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Real Effects: Malaysia's Experience**

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# Macroeconomic Surveillance of Portfolio Flows and its Real Effects: Malaysia's Experience

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## Abstract

This study highlights Bank Negara Malaysia's (BNM) statistical efforts for capital flow surveillance. We describe the development of various data systems that capture capital flows with differing levels of timeliness and coverage, and discuss how these datasets complement each other. We then estimate Structural Vector Autoregression (SVAR) models to assess the causes and effects of portfolio flows in Malaysia. Three findings emerge: first, global and domestic factors play transitory roles in driving portfolio flows, with domestic influences having a more gradual and persistent effect. Second, higher portfolio inflows lead to exchange rate appreciation, higher equity prices and higher credit. The effects are first visible in the exchange rate, followed by equity prices and credit. Portfolio inflows lead to transient short-term improvements in domestic growth, with volatile dynamics. In the transmission of higher portfolio flows to growth, the positive effects from improved equity prices and credit conditions are partially offset by the dampening effect that the appreciating exchange rate has on output.

**JEL Classification:** F41, F43

**Keywords:** Capital flows, SVAR, Malaysia

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## 1. Introduction

Emerging economies (EMs) with open capital and financial accounts constantly face risks associated with large capital inflows and their corresponding reversals. In developed financial markets, capital flows are easily dispersed across assets and sectors. Financial markets in many EMs, however, have not reached this level of development, resulting in capital flow movements being more visible in the exchange rate, asset prices and bank credit. When large enough, capital flow movements can cause the build-up of financial imbalances (e.g. over-valued asset prices, high credit growth and over-investment), exchange rate misalignments and a higher probability of financial crises. A policy priority for EMs with open capital accounts should therefore focus on pre-emptive measures to diffuse these risks.

This study uses Malaysia as an example to describe two pre-conditions that are necessary to implement such pre-emptive policies. The first pre-condition is having a robust framework to monitor capital flows with timeliness, depth and breadth. The second pre-condition is a deep understanding of the causes and effects of capital flows. We start by describing Bank Negara Malaysia's (BNM) efforts to develop several complementary databases for capital flow surveillance. Several data sources are necessary, as there is a trade-off between timeliness and coverage in the data collection. We then estimate a Structural Vector Autoregression (SVAR) model to give insight to three issues: What drives Malaysia's portfolio flows; what is the impact of portfolio flows on domestic financial markets and the real economy; and how important are domestic financial markets in the transmission of portfolio flows to the real economy. The model depicts Malaysia as a small-open economy and accounts for key features of the global environment, such as global liquidity and financial market volatility.

This study focuses on the portfolio (debt and equity) component of the financial account.<sup>2</sup> Our interest arises from the uncertainty surrounding the effects of portfolio flows on economic growth. Portfolio inflows are associated with higher asset prices and credit growth, which affect growth positively. However, inflows also cause the exchange rate to appreciate, which exerts downward pressure on growth through the trade channel<sup>3</sup>. The net impact of portfolio inflows on growth is thus an empirical question.

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<sup>2</sup> We exclude other types of flows such as foreign direct investment as their causes and effects could differ from portfolio flows.

<sup>3</sup> Beyond this traditional view, exchange rate appreciation can also exert upward pressure on growth by affecting the net wealth of economic agents where foreign debt is concerned, thus influencing consumption and investment. See, for instance, Serena and Sousa (2017).

Existing studies tend to analyse the effects of capital flows on financial markets and credit<sup>4</sup> and, separately, the effects of financial markets and credit on the real economy.<sup>5</sup> There are fewer studies, especially on EMs, that encompass capital flows, financial markets and the real economy within a common empirical framework. Our model uses monthly data, which departs from most relevant studies using cross-country and lower frequency datasets (quarterly or annually). A country-specific model is likely more informative as the causes and transmission of portfolio flows may differ across countries due to differences in institutions, regulation and financial market structure. Meanwhile, higher frequency data is arguably better suited to study the transmission of portfolio flows, which can be volatile and short-term in nature.

The SVAR estimations reveal that global and domestic factors play important transitory roles in driving Malaysia's portfolio flows, with domestic influences having a more gradual and persistent effect compared to global factors. Higher portfolio flows lead to first an appreciating exchange rate, followed by higher equity prices and increased credit. Though there are gains to growth from looser credit conditions and higher equity prices, there is also a downward pressure on growth from an appreciating exchange rate. The overall effect of portfolio flows on growth is positive with a time dynamic that is volatile and transitory.

The remaining sections proceed as follows. In section 2, we set the stage by giving a brief overview of Malaysia's portfolio flows, highlighting relevant regulatory changes and discussing how BNM monitors developments in portfolio flows. We then empirically assess the causes and effects of portfolio flows using an SVAR framework in section 3. The final section concludes the paper.

## **2. Malaysia's Portfolio Flows: Trends and Monitoring**

This section presents a stylised exposition of how Malaysia's portfolio flows have evolved over time and how they were facilitated by institutional changes. Subsequently, we describe how BNM monitors these cross-border flows.

Figure 1 illustrates cumulative net portfolio inflows from 2004 to present for EMs and Malaysia. Malaysia has experienced portfolio flow cycles that are strikingly similar to other EMs and the region. From 2005 to mid-2008, EMs, including Malaysia, were recipients of

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<sup>4</sup> See, for instance, Kim and Yang (2011), Tillmann (2013), Lane and McQuade (2014) and Rhee and Yang (2014).

<sup>5</sup> See, for instance, Schularick and Taylor (2012), Drehmann and Juselius (2014) and Jordà, Schularick, and Taylor (2015).

substantial inflows. These economies subsequently experienced outflows until mid-2009, during the most intense phase of the Global Financial Crisis (GFC). Inflows resumed until 2013 as liquidity from monetary easing by central banks in the advanced economies flowed largely to EMs with more favourable macroeconomic prospects.<sup>6</sup>

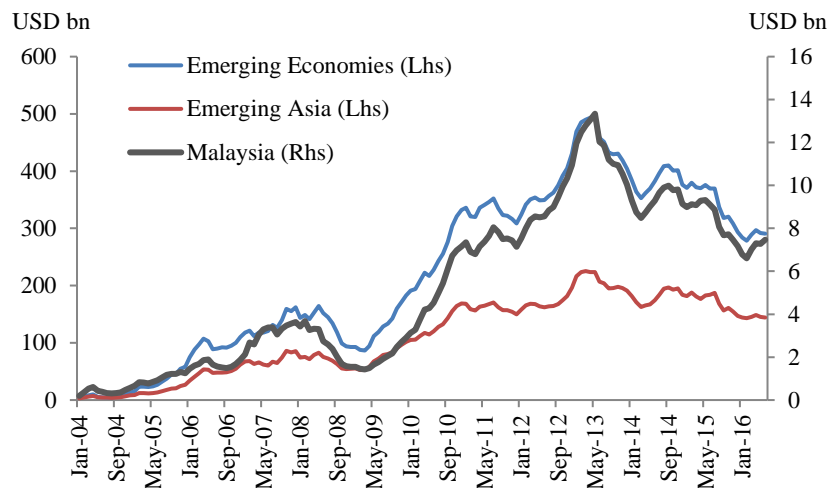
Figure 2 illustrates net portfolio flows from Malaysia's Balance of Payments, showing a steady increase in the magnitude and volatility since 2000. This occurred as Malaysia deepened its integration with global financial markets and thus increasingly exposed itself to global events. While major financial events since 2008 (the GFC and euro debt crisis) and loose global monetary conditions contributed to the higher volume and volatility in portfolio flows globally, in Malaysia's case, regulatory and policy efforts since the Asian Financial Crisis (AFC) in 1997 also played an important role in facilitating greater two-way movements in its portfolio flows. First, there was a significant effort to develop Malaysia's domestic bond market as an alternative source of financing from bank credit and equities.<sup>7</sup> Second, there was a continuous liberalisation of foreign exchange administration rules that were implemented since 1998. Third, the central bank adopted a managed float regime for the Malaysian ringgit on 21<sup>st</sup> July 2005. Reflecting these developments, there was a notable shift in composition of portfolio flows from predominantly equities in the early-2000s to debt currently. The share of debt and equity securities shifted from 22% and 78% of gross portfolio flows in 2001 to 60% and 40% in 2015, respectively.

