The Effects of Portfolio Capital Flows and Domestic Credit on the Australian Economy

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Abstract

Using a structural vector autoregressive (SVAR) model, this paper examines the relationships between portfolio capital flows and domestic credit and their impact on the Australian economy. Positive innovations to portfolio flows and the credit have increased the domestic activity and led to an exchange rate appreciation. By disaggregating the portfolio flows into net debt flows and net equity flows, we found the debt flows are driving the impact of net portfolio flows in Australia while equity flows have no real effect on the domestic macroeconomic variables. It is evident that including the GFC period in the sample results in a net debt flow shock having a greater impact on the gross national expenditure (GNE), gross domestic product (GDP) and credit. This indicates that monitoring net debt flows is important for Australian policy makers for maintaining macroeconomic and financial stabilities in the economy.

JEL Categories: F32, F41, C51, C32
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1. Introduction

The recent Global Financial Crisis (GFC) which originated in US credit markets, spread rapidly across borders, and highlighted that the high level of international economic integration and financial interdependence now characterises the global economy. Two of the key contributory factors in spreading the crisis were the domestic balance sheet problems associated with rapid credit growth, and the excessive external imbalances associated with excessive international capital flows (Lane and McQuade, 2013). The GFC has thus led to a renewed interest in understanding the linkages between credit, international capital flows and the real economy.

Within the literature, a number of studies examining the impact of credit growth have emphasised that periods of rapid credit growth are more likely to be followed by financial crises (see Kaminsky and Reinhart (1999), Elekdag and Wu (2011), Gourinchas and Obstfeld (2011), and Schularick and Taylor (2011)). A related branch of the literature further analyses the channels through which rapid domestic credit expansion and international capital flows are linked (see Reinhart and Reinhart (2008), Furceri, Guichard and Rusticelli (2011a, 2011b), Bruno and Shin (2012), Calderón and Kubota (2012), and Lane and McQuade (2013). These studies found that capital inflows can be quite persistent, and tend to appreciate the local currency and encourage asset price booms which in turn lead to an expansion of domestic credit. Large capital inflow episodes were also found to almost double the probability of having a banking or currency crisis with debt-driven portfolio investment flows being the most significant type of flows in increasing crisis probability.

As opposed to most of the studies focusing on large economies such as U.S., this paper examines the relationships between portfolio capital flows, credit and macroeconomic variables in Australia. Australia is a small open economy, therefore the high levels of financial interdependence and economic integration characterizing the global economy mean its domestic economy is vulnerable to global economic conditions. Moreover, the net foreign capital inflows are observed to increase during and post crisis period as Australia is considered a “safe heaven” for foreign investors. This paper aims to understand how international influences, such as capital flows shocks, influence the Australian economy and what the subsequent impact is for domestic credit and other key macroeconomic variables in Australia. The outcome of this study is important to policy makers as it can be used to guide both macro-prudential and monetary policies in Australia.

In this paper, we apply the structural vector autoregressive model to establish how domestic credit growth and international capital flows impact the Australian economy. This

approach has an advantage in analyzing dynamic effects of various shocks on an economy through analysis of impulse response functions and variance decomposition. The empirical results show that a positive credit shock leads to an increase in real domestic activity. Both gross national expenditure (GNE) and gross domestic product (GDP) increase significantly following a credit shock, reflecting the increased availability of funds in the economy, which is passed through to output and demand. A positive net portfolio flows shock has similar effects on the domestic variables; where both real output and credits increase significantly. These results highlight the anticipated relationship between net portfolio flows and domestic credit. In the case of either a positive credit shock or a positive net portfolio flows shock, monetary policy appears to be effective at mitigating the effects on inflation and thus there was no significant inflationary pressure in the economy.

Further by disaggregating the portfolio flows into net debt and net equity portfolio flows, we examine the relative significance of these flows for credit growth and macroeconomic variables. The central finding for policy makers is that net debt flows are driving the impact of net portfolio flows on the Australia economy, with net equity flows having no real significant effect on the domestic macroeconomic variables. It is evident that including the GFC period in the sample results in a greater impact on credit due to debt flow shock. This indicates that monitoring net debt flows is the relevant measure for policy makers in protecting and maintaining macroeconomic and financial stability.

