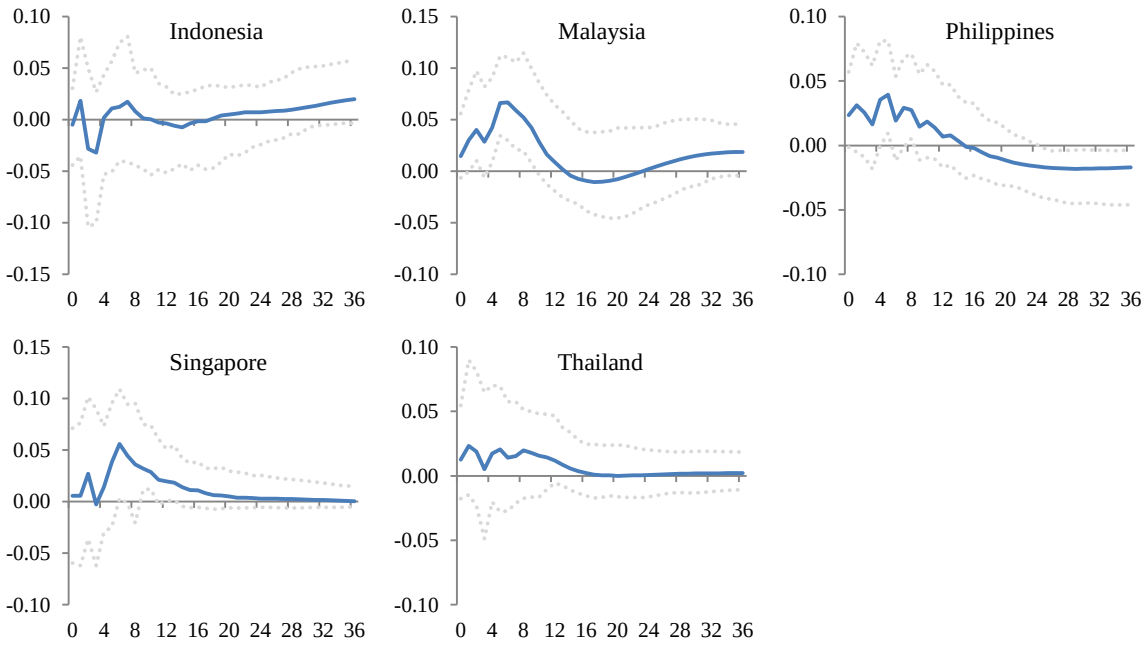


[16] This schematic abstracts from second round effects for simplicity.

Figures 4.6 and 4.7 give some insight to the first channel. Figure 4.6 depicts the impulse responses of an external financial shock on domestic financial stress, thus providing evidence of spillovers from external to domestic financial markets. The results broadly show that domestic financial stress increases 6-9 months after an external financial shock and reverts back to its mean within one year. The transmission for Malaysia is consistently statistically significant 4-12 months after the shock. In contrast, domestic financial stress in Singapore, Indonesia, Philippines and Thailand are insignificant over most of the period studied, although stress increases during the initial months. The impact is the most muted in Indonesia. Nonetheless, domestic financial stress displays some spillover from external financial markets, especially during the initial months after the shock.

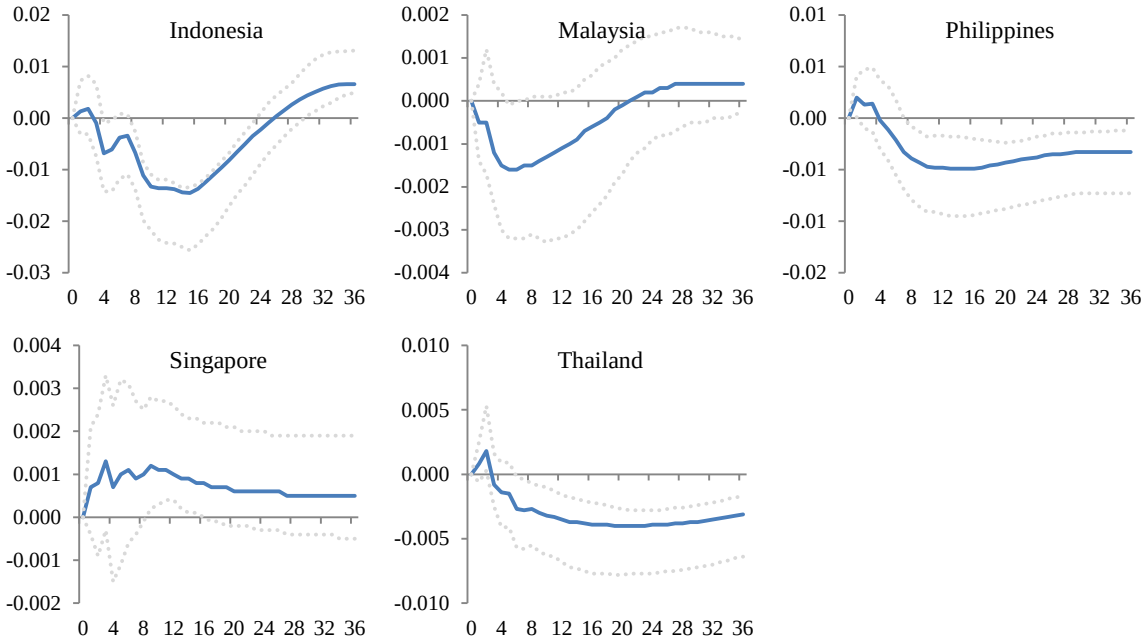
Figure 4.7 shows the adverse effects on credit when spillovers occur, by illustrating the response of domestic credit to an adverse domestic financial shock. Higher domestic financial stress has a negative effect on domestic credit in all the sample economies. Singapore is an exception, with credit increasing in response to higher financial stress. The error bands, however, are especially large in this case.