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<sup>6</sup> See Ooi (2008), Anwar and Tan (2009), BNM (2010), Razi, Ripin, and Nozlan (2012) and Sim and Tengku Muhammad Azlan (2016) for comprehensive discussions on the trends of capital flows in Malaysia and policy efforts to liberalise the foreign exchange market.

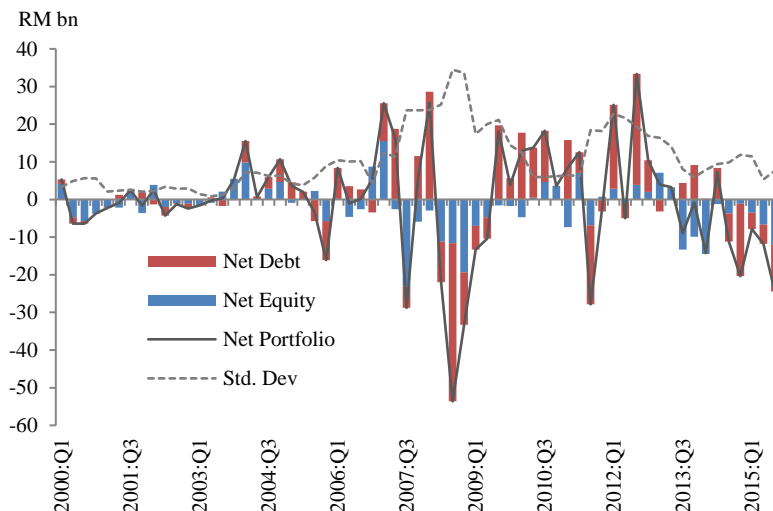
<sup>7</sup> See BNM and SC (2009) for a detailed account of the initiatives taken to develop Malaysia's bond market.

**Figure 1. Cumulative Net Portfolio Inflows in Emerging Economies and Malaysia<sup>8</sup>**



Source: EPFR Global

**Figure 2. Net Portfolio Debt and Equity Flows in Malaysia (2000-2015)**



Source: Bank Negara Malaysia

In recognizing the risks associated with capital flows, BNM developed several data systems for monitoring and statistical inference. The following are three main systems/databases used to monitor capital flows<sup>9</sup>:

- **Ringgit Operations Monitoring System (ROMS):** A system where authorized dealers report foreign exchange transactions to the central bank. Cross-border flows captured by ROMS are those converted from foreign to domestic currency. ROMS captures these transactions on a near real-time basis.

<sup>8</sup>The economies covered are listed in the Data Appendix.

<sup>9</sup> These databases are also described in Ooi (2008).

- **Cash Balance of Payments (CBOP):** CBOP records cross-border cash transactions between residents and non-resident. This system captures transactions that are intermediated through the banking system, intercompany and overseas accounts. CBOP is distinct from the official Balance of Payments (BOP) statement as information is recorded on a cash basis, while the BOP is recorded on an accrual basis.
- **BNM-DOSM Joint Survey on International Investment Position (IIP)**<sup>10</sup>: This quarterly survey records the size and structure of external assets and liabilities in the Malaysian economy. The IIP informs the size and composition of financial assets held by residents abroad and non-residents in the Malaysian economy. The information is captured on a stock and flow basis and contains detailed breakdowns. The assets and liabilities are marked to market, accounting for changes in the exchange rate and asset prices, as at end-period.

These databases encapsulate BNM’s view that no system perfectly captures portfolio flows (and, more generally, capital flows) with maximum timeliness, depth and breadth. Table 1 summarizes the timeliness and coverage across ROMS, CBOP and IIP, reflecting a trade-off between lags and coverage.

**Table 1. Timeliness and Coverage across Databases**

	<b>Lag</b>	<b>Coverage</b>	<b>Example of Application</b>
<b>ROMS</b>	Near real-time	Flows with foreign exchange transactions	Time sensitive open market operations and reserves management
<b>CBOP</b>	1 month	Flows intermediated through bank, inter-company & overseas accounts	Business/financial cycle and macro-financial analyses
<b>IIP</b>	1-2 quarters	All flows	Structural analyses

The near real-time basis in which ROMs captures capital flows makes it useful for decision-making on time sensitive market operations, such as open market operations to smooth exchange rate volatility as well as management of domestic liquidity and international reserves. In contrast, IIP is lowest in frequency but most comprehensive in detail and is able to

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<sup>10</sup> BNM and DOSM refer, respectively, to Bank Negara Malaysia and the Department of Statistics Malaysia (DOSM). This quarterly survey commenced in 1Q-2008, replacing the Survey on International Investments and Services by DOSM and the Report on External Assets and Liabilities by BNM. This survey also contributes to the compilation of Malaysia’s Balance of Payments (BOP), a quarterly statement that records economic transactions (flows concept) between residents and non-residents. The financial account of the BOP corresponds to but is not entirely similar to changes in the IIP (stock concept).

give a complete snapshot of how Malaysian residents have been re-allocating their wealth across borders by the type of assets. The IIP also captures the participation of non-residents in Malaysia's assets and the composition of these asset types. Hence, while less timely, the IIP very is useful for gauging Malaysia's aggregate risk profile in terms of its external wealth position.

The timeliness and coverage of CBOP lies between ROMS and IIP, and is suitable for empirical analyses related to business/financial cycles and the characterisation of macro-financial linkages for three reasons. First, the monthly frequency is high enough to capture financial dynamics while also being compatible with the timeliness of other key variables used to investigate macro-financial dynamics, typically captured at monthly or quarterly frequencies. Second, CBOP captures flows that are intermediated through the domestic financial system and large companies, thus encompassing the major institutions responsible for extending financing to the private sector. Finally, cross-border flows captured by CBOP includes both transactions that involve conversions to the Malaysian ringgit and those left in foreign currency, making CBOP's data better suited than ROMS to study potential linkages that occur through changes to balance sheet positions.

### **3. Assessing the Macroeconomic Causes and Effects of Portfolio Flows**

We now use the CBOP database to assess the causes of portfolio flows and its transmission to domestic financial markets and the real economy. This section starts by summarising findings from the macro-finance literature. We then use the findings and the narrative of global and Malaysia's portfolio flows to guide our empirical strategy.