The paper proceeds as follows. Section 2 reviews the theoretical and empirical evidence relating domestic credit growth, international capital flows and the Australian economy. The modelling framework and the associated identification issues for a small open economy like Australia are discussed in Section 3. Preliminary data analysis and model specification are reported in Section 4. The empirical results, in the form of impulse response functions and variance decomposition are presented in Section 5 while Section 6 concludes the paper.

2 Capital Flows, Credit Growth and the Australian Economy

This section provides an overview of the background and existing literature on the impact of international capital flows and credit growth on Australian economy. Although very little attention has been paid to understand the linkages between international capital flows and domestic credit growth on the Australian economy, there are a number of papers that examine the developments and significance of these factors individually.

2.1 Credit Growth in Australia

Australia has experienced a number of major cycles in credit. Kent and D'Arcy (2000) identify four of these cycles, in the 1890s, 1930s, 1970s and 1990s, and highlight that each of these episodes were associated with varying degrees of financial system instability. They state that the similarities between these episodes suggest there are a number of primary macro-indicators of financial system vulnerability, including rapid growth of output, credit and asset prices, as well as increased concentration of investment and lending. Furthermore, they argue that the prudential behaviour of financial institutions and markets is a significant factor in driving these macroeconomic developments, and has the potential to amplify cycles in the real economy.

Most recently, the GFC resulted in a major episode of financial turbulence. In terms of the effect on credit and financial markets, the crisis saw a sharp rise in risk premia in financial markets. As a consequence, in both Australia and abroad, constraints upon the supply of credit increased (Jacobs and Rayner, 2012). In Australia, this resulted in a significant easing in the pace of credit growth from around mid-2008 (Debelle, 2010). According to Davis (2011), the reason the rate of credit growth declined so noticeably following the onset of the GFC was due to substantial deleveraging by both businesses and households. Furthermore, following the onset of the crisis in 2008, credit growth was slower than growth in deposits for the first time since the early 1990s (Debelle, 2010).

In addition to papers outlining the history of developments in credit in Australia, there are also a small number of empirical studies that examine the impact of credit on the Australian economy. Two of the most recent studies, by Berkelmans (2005) and Jacobs and Rayner (2012) respectively, use a structural vector autoregressive (SVAR) approach to examine the relationship between credit and other Australian macroeconomic variables.

Berkelmans (2005) finds that over short time horizons, shocks to the interest rate, the exchange rate, and past shocks to credit are important factors for credit growth. Over longer time horizons, shocks to output, inflation and commodity prices play a greater role in explaining movements in credit. In terms of the impact of a credit shock on the economy, monetary policy is found to stabilise the economy effectively, resulting in output and the exchange rate being barely affected by a credit shock. A credit shock does however result in higher inflation for around two years.

Jacobs and Rayner (2012) include three variables to capture the domestic credit market. The variables are the spread between the average variable lending rate paid by large businesses and the cash rate, the log of aggregate real business credit, and a measure of

difficulty obtaining finance. Their results suggest that credit market developments have had a significant influence on the Australian economy since financial deregulation in the 1980s. Evidence of a 'credit channel' of monetary policy transmission is also found as unexpected changes to monetary policy result in an increase in the balance of firms reporting difficulty obtaining finance. The results are also consistent with the existence of a financial accelerator mechanism in the Australian economy, as positive shocks to net worth result in easier credit conditions, leading to higher GDP.

2.2 Capital Flows in Australia

For most of its history Australia has experienced a net inflow of capital, which is the counterpart to its current account deficit. According to Bloxham and Hartigan (2012), Australia's net capital inflows and current account deficit reflect that it has a high investment-to-GDP ratio for a developed economy. As Australia is a resource rich economy with a small population, it has more investment opportunities than can be funded by domestic saving. As a result, it has been necessary to use foreign capital to fund this investment, leading to capital inflow (Gali and Taplin, 2012).