Figure 4.6. Effects of an External Financial Shock on Domestic Financial Stress



Source: Author's estimates

Figure 4.7. Effects of a Domestic Financial Shock on Domestic Credit

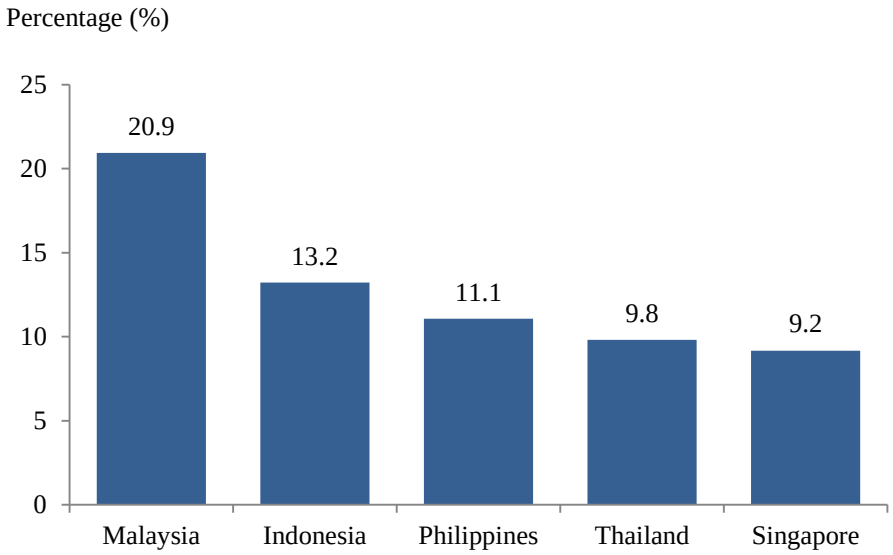


Source: Author's estimates

Given the evidence of financial spillovers, I now try to distinguish the first from the second and third paths of transmission shown in Figure 4.5, by quantifying the effects of an external financial shock on domestic output that is attributable to domestic financial stress. I achieve this by comparing the impulse response functions from the baseline model a restricted model. The restricted model is similar to the baseline, except that domestic financial stress is treated as an exogenous variable. The remaining contemporaneous, block-exogeneity and lag length assumptions are similar to the baseline specification. In doing so, I block off the responses of output to the external financial shock that passes-through domestic financial stress. The extent that the impulse responses from the restricted SVAR model are smaller reflects the degree of the pass-through via domestic financial stress (Chow, 2006; Morsink & Bayoumi, 2001; Raghavan, Silvapulle & Athanasopoulos, 2012). To characterize the pass-through of the external financial shock to domestic output through domestic financial stress, I compute the difference between the accumulated responses of output from the baseline and restricted specification for the first 12 months after the shock, expressed as a percentage of the accumulated response from the baseline. I choose a 12 month period because this is when the estimated impact of external financial shocks on output is most often significant (Figure 4.4).

Figure 4.8 presents the results, with the associated incremental impulse responses from the baseline and restricted SVARs over a 36 month period in Appendix 2. There is substantial cross-country difference in the pass-through. The largest pass-through is found in Malaysia, where 20.9% of the impact of an external financial shock on output occurs through domestic financial stress. Meanwhile, the lowest pass-through is found in Singapore at 9.2%. There are many potential reasons why the pass-through is so diverse across countries, which warrant further research. For example, policies aside from conventional monetary policy and structural characteristics of the economy as well as domestic financial markets that influence this pass-through are also not captured.

Figure 4.8. Pass-through of External Financial Shocks to Output through Domestic Financial Stress

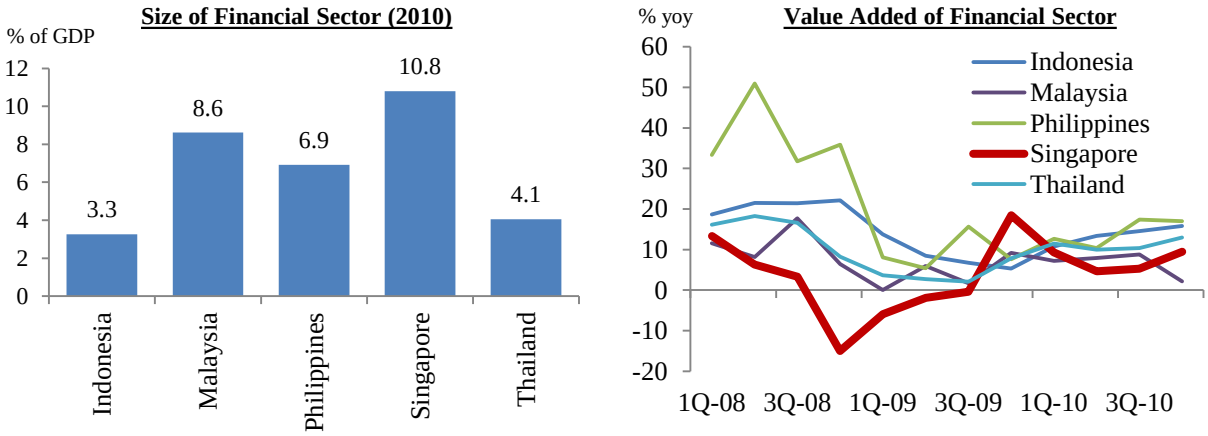


Source: Author's estimates

Figure 4.9 briefly explores the third channel of the schematic in Figure 4.5 separate from the econometric analysis. Here, the performances of financial sectors are affected directly during financial episodes through lower transactions, fee-based income and profits. This is reflected in lower value-added in the sector and hence in GDP. This channel applies most to Singapore as it operates as a regional financial centre. Its finance sector also comprises the largest share of GDP compared to the other 4 sample countries. Shocks that affect the performance of the sector therefore have the largest bearing on its economy. Figure 4.9 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.