#### **3.1 What Drives Portfolio Flows: "Push" and "Pull" Factors**

Since the wave of financial liberalisation in the early 1980s, EMs experienced various episodes of large portfolio flows that brought both benefits and risks to these economies. Following Calvo, Leiderman, and Reinhart (1996) and Fernandez-Arias (1996), the distinction between country-specific "pull" factors and foreign "push" factors provide a useful underlying theoretical framework to understand the drivers of capital flows.<sup>11</sup>

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<sup>11</sup> The push-pull dichotomy provides an intuitive classification of capital flows drivers, mainly to assess whether portfolio flows are mostly 'pulled' by attractive domestic conditions or 'pushed' by unfavourable external



Several papers have investigated how global and domestic conditions, classified as push- and pull-factors respectively, have influenced the flow of capital to EMs.<sup>12</sup> Among the common push-factors that matter for portfolio flows are global growth, global liquidity and global risk aversion. Stronger global growth increases portfolio flows. Higher global liquidity amplifies global leverage and together with global risk aversion, which measures risk appetite and is mainly influenced by uncertainties, can cause sudden shifts in capital flows.

Though classified as common shocks to EMs, the size and effects of these push factors on portfolio flows tend to vary across countries.<sup>13</sup> According to Fratzscher (2011), a large part of this heterogeneity is due to country specific pull-factors. Some commonly identified pull-factors are domestic macroeconomic conditions, monetary policy responses, financial sector development and the exchange rate exposures.

### **3.2 The Transmission of Portfolio Flows**

The capital flows literature has also concentrated on the macroeconomic implications and associated policy responses to surges in capital flows. This includes the benefits and costs in terms of economic growth and financial stability associated with portfolio flows. Unlike the broad consensus in existing literature on the positive impact of trade openness on growth, there is little agreement on the impact of financial openness and the associated portfolio flows on EMs. Obstfeld and Rogoff (1996), Obstfeld (1998), Mishkin (2009), Kose, Prasad, Rogoff, and Wei (2009) and Obstfeld (2009) argue that increased openness to capital flows is important and beneficial for growth in EMs. The premise is that access to international funds allows developing countries to supplement domestic savings and achieve higher rates of capital accumulation, thus accelerating growth through investment and/or greater consumption. Rodrik (1998) and Rodrik and Subramanian (2009), among others, argue that increasing capital flows is a serious impediment to global financial stability, consequently leading to adverse effects on growth stability in EMs. After the financial crises in the 1990s in Latin American and Asian economies, it became apparent that capital flows to emerging economies came with risks. This was mainly attributable to the liquidity risks underpinned by maturity mismatches

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conditions. The push-pull framework is also useful for explaining the behaviour of portfolio flows during and after the financial crisis. See, for example, Koepke (2015).

<sup>12</sup> See, for example, Milesi-Ferretti and Tille (2011), Fratzscher (2011), Forbes and Warnock (2012), Ahmed and Zlate (2014), Cerutti, Claessens, and Puy (2015), Rey (2015), Koepke (2015), among many others.

<sup>13</sup> Cerutti et al. (2015) finds that Malaysia's portfolio flows is largely sensitive to push factors in comparison with other EMs.

between foreign assets and liabilities, and the associated exchange rate exposures (Bosworth & Collins, 1999; Rey, 2015).

More recently, developing countries have been receiving large amounts of financial flows arising from expansionary unconventional monetary policy in major advanced economies. The increase in global liquidity and associated inflows has led to concerns over excessive asset prices and the unsustainable build-up of leverage in EMs. In the short-term, large capital inflows fuel credit booms and elevate asset prices, thus increasing household consumption and investment through laxer credit and positive wealth effects. Over the longer-term, however, higher debt and overheating asset markets may lead to vulnerabilities, such as increased domestic and external indebtedness and the erosion of current account positions. As described in Calvo (1998), an exogenous sudden slowdown in capital flows can cause large unexpected changes in relative prices such as depreciation of the domestic currency and collapse of asset prices. These developments can trigger a further reversal of capital flows, leading to sharp corrections in collateral values and a credit crunch (Borio & Zhu, 2012; Meissner, 2013).

Capital flows related crises have often been attributed to inappropriate/misinformed macroeconomic policies and weak country fundamentals, with proponents often citing the reluctance of developing economies to allow free-floating exchange rates. Central to this view is the concept of the “impossible trinity” or the “open-economy trilemma”. Countries with an open capital account that wish to maintain monetary autonomy have to allow their exchange rates to float freely. Attempts to control currency movements are unsustainable and ultimately result in speculative attacks and financial instability (Bosworth & Collins, 1999; Koepke, 2015; Obstfeld, 2009; Obstfeld & Taylor, 1997; Reinhart & Reinhart, 2008).<sup>14</sup>

Several studies on EMs have empirically explored the macroeconomic effects of capital flows. One stand uses cross-country panel models with relatively low data frequency (mostly annual), in part due to limited data availability. Soto (2000), Kose, Prasad, and Terrones (2005), Bussière and Fratzscher (2008) and Ferreira and Laux (2009) find that portfolio equity flows promote growth. On the other hand, Durham (2004), Baharumshah and Thanoon (2006) and Choong, Baharumshah, Yusop, and Habibullah (2010) find that short-term capital inflows do

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<sup>14</sup> A recent study by Rey (2015) argues that the global financial cycle has transformed the well-known “trilemma” into a “dilemma”. Since exchange rate adjustment cannot insulate against large movements in capital flows, independent monetary policies are only possible if the capital account is managed accordingly and is supported with the right policies to curb excessive leverage and credit growth.

not positively affect growth. More recently, Aizenman, Jinjarak, and Park (2013) find that the association of portfolio flows with growth is smaller and less stable compared to FDI flows.

Another strand of papers focus on the impact of global liquidity and capital flows on asset prices and credit conditions in EMs using panel VAR models. Kim and Yang (2011) and Tillmann (2013) find that a surge in portfolio inflows boosts asset prices and the exchange rate in emerging East Asian countries. Brana, Djigbenou, and Prat (2012) find that excess global liquidity contributes significantly to higher GDP and inflation, while the effects on equity and property prices are less clear. Rhee and Yang (2014) show that a positive shock to global liquidity leads to larger portfolio inflows, exchange rate appreciation and positive effects on GDP, inflation and equity prices.

It appears that the effects of capital flows on growth depend on how the flows are intermediated and channelled to productive economic activities. The evidence suggests that capital inflows can benefit growth, depending on factors such as the type of flows, state of financial market development and exchange rate regimes of the recipient country. The effects on GDP, stock prices and exchange rate are often larger and more persistent in emerging recipient economies compared to advanced economies.

### 3.3 The Data

Ten variables are considered for econometric analysis and fall into two broad categories with some overlap: those used to identify push- and pull-factors of portfolio flows and those that capture fundamentals and market characteristics of the Malaysian economy. Appendix 1 provides the sources and detailed data descriptions. The series are in monthly frequency spanning January 2000 to September 2015.

Three variables characterise the global push-factors. The world production index (*WPI*) captures the global business cycle. *GLI* is a measure of global liquidity and proxies for unconventional monetary policy in the advanced economies.<sup>15</sup> *GLI* is constructed as the sum of M2 from the United States, Euro Area, Japan and United Kingdom.<sup>16</sup> The implied volatility

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<sup>15</sup> In recent years, unconventional monetary policy and the associated lower interest rates in mature economies have driven much of portfolio flows to EMs (Cerutti et al., 2015).

<sup>16</sup> For a detailed explanation on the construction and the interpretation of this index, please refer to Rhee and Yang (2014).

index (*VIX*) index captures global investors' reaction to economic and financial market uncertainties.