There have been a number of benefits of Australia's net capital inflow. Gali and Taplin (2012) highlight that capital inflow has helped to build the stock of productive capital, as well increase living standards by building up incomes and wages and overall enhancing the wellbeing of Australians. Nevertheless, throughout Australia's history there have still been instances where periods of high and volatile capital flows have threatened macroeconomic and financial stability. This was particularly evident prior to the floating of the Australian dollar in 1983. For instance, Veale (2008) provides a summary of Australia's experience with capital flows under the four different exchange rate regimes that were in place between 1931 and 1983. He highlights that during this period, there were several occurrences in which volatile capital flows threatened to destabilise domestic financial conditions so much that the authorities were required to make abrupt currency realignments.

However in the post-float era, while Australia has continued to face high and sometimes volatile capital flows, they do not pose the same problems for monetary policy as when capital controls were in place and financial prices regulated (Veale, 2008). Stevens (2006) reasons that this is because in the current inflation-targeting regime, when capital flows suddenly change, the exchange rate is free to move to absorb at least part of the shock, and the RBA is able to decide how much of the shock should show up as changed financial conditions in Australia. Lodewijks and Monadjemi (2004) also emphasise the role that

structural reforms implemented over the past fifteen years in Australia have had in strengthening the economy's capacity to deal with external shocks.

In addition to the structural changes to the Australian economy that have improved its ability to accommodate volatile capital flows, a number of changes in the structure of the economy and the composition of funding for domestic banks have changed the composition of capital flows into Australia. Many such changes have occurred as a result of the GFC. For example, Davis (2011) provides a review of Australian financial sector performance and development over the 2000s and shows that prior to the GFC, there was a decline in the role of deposit funding, and an increasing role for offshore funding for Australian banks. Debelle (2010) also argues that the steady source of capital inflow prior to the GFC reflects the fact that Australian banks found it cost effective to raise wholesale funds offshore to fund domestic asset growth. Following the GFC however, a significant reassessment and repricing of risk has led to changes in the structure of funding patterns of some Australian banks, causing these trends to change. Australian bank funding patterns have become more conservative, involving higher equity capital levels, more reliance on domestic deposits, and less reliance on overseas funding (Davis, 2011). D'Arcy and Ossolinki (2009) also highlight that there has been a decline in foreign portfolio equity investment by Australians, and a pick-up in foreign portfolio investment in Australia, resulting in the composition of net capital inflows shifting towards sizeable equity inflows. Furthermore, Debelle (2010) states that financial inflows in the form of offshore debt raisings by Australian financial institutions have declined. Altogether, these changes have had a substantial effect on the composition of capital flows into Australia.

This paper contributes to and extends the existing literature in two ways. First, using recent SVAR framework and small open economy application, it analyses the interaction between international capital flow and domestic credit. Two, the model framework identifies the contemporaneous and dynamic relationship between these variables and their implications on the Australian economy during the pre- and post GFC periods.

3. SVAR Framework

To assess the impact of credit growth and international capital flows on the Australian economy, a structural vector autoregressive (SVAR) model is constructed as it allows for greater flexibility in imposing restrictions and to determine the relationships between the variables by using economic theory and stylised facts. A SVAR with the intercept terms suppressed for ease of exposition can be written as:

$$B_0 y_t = B_1 y_{t-1} + \cdots + B_p y_{t-p} + \varepsilon_t \quad (1)$$

where y_t is a (K × 1) vector of endogenous macroeconomic and policy variables at time *t*, B_i is a (K × K) matrix of parameters for $i = 0, 1, \ldots, p$, and ε_t is a (K × 1) vector of uncorrelated orthogonal structural shocks and $E(\varepsilon_t \varepsilon_t') = D$. D is the variance-covariance matrix of ε_t, and is a constant and diagonal matrix with off-diagonal elements being zero, and the diagonal elements being the structural disturbances.