Figure 4.9. Size and Performance of Financial Sectors in the ASEAN-5 Economies during the GFC period



Source: Haver, CEIC

5. Robustness of the SVAR Model Results

The assumptions about the exogeneity of the foreign to the domestic variables and the precedence of the real over the financial variables are intuitive and common practice in existing literature. However, the ordering of the FSI variable within the financial block is not as self-evident. For instance, financial stress can be hypothesized to have contemporaneous effects on the exchange rate and credit. Monetary policy may also react contemporaneously to financial stress if the Central Bank takes it as a forward looking signal of growth and inflation prospects. To investigate the robustness of the findings from the baseline model, I estimate the SVAR with alternative orderings of the FSI variable within the financial block. Appendix 3 replicates the impulse response functions that are shown thus far and compared with impulse responses from SVARs with the FSI ordered before the exchange rate, credit and the interest rate. The results show that the responses of output, prices and domestic financial stress are similar to the baseline. The largest divergence from the baseline results is in the response of credit to a domestic financial shock. Although the direction of the trajectory is similar, the magnitude and persistence differ in some cases.

6. Concluding Remarks

In this paper, I estimate SVAR models to give insight to the exposure of the ASEAN-5 economies to the external environment. External demand broadly 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 domestic output and prices are driven by external factors, although the importance among the three studied external variables differ across countries. Countries with a higher dependence on exports are proportionately more sensitive to external demand shocks. Positive 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 demand for these commodities. Adverse external financial shocks are found to spill over to domestic financial markets and cause output and prices to decline. However, the role of domestic financial stress in transmitting higher global financial stress to lower domestic output differs among the ASEAN-5 countries. Explaining this diversity warrants further research.

Overall, the significant influence of external factors on the countries studied here suggests a need for policy institutions to closely monitor such risks. One challenge for small open economies is that while external headwinds may be identifiable as risks build up, their exogenous nature makes it more difficult to assess when and whether they will materialize into economically impactful events and the exact timing of their occurrence. Being able to identify them early is necessary for the implementation of pre-emptive policies to limit their macroeconomic consequences. Equally necessary is an understanding of the magnitude and duration of such shocks on the domestic economy and, in particular, how they will be transmitted. Only with this information can policymakers deliberate on the appropriate instrument and the magnitude of their application needed to address the risks at hand in a targeted manner.

References

Bernanke, B. S. (1986). Alternative Explanations of the Money-Income Correlation. *Carnegie-Rochester Conference Series on Public Policy, 25*, 49-99.

Bernanke, B. S., & Gertler, M. (1989). Agency Costs, Net Worth, and Business Fluctuations. *The American Economic Review, 79*(1), 14-31.

Bernanke, B. S., & Gertler, M. (1992). The Federal Funds Rate and the Channels of Monetary Transmission. *The American Economic Review, 82*(4), 901-921.

Bernanke, B. S., Gertler, M., & Gilchrist, S. (1999). Chapter 21 The Financial Accelerator in a Quantitative Business Cycle Framework. In B. T. John & W. Michael (Eds.), *Handbook of macroeconomics* (Volume 1, Part C, pp. 1341-1393).

Bloom, N. (2009). The Impact of Uncertainty Shocks. *Econometrica, 77*(3), 623-685.

Chow, H. K. (2006). Analyzing Singapore's Monetary Transmission Mechanism. In Winston Koh and Roberto Mariano, *The Economic Prospoects of Singapore.* Singapore: Addison-Wesley.

Cushman, D. O., & Zha, T. (1997). Identifying Monetary Policy in a Small Open Economy Under Flexible Exchange Rates. *Journal of Monetary Economics, 39*(3), 433-448.

Davig, T., & Hakkio, C. (2010). What is the Effect of Financial Stress on Economic Activity. *Economic Review - Second Quarter 2010*.

Dell'Ariccia, G., Detragiache, E., & Rajan, R. (2008). The Real Effect of Banking Crises. *Journal of Financial Intermediation, 17*(1), 89-112.

Genberg, H. (2005). External Shocks, Transmission Mechanisms and Deflation in Asia. *BIS Working Papers* (187).

Hakkio, C., S., & Keeton, W., R. (2009). Financial Stress: What Is It, How Can It Be Measured, and Why Does It Matter? *Economic Review*, 5-50. Federal Reserve Bank of Kansas City.

Hall, P. (1992). *The Bootstrap and Edgeworth Expansion*. New York: Springer.

Hollo, D., Kremer, M., & Duca, M. L. (2011). CISS - A Composite Indicator of Systemic Stress in the Financial System.
Available at http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1611717.