Seven variables characterise the domestic economy. The industrial production index (*IPI*) captures business cycle movements and is an important pull-factor for portfolio flows (Koepke, 2015). The consumer price index (*CPI*) reflects the price level. The short-term interbank interest rate (*IR*) reflects liquidity conditions in domestic financial markets and the nominal effective exchange rate (*EX*) represents the exchange rate. Credit (*CR*) refers to loans outstanding from domestic banks. Lane and McQuade (2014) find a significant relationship between international capital flows and domestic credit growth. Berkelmans (2005) and Jacobs and Rayner (2012) find that the inclusion of credit is necessary to capture the balance sheet effects of portfolio flows on banks. The equity price index (*KLCI*) measures asset prices. The final variable is portfolio flows (*CF*), comprising of debt and equity securities flows from the CBOP database. This variable is expressed in net terms (inflows minus outflows).

Except for the interest rate and portfolio flows, all variables are transformed to natural logarithm and, where necessary, are seasonally adjusted. Portfolio flows are in level terms as the series contains negative values.

### 3.4 The SVAR Model

The relationship among the ten variables is modelled using a Structural VAR (SVAR) framework. With the intercept suppressed for ease of exposition, an SVAR model representation is:

$$A_0 X_t = A_1 X_{t-1} + \dots + A_p X_{t-p} + \varepsilon_t \quad (1)$$

where  $X$  is a  $(10 \times 1)$  vector of variables, the  $A_i (i = 0, 1, 2, \dots, p)$  are  $(10 \times 10)$  matrices of coefficients with  $A_0$  normalised across the main diagonal and  $\varepsilon_t$  is a  $(10 \times 1)$  multivariate white noise error process with zero mean and a diagonal covariance matrix,  $\Sigma_\varepsilon$  containing the variances of the structural disturbances. The SVAR in (1) is represented as:

$$A(L)X_t = \varepsilon_t \quad (2)$$

where  $A(L)$  is a matrix polynomial in lag operator  $L$  and  $A(L) = A_0 - A_1L - \dots - A_pL^p$ . Since shocks to small open economies have little impact on major foreign economies, we treat the foreign variables as exogenous to domestic economic variables. The SVAR system, divided into foreign and domestic blocks and the  $X_t$  in (2), is represented as:

$$X_t = [X_{1,t} \quad X_{2,t}]'$$

where  $X_{1,t} = [WIPI_t, GLI_t, VIX_t]$  and  $X_{2,t} = [IPI_t, CPI_t, IR_t, CF_t, CR_t, KLCI_t, EX_t]$  represent the foreign and domestic blocks, respectively. To capture the foreign block exogeneity phenomenon, the contemporaneous and lagged values of the Malaysian variables are restricted from entering the foreign equations. Hence, the  $A(L)$  in (2) is:

$$A(L) = \begin{bmatrix} A_{11}(L) & 0 \\ A_{21}(L) & A_{22}(L) \end{bmatrix} \quad (3)$$

Apart from foreign block exogeneity restrictions, no further restrictions are imposed on the lag structure. To provide some economic structure to the model, restrictions on the contemporaneous matrix  $A_0$ , shown in (4), are drawn from theory, stylized facts and existing literature.

$$A_0 = \begin{bmatrix} 1 & 0 & 0 & \vdots & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ a_{2,1}^0 & 1 & 0 & \vdots & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ a_{3,1}^0 & a_{3,2}^0 & 1 & \vdots & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ \dots & \dots & \dots & \vdots & \dots & \dots & \dots & \dots & \dots & \dots & \dots \\ a_{4,1}^0 & 0 & a_{4,3}^0 & \vdots & 1 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & \vdots & a_{5,4}^0 & 1 & 0 & 0 & 0 & 0 & 0 \\ 0 & a_{6,2}^0 & 0 & \vdots & a_{6,4}^0 & a_{6,5}^0 & 1 & 0 & 0 & 0 & 0 \\ a_{7,1}^0 & a_{7,2}^0 & a_{7,3}^0 & \vdots & a_{7,4}^0 & a_{7,5}^0 & a_{7,6}^0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & \vdots & a_{8,4}^0 & a_{8,5}^0 & a_{8,6}^0 & a_{8,7}^0 & 1 & 0 & 0 \\ a_{9,1}^0 & a_{9,2}^0 & a_{9,3}^0 & \vdots & a_{9,4}^0 & a_{9,5}^0 & a_{9,6}^0 & a_{9,7}^0 & a_{9,8}^0 & 1 & 0 \\ a_{10,1}^0 & a_{10,2}^0 & a_{10,3}^0 & \vdots & a_{10,4}^0 & a_{10,5}^0 & a_{10,6}^0 & a_{10,7}^0 & a_{10,8}^0 & a_{10,9}^0 & 1 \end{bmatrix} \quad (4)$$

World production index ( $WIPI_t$ ) is ordered first with the expectation that it has flow-on effects on global liquidity ( $GLI_t$ ) and financial market volatility ( $VIX_t$ ).  $GLI$  is ordered before

the *VIX* index to capture the fact that the uncertainty variable responds instantaneously to global economic and liquidity shocks (Bekaert, Hoerova, & Lo Duca, 2013). All three variables can influence one another in the lags.

Among the domestic variables, portfolio flows ( $CF_t$ ), equity prices ( $KLCI_t$ ) and the exchange rate ( $EX_t$ ) respond immediately to the foreign shocks. As in Forbes and Warnock (2012), Tillmann (2013) and Koepke (2015), the portfolio flow shock is partially driven by push-factors, where global financial and macroeconomic conditions lead investors to channel funds to EMs. On the other hand, the price level ( $CPI_t$ ) and bank credit ( $CR_t$ ) do not contemporaneously react to foreign shocks. As in Raghavan, Silvapulle, and Athanasopoulos (2012) and Tng and Kwek (2015), these variables are perceived as sluggish and respond slowly through the lag structure. As a small open economy, interest rates ( $IR_t$ ), reflecting liquidity and financing conditions in Malaysia's financial markets, is assumed to be contemporaneously affected by foreign monetary conditions, represented by global liquidity. Malaysia's output ( $IPI_t$ ) responds immediately to world production, which is a common assumption in small open economy SVAR studies (Cushman & Zha, 1997; Dungey & Pagan, 2009; Dungey, Osborn & Raghavan, 2014). We also allow Malaysia's output ( $IPI_t$ ) to respond contemporaneously to the *VIX* index, as export-oriented companies may interpret increases in global financial turmoil as higher uncertainty and foreshadow slower future external demand.

The contemporaneous ordering assumptions in the domestic block are largely in line with existing literature. The production index, the most exogenous variable has immediate effects on the domestic variables. The domestic price level equation reflects a basic Phillips curve, where prices respond contemporaneously to output shocks. We also assume firms do not change their output and prices to unexpected changes in output, inflation, financial signals or monetary policy within a month due to inertia, adjustment costs and planning delays. No such restrictions are imposed in the lag structure. The short-term interest rate modelled as contemporaneously dependent on output and prices, reflecting money market behaviour.  $IPI_t$ ,  $CPI_t$  and  $IR_t$  affect portfolio flows contemporaneously, while portfolio flows have immediate flow-on effects on equity prices and the exchange rate.

Credit is influenced by expectations of future activity. As such, credit contemporaneously reacts to output as current activity gives some indication of future conditions. Credit also reacts contemporaneously to prices and the interest rate, which reflects the perception that borrowers respond quickly to the real cost of credit (the difference between the interest rate and the inflation rate). Credit is restricted from having an immediate effect on output because it is likely

that firms and households use internal funds and savings to finance spending in the short term rather than rely on new credit. The equity price is a forward-looking variable. We therefore assume that all variables have contemporaneous effects on equity prices except the exchange rate. The exchange rate is an information market variable and is contemporaneously affected by all variables.