The contemporaneous relationships between the variables specified in the vector y_t are described in a non-singular matrix B_0. The remaining B matrices (for $i = 1, \ldots, p$) on the right hand side of Equation (1) describe how the variables are affected by their own lags, as well as lags of the other variables in the system. The B_0 matrix is normalised to have ones on the diagonal, so that each equation in the SVAR system has a designated dependent variable.

To recover consistent estimates of the values of ε_t and the coefficients of $B_0, \ldots, B_p$, the SVAR model must be estimated in two stages. In the first stage, the following reduced form VAR model is estimated:

$$y_t = A_1 y_{t-1} + \cdots + A_p y_{t-p} + e_t \quad (2)$$

where $A_i = B_0^{-1} B_i$ and e_t is a vector of reduced form disturbances with properties $E(e_t e_t') = \Sigma$. The structural disturbances of the SVAR and the reduced form residuals are related by $\varepsilon_t = B_0 e_t$, which implies that the covariance-variance matrix of errors from the structural form is given by:

$$E(B_0 e_t e_t' B_0') = D \quad (3)$$

To recover the structural parameters of the SVAR specified in Equation (1), it is necessary for the model to be exactly or over-identified. The second stage of the SVAR estimation therefore requires placing sufficient restrictions on the B_0 and D matrices; which are discussed in detail under Subsection 3.2.

3.1 Model Specification

In most Australian SVAR studies (see Dungey and Pagan, 2000; Berkelmans, 2005; Lawson and Rees, 2008; Jääskelä and Smith, 2011; Jacobs and Rayner, 2012), it is standard practice to incorporate a small open economy assumption that allows foreign variables to affect domestic variables, but assume there is no feedback effect from domestic variables to foreign variables. This study also includes both foreign and domestic variables; there are ten variables in total, which includes three foreign variables, and seven domestic variables.

The three foreign variables are the RBA's Index of Commodity Prices (ICP), US Domestic Product (USGDP) and the US Federal Funds Rate (FFR). ICP are included as they contain information about anticipated inflationary pressures while USGDP represents global economic activity and the FFR represents foreign monetary policy.[2]

The variables included in the domestic block are also largely similar to those included in previous Australian studies. Australian GDP (GDP) is included as a measure of domestic output, while Australian GNE (GNE) is included as a measure of domestic aggregate demand. The quarterly inflation rate (INF) is included as a measure of relative prices. Incorporating an inflation rate rather than a price level is common as the objective of monetary policy in Australia is the inflation target. The inclusion of the target cash rate (CASH) represents the policy response of the RBA to changes in the Australian economy. The exchange trade-weighted index (ETWI) is incorporated in the SVAR as a measure of the real exchange rate. Also included in the domestic block is a total private sector credit variable (CREDIT). Inclusion of a credit variable is consistent with Berkelmans (2005) and Jacobs and Rayner (2012) and is necessary in this study to capture the effect of domestic credit growth on the Australian economy.

A point of difference to previous SVAR studies in Australia is the inclusion of a capital flows variable. Given the purpose of this study is to determine the effect of domestic credit growth and capital flows on the Australian economy, incorporating a variable to represent capital flows is essential. Portfolio flows can be included both as a total net measure (NETFLOWS) as well as disaggregated into net debt flows (DEBT) and net equity flows (EQUITY). The ability to separate portfolio flows into different types allows the opportunity to test whether debt or equity flows have a more significant effect on economic variables in Australia. Table 1 specifies all variables included in the model. Data sources and further details of the variables are provided in Appendix A, Table 1A.

Table 1. List of variables included in the SVAR model

Foreign Block	**Capital Flows Block**	**Domestic Block**
Commodity Prices (ICP)	Net International Portfolio Flows (NETFLOWS)	Gross National Expenditure (GNE)
US Gross Domestic Product (USGDP)	Net Debt Flows (DEBT)	Gross Domestic Product (GDP)

[2] Including US variables as proxies for the global economy is a common assumption in small open economy SVAR studies.