Jensen, M. C., & Meckling, W. H. (1976). Theory of the Firm: Managerial Behavior, Agency Costs and Ownership Structure. *Journal of Financial Economics, 3*(4), 305-360.

Kashyap, A., & Stein, J. (1995). The Impact of Monetary Policy on Bank Balance Sheets. *Carnegie-Rochester Conference Series on Public Policy, 42*, 151-195.

Lee, J., Rabanal, P., & Sandri, D. (2010). U.S. Consumption after the Crisis. *IMF Staff Position Notes, 10/01*.

Li, F., & St-Amant, P. (2010). Financial Stress, Monetary Policy and Economic Activity. *Bank of Canada Working Paper, 2010-12*.

Maćkowiak, B. (2007). External Shocks, U.S. Monetary Policy and Macroeconomic Fluctuations in Emerging Markets. *Journal of Monetary Economics, 54*(8), 2512-2520.

Mallick, S. K., & Sousa, R. M. (2011). The Real Effects of Financial Stress in the Euro Zone. *NIPE Working Paper Series, 12/2011*.

Mendoza, E. G., & Terrones, M. E. (2008). An Anatomy Of Credit Booms: Evidence From Macro Aggregates And Micro Data. *National Bureau of Economic Research Working Paper Series, No. 14049*.

Morsink, J., & Bayoumi, T. (2001). A Peek Inside the Black Box: The Monetary Transmission Mechanism in Japan. *IMF Staff Papers, 48*(1).

Phillips, P. C. B. (1998). Impulse Response and Forecast Error Variance Asymptotics in Nonstationary VARs. *Journal of econometrics, 83*(1–2), 21-56.

Raghavan, M., Silvapulle, P., & Athanasopoulos, G. (2012) Structural VAR Models for Malaysian Monetary Policy Analysis During the Pre- and Post-1997 Asian Crisis Periods. *Applied Economics*, 44(29), 3841-3856.

Ramaswamy, R., & Sloek, T. (1997). The Real Effects of Monetary Policy in the European Union: What Are the Differences? *IMF Working Papers, 97/160*.

Roye, B. V. (2011). Financial Stress and Economic Activity in Germany and the Euro Area. *Kiel Working Paper, 1743*.

Sims, C. A. (1986). Are Forecasting Models Usable for Policy Analysis? *Quarterly Review, Federal Reserve Bank of Minneapolis*(Win), 2-16.

Sims, C. A., Stock, J. H., & Watson, M. W. (1990). Inference in Linear Time Series Models with Some Unit Roots. *Econometrica: Journal of the Econometric Society, 58*(1), 113-144.

Stiglitz, J., & Weiss, A. (1981). Credit Rationing in Markets with Imperfect Information. *American Economic Review, 71*(3), 393-410.

Svensson, L. E. O. (2000). Open-economy Inflation Targeting. *Journal of International Economics, 50*(1), 155-183.

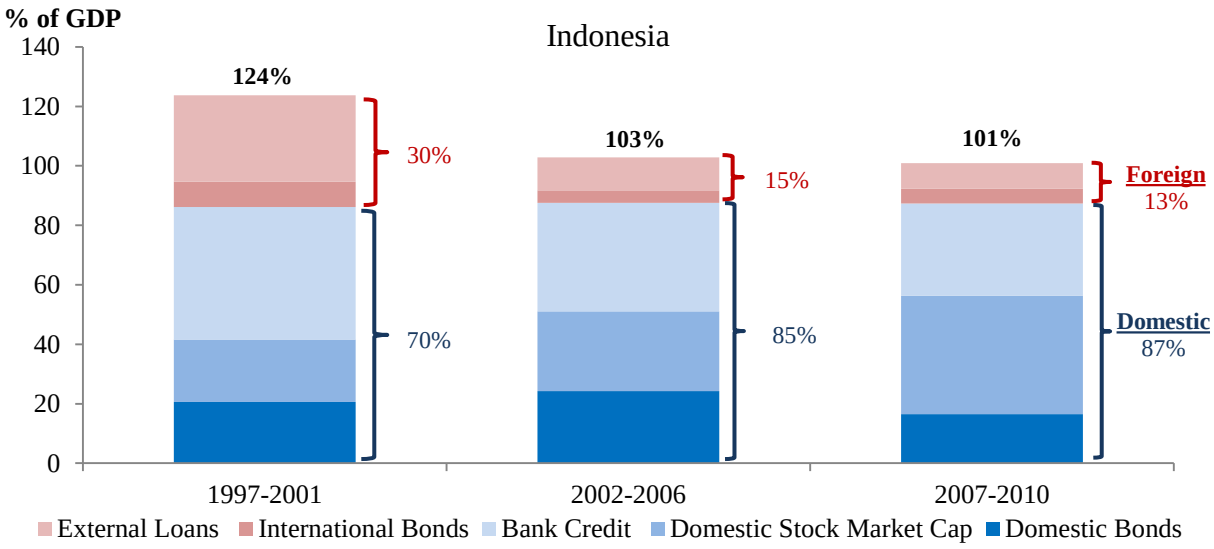
Taylor, J. B. (1993). Discretion Versus Policy Rules in Practice. *Carnegie-Rochester Conference Series on Public Policy, 39*, 195-214.