We also include two exogenous dummy variables. The first dummy identifies the post-GFC period from January 2009 to September 2015 and is included in the foreign block equations and the portfolio flow equation. This dummy reflects the structural break from major central banks shifting their monetary policy from controlling a short-term interest rate to quantity-based policies. This shift likely changed the monetary policy transmission in these economies and also created substantial liquidity which potentially increased gross portfolio flows globally, especially to EMs. The second dummy identifies the shift in Malaysia's exchange rate from a fixed to floating regime and corresponds with the dates January 2000 to July 2005. This dummy is included in all domestic equations.

We estimate our SVAR model with 6 lags. The Schwarz (SC) and Hannan-Quinn (HQC) tests chose an optimal lag length of one, while Akaike (AIC) and log likelihood (LR) ratio tests picked a lag length of at least twelve. One lag is likely inadequate to capture the underlying dynamics of the system, while too many lags risks over-parameterising the model. Subsequently, we rely on the LM-test for residual autocorrelation which indicates that at least six lags are required to capture the model's dynamics.

The disturbances,  $\varepsilon_t$ , have economic meaning and therefore the effects of various shocks on domestic variables are captured effectively by the impulse response functions given in (5):

$$X_t = A(L)^{-1}\varepsilon_t \quad (5)$$

where  $\varepsilon_t = [\varepsilon_{WIPi,t}, \varepsilon_{GLI,t}, \varepsilon_{VIX,t}, \varepsilon_{IPI,t}, \varepsilon_{CPI,t}, \varepsilon_{IR,t}, \varepsilon_{CF,t}, \varepsilon_{CR,t}, \varepsilon_{KLCl,t}, \varepsilon_{EX,t}]'$

### 3.5 Estimation Results

This section presents the results. First, we analyse how foreign (push-factors) and domestic (pull-factors) variables affect portfolio flows. Second, we assess the effects of portfolio flows

on domestic output and financial markets. Finally, we characterise the role of domestic financial markets in transmitting portfolio flow shocks to the real economy.

The impulse responses are plotted over three years and measured relative to one-standard deviation shocks. The shocks,  $\varepsilon_t$ , are one standard deviation of the orthogonal errors obtained from (1) and are presented in Table 2. The confidence bands are computed using the bootstrap-after-bootstrap method of Kilian (1998). Although (1) does not guarantee that the residuals are orthogonal, Table 3 indicates that the values are zero or very small. This implies that the portfolio flow residual is effectively uncorrelated with other residuals.

**Table 2. Magnitude of One Standard Deviation Shocks**

	Size of shocks from foreign variables			Size of shocks from domestic variables						
	WIPI	GLI	VIX	IP	CPI	IR	CF	CR	KLCI	NEER
Shocks	0.0279	0.0497	0.2925	0.0942	0.0255	0.1077	0.6677	0.0095	0.1080	0.1933

**Table 3. Residual Correlations**

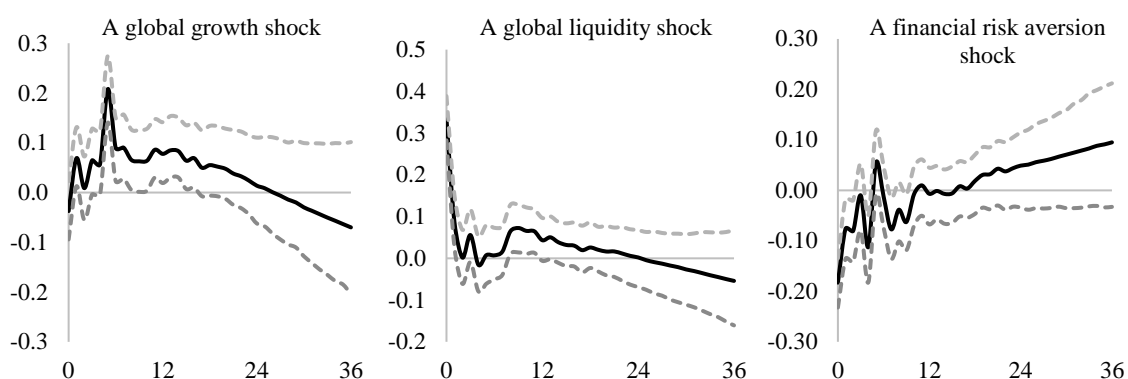
	with shocks from foreign variables			with shocks from domestic variables						
	WIPI	GLI	VIX	IP	CPI	IR	CF	CR	KLCI	NEER
Portfolio Flow Shock	0.000	0.000	0.000	0.000	0.000	0.000	1.000	-0.017	-0.038	-0.027

### 3.5.1 The Role of Push and Pull Factors in Driving Portfolio Flows

Figure 3 illustrates how net portfolio flows respond to changes in global conditions. An increase in global growth (*WIPI*) leads to higher portfolio flows to Malaysia. Portfolio flows increase after the shock, peaks after 6 months and normalise after approximately two years. Two possible transmission channels are at play here. Initially, higher global growth improves market expectations of Malaysia's growth prospects, which manifests as portfolio inflows with a low lag. As higher global growth leads to enhanced realised growth over time (for instance, through higher exports and foreign direct investments), there is added impetus for more portfolio inflows due to the improved macroeconomic outlook.