US Federal Funds Rate (FFR)	Net Equity Flows (EQUITY)	Inflation (INF)
		Cash Rate (CASH)
		Domestic Private Sector Credit (CREDIT)
		Exchange Rate (ETWI)

3.2 Identification Restrictions

It is common to establish a set of restrictions that are guided by economic theory and stylised facts, which produce sensible dynamic responses that are largely consistent with economic theory. With this in mind, three types of restrictions are placed on the SVAR system in this study.

Block Structure of the System

For a small open economy such as Australia, international dynamics have important influences on domestic economic outcomes while Australian variables have very little impact on international economic conditions. To reflect the relatively small size of the Australian economy, foreign block exogeneity is imposed on the SVAR model. The block exogeneity allows foreign variables to affect domestic variables both contemporaneously and with lags, but restricts any feedback effect. To describe the imposition of foreign block exogeneity, the variables included in the SVAR can be divided into three blocks:

$$y_t = [y_{1,t}, y_{2,t}, y_{3,t}]' \tag{5}$$

where $y_{1,t} = [ICP, USGDP, FFR]'$ represents the foreign block, $y_{2,t} = [NETFLOWS]'$ represents the capital flows block and $y_{3,t} = [GNE, GDP, INF, CASH, CREDIT, ETWI]'$ represents the domestic block. The SVAR model in Equation (1) can now be represented by

$B(L)y_t = \varepsilon_t$, where

$$y_t = \begin{bmatrix} y_{1,t} \\ y_{2,t} \\ y_{3,t} \end{bmatrix} \quad B(L) = \begin{bmatrix} B_{11}(L) & B_{12}(L) & B_{13}(L) \\ B_{21}(L) & B_{22}(L) & B_{23}(L) \\ B_{31}(L) & B_{32}(L) & B_{33}(L) \end{bmatrix} \quad \varepsilon_t = \begin{bmatrix} \varepsilon_{1,t} \\ \varepsilon_{2,t} \\ \varepsilon_{2,t} \end{bmatrix} \tag{6}$$

In line with the block exogeneity assumption that domestic variables have no impact on the foreign variables, all domestic variables are excluded from entering the foreign block of equations. This is achieved by setting $B_{12}(L) = B_{13}(L) = 0$.

Contemporaneous and Lag Structure of the System

The contemporaneous restrictions are summarised by Equation (7), which is the left-hand side of Equation (1). The key aspects of the specification of the contemporaneous structure are discussed below.

$$B_0 y_t = \begin{bmatrix} 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ b_{21}^{(0)} & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ b_{31}^{(0)} & b_{32}^{(0)} & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ b_{41}^{(0)} & b_{42}^{(0)} & b_{43}^{(0)} & 1 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & b_{54}^{(0)} & 1 & 0 & 0 & 0 & 0 & 0 \\ b_{61}^{(0)} & b_{62}^{(0)} & 0 & b_{64}^{(0)} & b_{65}^{(0)} & 1 & 0 & 0 & 0 & 0 \\ b_{71}^{(0)} & 0 & 0 & 0 & b_{75}^{(0)} & 0 & 1 & 0 & 0 & 0 \\ b_{81}^{(0)} & 0 & 0 & 0 & b_{85}^{(0)} & 0 & b_{87}^{(0)} & 1 & 0 & 0 \\ b_{91}^{(0)} & b_{92}^{(0)} & 0 & b_{94}^{(0)} & b_{95}^{(0)} & b_{96}^{(0)} & b_{97}^{(0)} & b_{98}^{(0)} & 1 & 0 \\ b_{101}^{(0)} & b_{102}^{(0)} & b_{103}^{(0)} & b_{104}^{(0)} & b_{105}^{(0)} & b_{106}^{(0)} & b_{107}^{(0)} & b_{108}^{(0)} & b_{109}^{(0)} & 1 \end{bmatrix} \begin{bmatrix} ICP \\ USGDP \\ FFR \\ NETFLOWS \\ GNE \\ GDP \\ INF \\ CASH \\ CREDIT \\ ETWI \end{bmatrix} \quad (7)$$

Within the foreign block, ICP are ordered before USGDP and FFR, ICP is taken to have a contemporaneous effect on USGDP while USGDP and ICP are both assumed to have contemporaneous effect on the FFR.