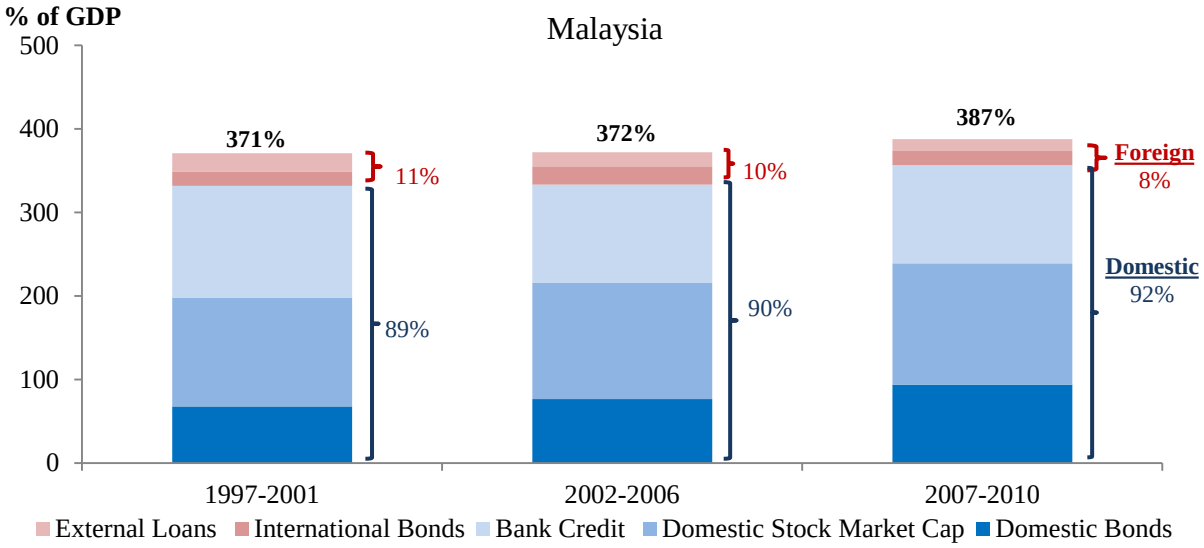
Tng, B. H., Kwek, K. T., & Sheng, A. (2012). A Credit Approach to Measuring Financial Stress in Malaysia: A Comparison from Asian Crisis to Global Crisis. *Singapore Economic Review, 57(2)*, 1250013-1-1250013-24.

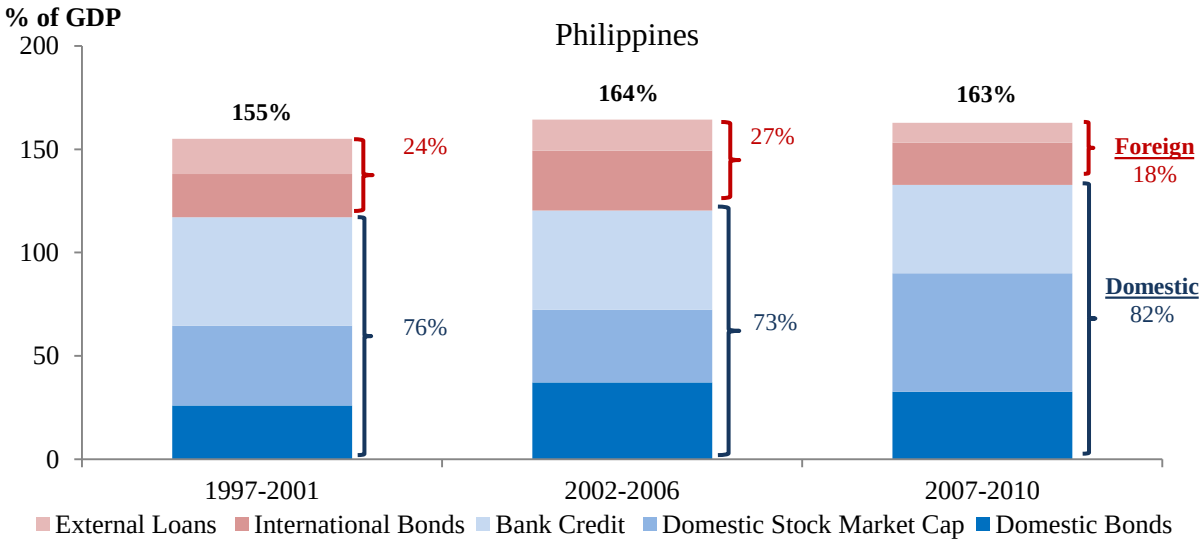
Tobin, J. (1969). A General Equilibrium Approach to Monetary Theory. *Journal of Money, Credit and Banking, 1*(1), 15-29.