**Figure 3. Responses of Portfolio Flows to Global Shocks**



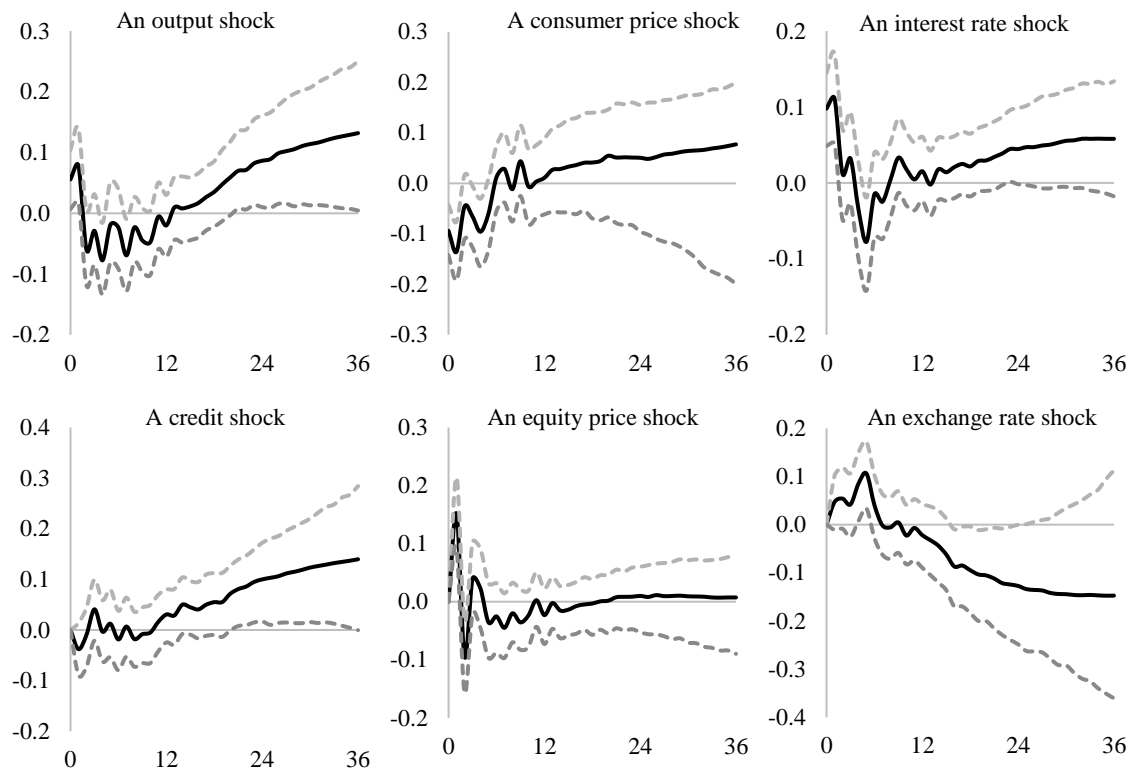
Source: Authors' calculations

Higher global liquidity (*GLI*) leads to an immediate and transitory increase in portfolio inflows. While most of the effects normalise to initial levels within 6 months, portfolio flows remain higher with the effects fully dissipating only after 2 years. This indicates that the expansion of global liquidity created by the quantitative easing policies of major central banks have indeed led to higher portfolio inflows in Malaysia. Meanwhile, an increase in global financial risk aversion (*VIX*) causes an immediate and volatile net outflow of portfolio securities, which returns to normal levels after approximately 1 year. These dynamics are in line with investors' behaviour to search for yield amid a low interest rate environment globally.

Figure 4 gives insight into how domestic factors attract inflows into Malaysia. Portfolio inflows increases immediately and normalises quickly in response to higher domestic interest rates, equity prices and appreciation in the exchange rate. The increase in portfolio inflows from higher domestic output and credit is more persistent, as the increase occurs with a lag of approximately 12 months and remains higher throughout the 36-month horizon. Meanwhile, higher consumer prices trigger an outflow over a 12-month period.

Figures 3 and 4 show that both foreign push and domestic pull factors influence Malaysia's portfolio flows. The effects on portfolio flows from financial shocks (*GLI*, *VIX*, *KLCI* and *IR*) manifest quicker compared to the growth (*WIPI* and *IP*) and credit shocks. The slower response of portfolio flows to these shocks likely reflects information delays vis-à-vis the lag in data releases of these variables.

**Figure 4. Response of Portfolio Flows to Domestic Shocks**



Source: Authors' calculations

Table 4 presents the forecast error variance decomposition (FEVD) of portfolio flows. The results suggest that push- and pull- factors play significant roles in portfolio flow trends. At the 12-month horizon, all global variables emerge as the main drivers of Malaysia's portfolio flows, with the largest shares attributable to global liquidity (14.37%), global output (9.57%) and global financial risk aversion (7.22%). At the 24- and 36-month horizons, global growth and global liquidity remain among the top three most significant drivers of the variation in portfolio flows, although the exchange rate becomes increasingly important as the horizon increases. Domestic growth also gains significance in its role over time, as its share rises gradually from 2.89% at 12-months to 7.82% at 36-months, almost equivalent to the share of global growth (8.66%). Hence, for Malaysia's portfolio flows, push factors are initially more influential, while pull factors become more influential over time.

**Table 4. Forecast Error Variance Decomposition of Portfolio Flows (%)**

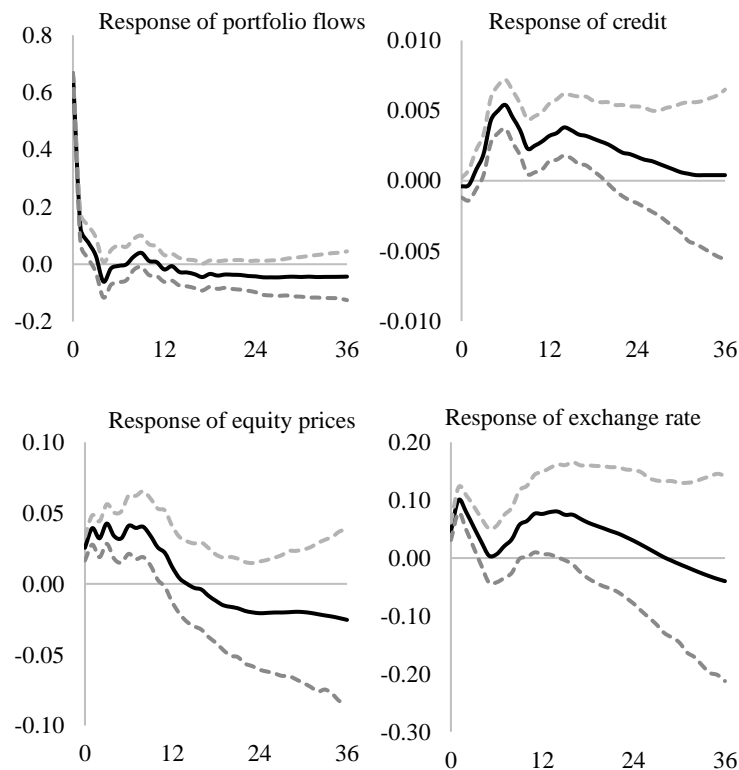
	Global			Domestic (Exc. Portfolio Flows)					
	WIPI	GLI	VIX	IPI	CPI	IR	CR	KLCI	NEER
12 Months	9.57	14.37	7.22	2.89	5.12	2.80	0.65	3.57	2.86
	31.16			17.89					
24 Months	10.23	12.60	6.24	4.59	5.77	2.85	2.47	2.88	10.15
	29.06			28.71					
36 Months	8.66	9.00	6.23	7.82	6.72	3.07	5.90	2.04	20.53
	23.90			46.09					

Source: Authors' calculations

### 3.5.2 The Macroeconomic Effect of Portfolio Shocks

We now analyse how portfolio flows affect domestic financial markets and growth. Figure 5 illustrates the responses of financial market variables from a portfolio flow shock. Portfolio flow shocks are not persistent as they return to initial levels within 3 months of the shock.

**Figure 5. Response of Domestic Financial Markets to Portfolio Flow Shocks**

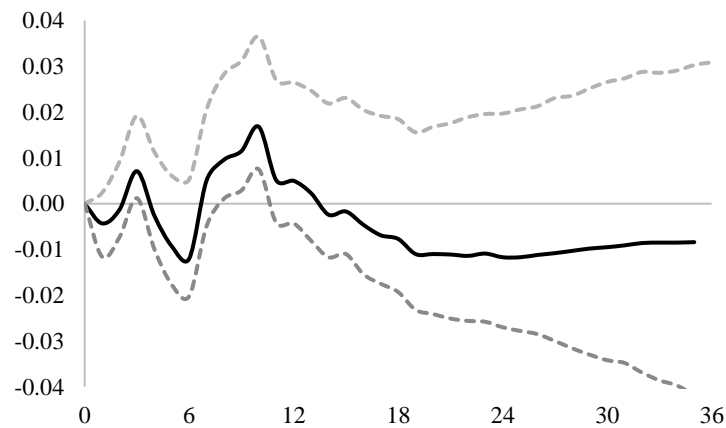


Source: Authors' calculations

The financial market responses to portfolio flow shocks are also largely transitory. The exchange rate appreciates immediately, peaks within one month and dissipates close to initial levels by the fourth month. Although the response indicates some persistence, the confidence bands become large especially after the first year, making inference over that horizon difficult. Equity prices rise immediately in response to a portfolio flow shock, with the highest impact after seven months that normalises beyond one year. The response of credit is the most persistent, increasing only gradually after the shock and dissipates back to initial levels after 2-3 years.