ICP and USGDP are allowed to affect domestic variables contemporaneously with a few exceptions. The first exception prevents USGDP from having an immediate effect on the CASH, reflecting that the specification of the cash rate equation as following a Taylor-type monetary policy rule. The second exception prevents USGDP from having an immediate effect on INF, as it is normally believed that any domestic inflationary pressures as a result of world economic activity would be indirectly transmitted through domestic activity. Both of these identification restrictions are also employed by Dungey and Pagan (2000), Berkelmans (2005, Lawson and Rees (2008) and Dungey et.al (2014). The third exception prevents a contemporaneous effect of both ICP and USGDP on GNE, which reflects that expenditure decisions are not likely to respond to changes in foreign variables immediately.

The contemporaneous effect of the FFR on NETFLOWS stems from the relationship between international capital flows, and monetary policy. If the US tightens monetary policy, the Federal Funds rate increases relative to interest rates in the rest of the world. Investors are likely to take advantage of the higher interest rate in the US, resulting in capital flows into the US. This relationship was reinforced by the IMF (2011), which found that for countries with direct financial exposure to the United States, net capital flows were sensitive to US monetary policy.

The portfolio flows variable is considered the most exogenous of the domestic

variables, and as such is placed before the domestic block. The total portfolio flows variable can be disaggregated into a net debt or a net equity variable in order to examine whether debt or equity flows have a greater impact on the Australian economy. The contemporaneous response of portfolio flows to the foreign variables follows findings from a number of studies (for example, Reinhart and Reinhart, 2008; Fratzscher, 2011) that highlight the importance of push factors such as commodity prices, international interest rates and growth in the world's largest economies, in determining capital flows. Pull factors, in particular countries' macroeconomic fundamentals, institutions and policies, are also found to be related to the drivers of capital flows. The impact of pull factors on capital flows is accounted for in the lag structure of the system.

In terms of the domestic block, GNE is ordered directly after the portfolio flows variable. Consistent with Dungey and Pagan (2000), most domestic variables, including the cash rate affect GNE only with lags due to the time delay in the pass-through of these variables to aggregate demand. The only variable assumed to affect GNE contemporaneously is portfolio flows, which reflects that net capital flows are likely to have relatively immediate effects on demand. GNE is assumed to contemporaneously affect output, reflecting that aggregate demand influences output. Following Jacobs and Rayner (2012), credit is restricted from having an immediate effect on output. Reasoning for this is that in the short term, firms are likely to use internal funds to maintain output rather than rely on new credit.[3] The inclusion of GNE in the INF equation represents a measure of demand pressure while ICP is included to capture the impact of international relative prices.

The cash rate represents the response of the RBA to changes in the Australian economy. To specify the contemporaneous policy reaction function, we applied a Taylor-type monetary policy rule (similar as in as in Dungey and Pagan (2000) and Dungey. et al (2014). which assumes the cash rate contemporaneously responds to changes in inflation and the output gap. Accordingly, GNE and inflation are allowed to contemporaneously affect the cash rate. In addition, commodity prices are assumed to contemporaneously influence the cash rate, reflecting the role they play as an indicator of anticipated inflation.