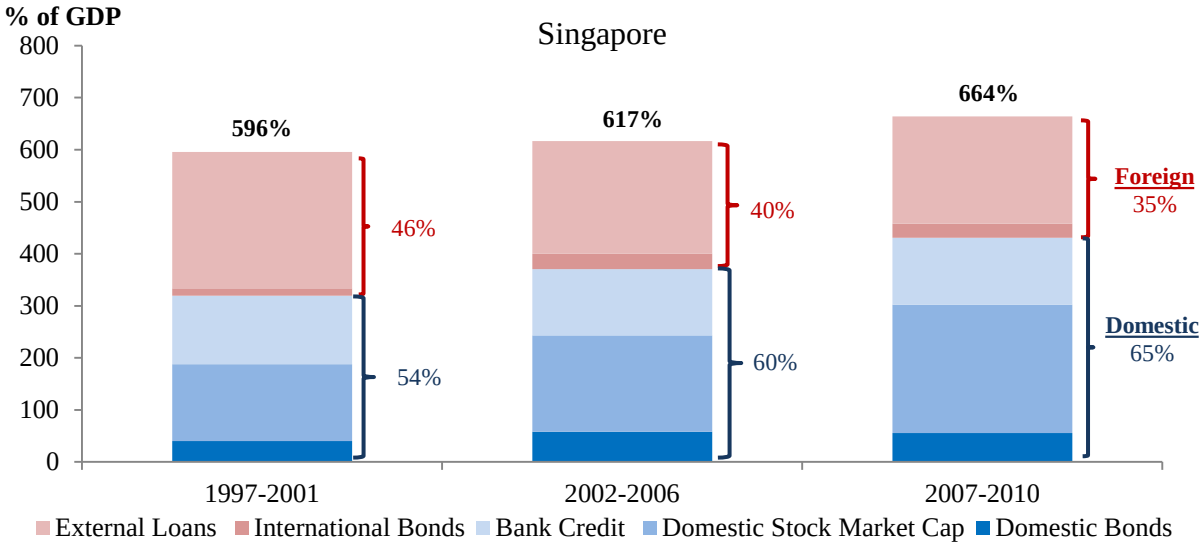
Van Den Heuvel, S. J. (2002). Does Bank Capital Matter for Monetary Transmission? *Economic Policy Review, 8*(1), 259–265.

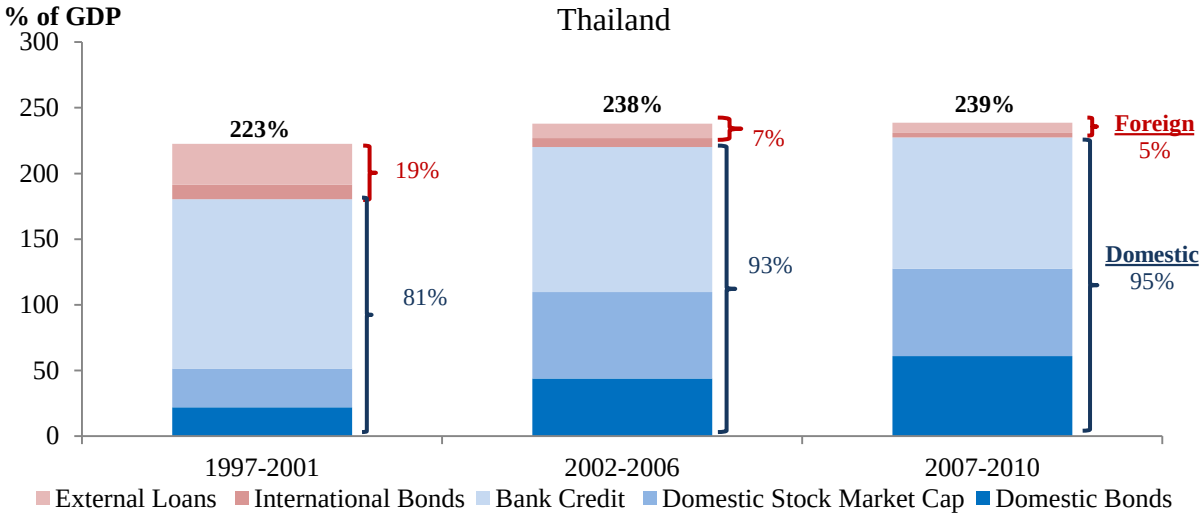
Appendix 1: Composition of the Major Sources of Financing in the ASEAN-5 Countries