Figure 6 shows that higher portfolio inflows have a positive effect on output (*IPI*). Output becomes volatile during the first 6 months after the shock, but displays a positive effect that peaks after 10 months before converging to initial levels just over a year after the shock.

**Figure 6. Response of Output to a Portfolio Flow Shock**



Source: Authors' calculations

The impulse response results are qualitatively in line with those by Jansen (2000), Berument and Dincer (2004), Kim and Yang (2011), Brana et al. (2012), Tillmann (2013) and Rhee and Yang (2014), for which comparable impulse response functions are reported. Nonetheless, the speed of reaction and persistence differ considerably. Jansen (2000) finds that capital flow shocks have more persistent implications on the financial and real variables, with the positive impact on output lasting for more than 3 years. In contrast, Berument and Dincer (2004) find that a positive capital flow shock very quickly led to higher output that lasted for 2-5 months. Our results also differ from the literature in the persistence of the exchange rate appreciation, with these four studies reporting persistent effects. Nevertheless, the impulse

responses are intuitive and match our expectations on the time dynamics. When portfolio inflows increase, the initial effects are most visible first in the appreciating exchange rate and asset prices. Bank credit then starts increasing as the effects of portfolio flows on the balance sheets of banks and economic agents gradually translate to a higher credit quantity. Finally, the positive effect on the real economy is the slowest, temporary and marked by volatility.

Table 5 illustrates the importance of portfolio flows in driving Malaysia’s output. Portfolio flows play a relatively small role in the overall variation of output, with shares of 1.62% and 1.59% at the 12- and 24-month horizons. This result and Figure 6 suggests that portfolio flows reflect “tail risks” to growth. While its share to output dynamics is low, the impulse responses show that output does change when there are portfolio flow shocks. Consequently, a very large episode of portfolio outflows could pose a material risk to growth, although such an event has a low likelihood of occurring, based on historical observation.

**Table 5. Forecast Error Variance Decomposition of Output (%)**

	Global			Domestic (Exc. IPI)					
	WIPI	GLI	VIX	CPI	IR	CF	CR	KLCI	NEER
12 Months	22.48	16.54	1.35	7.72	2.07	1.62	7.81	1.54	13.23
	<i>40.38</i>			<i>34.00</i>					
24 Months	18.06	18.19	1.31	5.58	3.59	1.59	9.52	2.82	18.25
	<i>37.57</i>			<i>41.39</i>					
36 Months	10.64	10.58	3.24	4.62	3.08	1.16	14.53	2.05	30.08
	<i>24.47</i>			<i>55.53</i>					

Source: Authors’ calculations

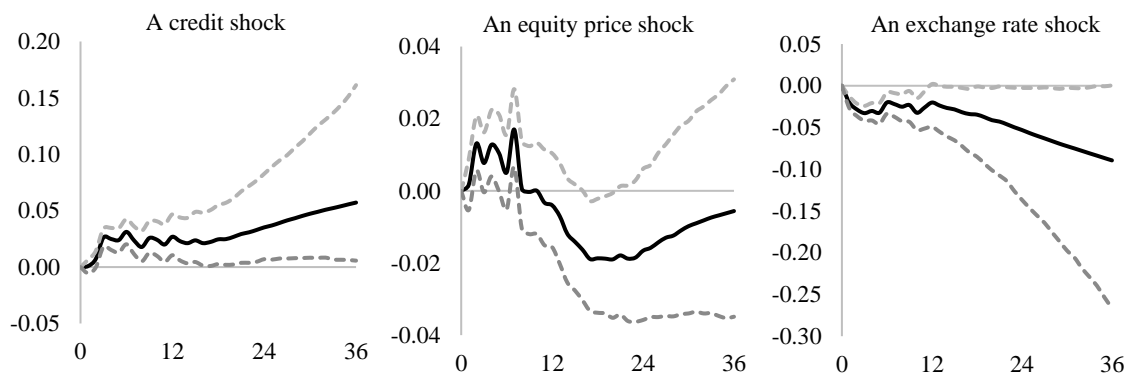
### 3.5.3 Channels of Transmission of Portfolio Flow Shocks to Output

We now give insight to the contribution of the various transmission channels of portfolio flow shocks to output. Figure 5 shows the impulse responses of variables that serve as key transmission channels - the exchange rate, equity prices and credit - to portfolio flow shocks. To quantify the contribution from each channel, we first analyse the impulse responses of output to exchange rate, equity prices and credit shocks. We then compare the impulse response of output to portfolio flow shocks from the baseline model with those from alternative models with the respective channels individually shut down. This is done by incorporating the variables exogenously, which restricts the “exogenised” variables’ direct and indirect roles in the

transmission process. This approach to quantifying transmission channels follows from Morsink and Bayoumi (2001), Chow (2004), Raghavan et al. (2012) and Tng and Kwek (2015).

Figure 7 shows the impulse responses of output to exchange rate, equity prices and credit shocks. An exchange rate appreciation leads to a gradual decline in output that reaches its trough 6 months after the shock. The effects thereafter are uncertain as the error bands start to widen substantially, especially after 12 months. Meanwhile, higher equity prices and credit lead to higher output, although the output response to credit is more persistent. In a scenario, as shown in Figure 5, in which all three variables increases to positive portfolio shocks, an appreciating exchange rate has an offsetting effect that reduces the improvements in output from higher credit and equity prices.