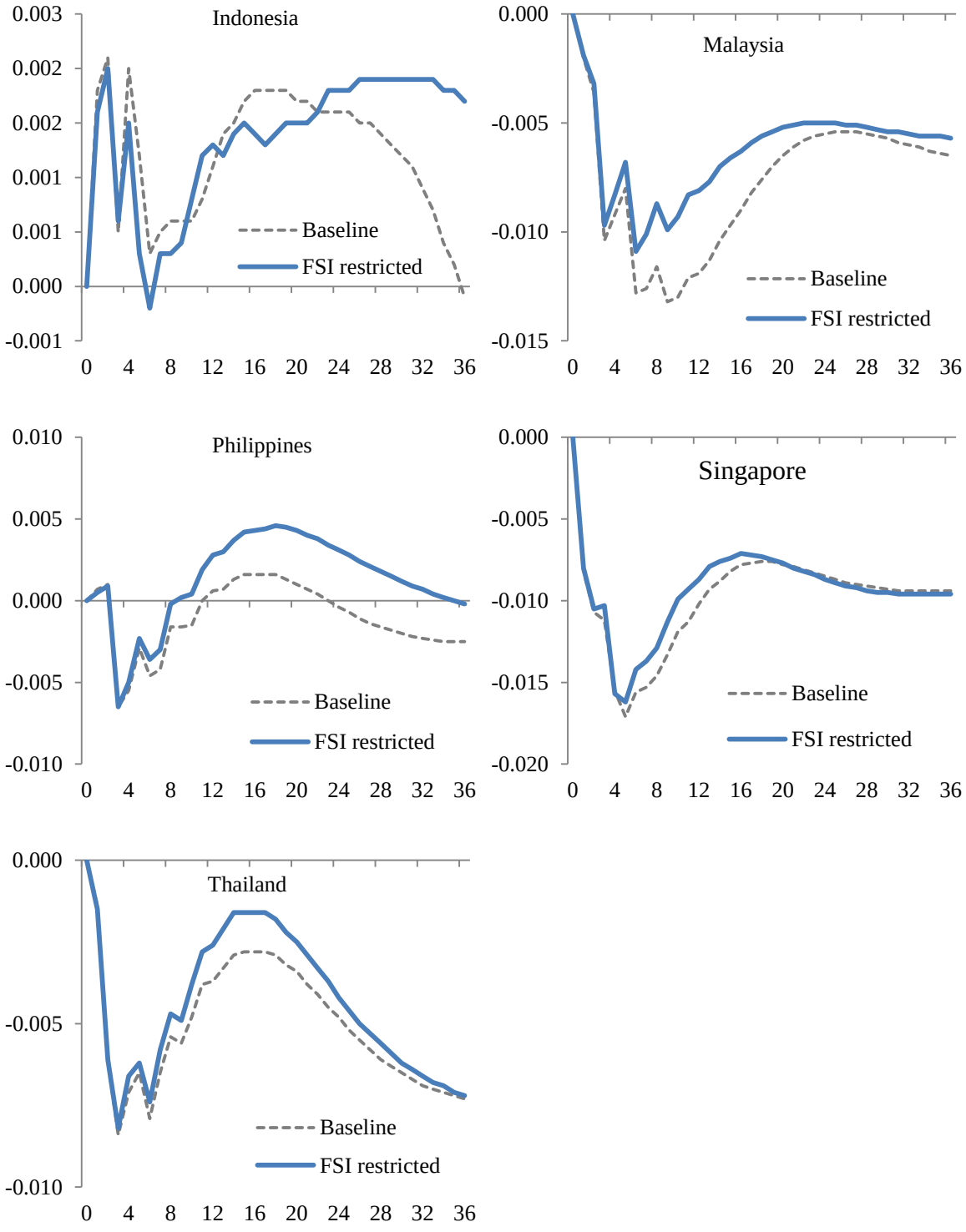



% of GDP
Philippines
200
150
100
50
0
155%
164%
163%
24%
27%
76%
73%
Foreign
18%
Domestic
82%
1997-2001
2002-2006
2007-2010
External Loans
International Bonds
Bank Credit
Domestic Stock Market Cap
Domestic Bonds


% of GDP
Singapore
800
700
600
500
400
300
200
100
0
596%
617%
664%
46%
40%
54%
60%
Foreign
35%
Domestic
65%
1997-2001
2002-2006
2007-2010
External Loans
International Bonds
Bank Credit
Domestic Stock Market Cap
Domestic Bonds