**Figure 7. Responses of Output to Domestic Financial Shocks**

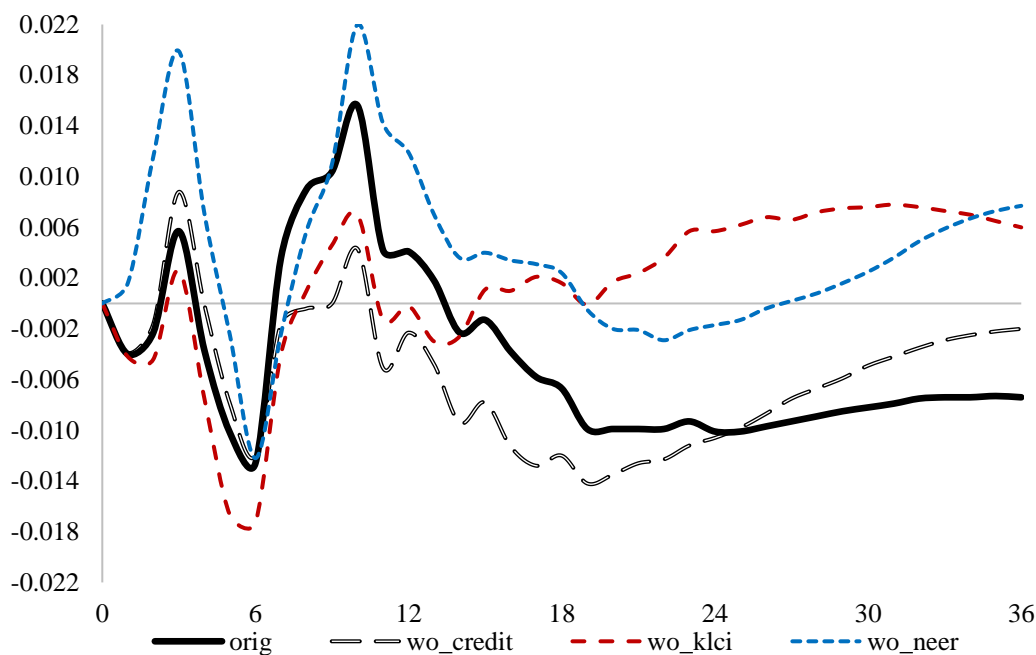


Source: Authors' calculation

Figure 8 illustrates the output responses from a portfolio shock from the baseline and alternative SVAR models with the exchange rate, equity prices and credit individually exogenised (Table 6 presents a summary of the responses). Credit and equity prices are important conduits in channelling the increase in portfolio flows to output. Compared with the baseline output response, the response of output with the equity price channel shut down (dotted blue line) is materially smaller after approximately 4-12 months. The differences between the output responses with the credit channel shut down compared to the response from the baseline model is most visible between the 4- to 24-month period. This indicates that relative to credit, portfolio flows affect asset prices quicker, which in turn affects output quicker (as shown in Figure 6). Credit's role in the transmission occurs with more lag and is more persistent. The exchange rate channel plays the opposite role compared to equity prices and credit, as the exchange rate reduces the positive effect of portfolio flows on output. The effects

are visible relatively quickly<sup>17</sup>, and are most visible after 12 months. These results reiterate the output dynamics highlighted in Figure 7. The exchange rate appreciation from higher portfolio flows partially offsets the increase in output through the equity and credit channels.

**Figure 8. Responses of Output to a Portfolio Flow Shock from Baseline and Restricted Models**



Source: Authors' calculation

Note: wo\_neer, wo\_klci and wo\_credit refer to the impulse response of output to a portfolio shock in SVAR models with the neer, klci and credit included as exogenous variables.

**Table 6. Responses of Output to a Portfolio Flow Shock of Restricted Models against Baseline**

	Compared to Baseline (Lower: Positive impact of channel to growth)	Period of Difference	Inference
Exogenous Credit	Lower	7-24 months	Greater lag and more persistent impact
Exogenous KLCI	Lower	4-12 months	More immediate impact
Exogenous NEER	Higher	1-6 months	Immediate impact

<sup>17</sup> Inference on the role of the exchange rate over longer horizons is complicated by the large error bands. Hence, we focus only on the shorter-term dynamics.

#### **4. Concluding Remarks**

In this study, we start by describing BNM's efforts to develop complementary data systems to ensure that capital flows monitoring is conducted with timeliness, depth and breadth. Monitoring capital flows is a multi-faceted task with distinct policy goals, ranging from ensuring a stable exchange rate and managing international reserves, to assessing cyclical growth prospects and risks from financial imbalances and financial market instability, to longer-term structural issues. We show that different measures of capital flows are better suited for each surveillance/policy goal, where the analytical demands on timeliness and depth differ.

We then estimate an SVAR model to examine the causes and effects of portfolio flows for Malaysia. Three key findings emerge: First, global and domestic factors play important transitory roles in driving Malaysia's portfolio flows. Portfolio flows increase immediately with higher global liquidity, falls when global financial risk aversion increases and increases gradually when global growth improves. Higher domestic equity prices and output lead to higher portfolio inflows, with the response from the former occurring sooner than the latter. Second, higher portfolio inflows lead to exchange rate appreciation, higher equity prices and higher credit. The impact of portfolio flows is felt most immediately by the exchange rate, followed by equity prices and finally credit. Portfolio inflows lead to short-term improvements in growth, but with volatile dynamics. Finally, the transmission from higher portfolio flows to higher growth occurs through improved equity prices and credit conditions, which is partially offset by the dampening effect that the appreciating exchange rate has on output.

While our results suggest that growth benefits from portfolio inflows, its contribution to variations in output is nonetheless small. This indicates that portfolio flows are "tail risks" to growth, whereby a very large episode of portfolio outflows could have a material impact on growth, but with low likelihood due to the rarity of such occurrences. The positive effect of portfolio inflows on growth could partially be due to the foreign exchange intervention operations by the central bank. While the central bank does not target a level of the exchange rate, foreign exchange operations are conducted to reduce exchange rate volatility when capital flows are sudden and volatile, both during episodes of inflow and outflow. Hence, the exchange rate does not react as strongly as it otherwise would to portfolio flow movements and thus does not exert the full pressure on growth through the trade and valuation channels.

As a whole, while the size and volatility of portfolio flows have increased significantly over the years, the impact of these flows on the Malaysian economy appear to have remained



relatively contained. This likely reflects both the steady development of domestic financial markets as well as policies that have been implemented by regulatory authorities. In particular, the central bank has always recognised the importance of gradualism in the conduct of capital and financial account policies. Given that capital flows could have a significant impact on growth when the size is large, the conscious effort to pursue liberalisation in a gradual manner is appropriate such that any resultant impact to the real economy is limited and manageable. In sum, while our findings suggest that portfolio flows do increase the volatility of the Malaysian business cycle, its effects have remained manageable.

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## Data Appendix

### Coverage of Economies in Figure 1

Emerging Asia refers to Bangladesh, Cambodia, China, India, Indonesia, North Korea, South Korea, Malaysia, Mongolia, Myanmar, Pakistan, Papua New Guinea, Philippines, Sri Lanka, Taiwan, Thailand and Vietnam. Emerging Economies refer to Emerging Asia economies plus Angola, Botswana, Egypt, Ghana, Ivory Coast, Kenya, Liberia, Madagascar, Malawi, Mauritius, Mozambique, Namibia, Nigeria, Rwanda, Sierra Leone, South Africa, Swaziland, Tanzania, Tunisia, Uganda, Zambia, Zimbabwe, Baltic Republics, Bulgaria, Croatia, Syprus, Czech Republic, Estonia, Georgia, Hungary, Kazakhstan, Latvia, Lithuania, Poland, Romania, Russia, Serbia, Slovakia, Slovenia, Tajikistan, Turkey, Turkmenistan, Ukraine, Argentina, Bolivia, Brazil, Chile, Colombia, Costa Rica, Dominican Republic, Ecuador, Guatemala, Mexico, Panama, Paraguay, Peru, Uruguay, Venezuela, Algeria, Bahrain, Iran, Iraq, Israel, Jordon, Kuwait, Lebanon, Morocco, Oman, Qatar, Saudi Arabia, United Arab Emirates and Yemen.

### Summary of Variables used in the SVAR Model

Variable	Abbreviation	Definition	Source
World Production	WIPI	World Industrial Production Index	CPB Netherlands Bureau for Economic Policy Analysis
Global liquidity	GLI	M2 for the United States, Japan, United Kingdom and Euro area	Datastream
VIX index	VIX	Implied volatility of the S&P index from the Chicago Board of Options Exchanges	Bank for International Settlements
Output	IPI	Industrial production index	Bank Negara Malaysia
Prices	CPI	Consumer price index	Bank Negara Malaysia
Interest rate	IR	3-month interbank offered rate (KLIBOR)	Bloomberg
Portfolio flows	CF	Portfolio flows from the cash balance of payments database	Bank Negara Malaysia
Bank credit	CR	Bank credit, deflated by CPI	Bank Negara Malaysia
Equity Price	KLCI	Kuala Lumpur Composite Index, deflated by CPI	Bank Negara Malaysia
Exchange rate	EX	Nominal effective exchange rate	Bank Negara Malaysia