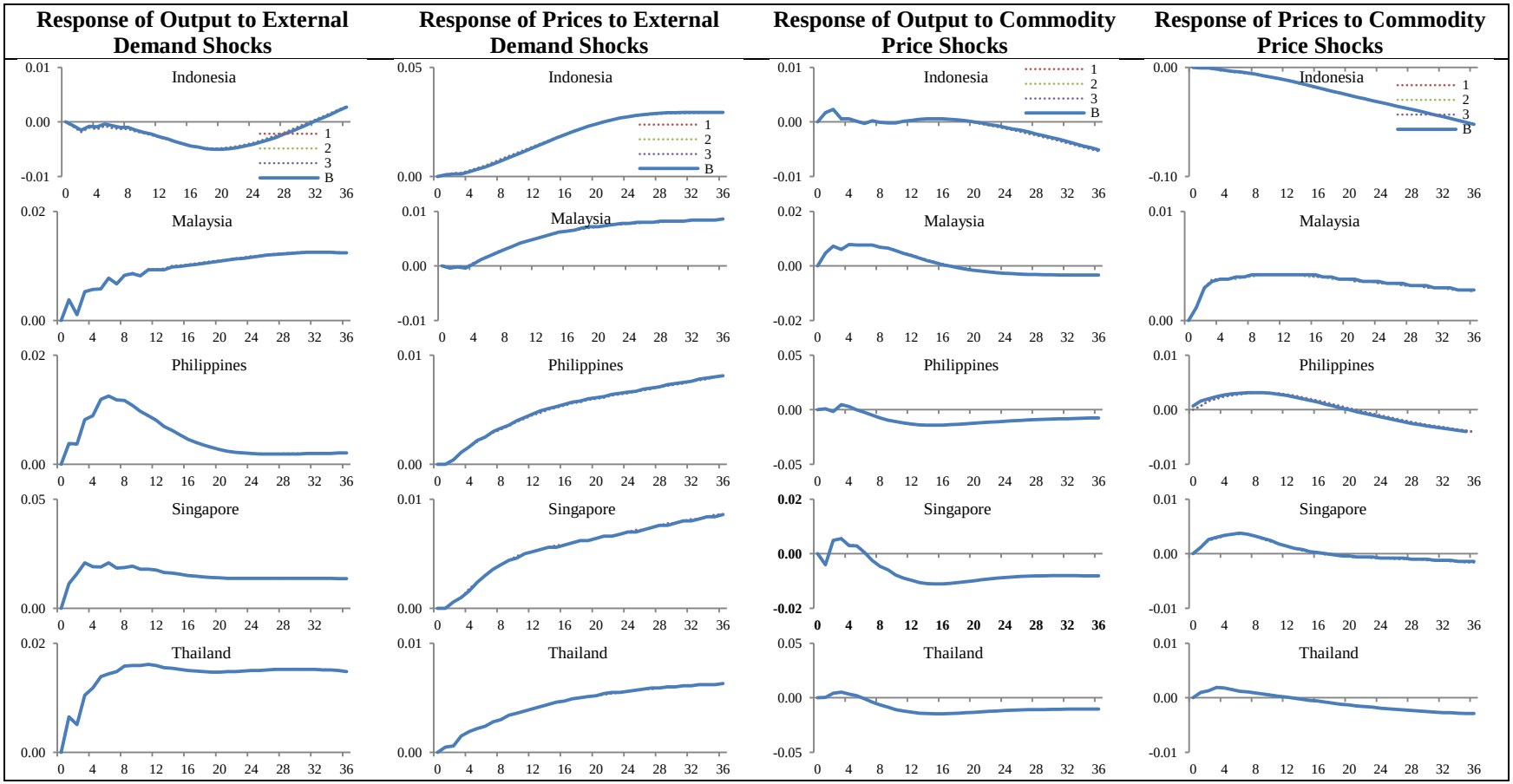

% of GDP
Thailand
300
250
200
150
100
50
0
223%
238%
239%
19%
7%
81%
93%
Foreign
5%
Domestic
95%
1997-2001
2002-2006
2007-2010
External Loans
International Bonds
Bank Credit
Domestic Stock Market Cap
Domestic Bonds

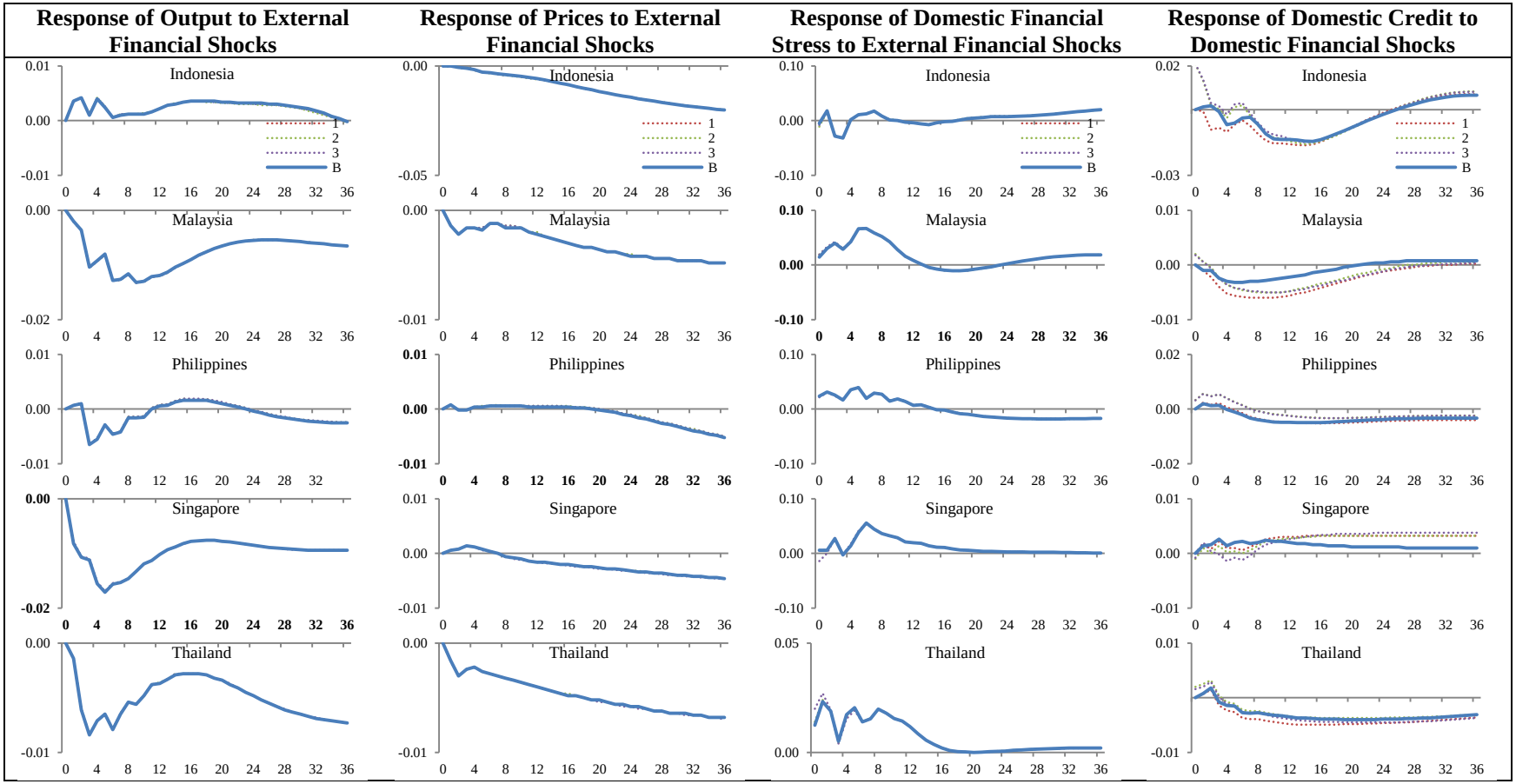
Appendix 2: Impulse Response of Output to a 1 Standard Deviation External Financial Shock from the Baseline and Restricted SVARs



Source: Author's estimates

Appendix 3: Robustness of Impulse Reponses to Alternative Ordering Assumptions





Source: Author's estimates

Note: B refers to impulse responses from the baseline model. 1, 2 and 3 are impulse responses from specifications with the FSI ordered respectively before the NEER, the NEER and real credit, and the NEER, real credit and the interest rate. Other assumptions remain similar to the baseline model.