According to Berkelmans (2005), credit demand is influenced by expectations of future activity. As such, credit is assumed to react to GNE and GDP contemporaneously as current activity gives some indication of what the future holds. Credit is also assumed to react to inflation and the cash rate contemporaneously, which is justified by the perception that

[3] This restriction differs from that of Berkelmans (2005) who included an immediate effect of credit on GDP to reflect a quick pass-through of credit to aggregate demand.

borrowers respond quickly to the real cost of credit (the difference between the interest rate and the inflation rate). These restrictions are all in line with both Berkelmans (2005) and Jacobs and Rayner (2012). Additionally, credit is specified as responding contemporaneously to net portfolio flows. Reasoning for this relationship is drawn from Lane and McQuade (2012), who find a significant relationship between international capital flows, particularly net debt flows, and domestic credit growth. Economic intuition also suggests that any changes in net capital flows are likely to impact the availability of credit fairly rapidly. Finally, the exchange rate is taken to react to all variables contemporaneously as it can respond immediately to all available information.

Lag Structure of the System

The lag restrictions are summarised by Equation (8), which appears on the right-hand side of Equation (1). Each non-zero coefficient $b_{ij}^{(i)}$ in the B_i matrix indicates that variable *j* affects variable *i* with a lag. However, the asterisk (*) denotes that variable *j* affects variable *i* with a two quarter delay. The lag restrictions depicted in Equation (8) are primarily consistent with those applied in Dungey and Pagan (2000). The two variables that provide a point of difference from Dungey and Pagan (2000) are the net capital flows and credit variables.

$$B_i y_{t-p} = \begin{bmatrix} b_{11}^{(i)} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ b_{21}^{(i)} & b_{22}^{(i)} & b_{23}^{(i)} & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ b_{31}^{(i)} & b_{32}^{(i)} & b_{33}^{(i)} & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ b_{41}^{(i)} & b_{42}^{(i)} & b_{43}^{(i)} & b_{44}^{(i)} & b_{45}^{(i)} & b_{46}^{(i)} & b_{47}^{(i)} & b_{48}^{(i)} & b_{49}^{(i)} & b_{410}^{(i)} \\ 0 & 0 & 0 & b_{54}^{(i)} & b_{55}^{(i)} & 0 & b_{57}^{(i)} & b_{58}^{(i)*} & b_{59}^{(i)} & b_{510}^{(i)} \\ b_{61}^{(i)} & b_{62}^{(i)} & 0 & b_{64}^{(i)} & b_{65}^{(i)} & b_{66}^{(i)} & b_{67}^{(i)} & b_{68}^{(i)*} & b_{69}^{(i)} & b_{610}^{(i)} \\ b_{71}^{(i)} & 0 & 0 & 0 & b_{75}^{(i)} & 0 & b_{77}^{(i)} & 0 & b_{79}^{(i)} & b_{710}^{(i)} \\ b_{81}^{(i)} & 0 & 0 & 0 & b_{85}^{(i)} & 0 & b_{87}^{(i)} & b_{88}^{(i)} & b_{89}^{(i)} & b_{810}^{(i)} \\ b_{91}^{(i)} & b_{92}^{(i)} & 0 & b_{94}^{(i)} & b_{95}^{(i)} & b_{96}^{(i)} & b_{97}^{(i)} & b_{98}^{(i)} & b_{99}^{(i)} & b_{910}^{(i)} \\ b_{101}^{(i)} & b_{102}^{(i)} & b_{103}^{(i)} & b_{104}^{(i)} & b_{105}^{(i)} & b_{106}^{(i)} & b_{107}^{(i)} & b_{108}^{(i)} & b_{109}^{(i)} & b_{1010}^{(i)} \end{bmatrix} \begin{bmatrix} ICP \\ USGDP \\ FFR \\ NETFLOWS \\ GNE \\ GDP \\ INF \\ CASH \\ CREDIT \\ ETWI \end{bmatrix} \quad (8)$$

Net capital flows are assumed to be affected by all domestic variables with a lag. Justification for this comes from Fratzscher (2011), who found that while push factors exert a significant effect on capital flows to other advanced economies, pull factors in the form of domestic macroeconomic fundamentals, institutions and policies, are also relevant in driving capital flows. Therefore, although only foreign variables are assumed to affect net portfolio flows contemporaneously, domestic variables are taken to also be a driver of this variable

with a time lag. Similarly to the contemporaneous restrictions, net portfolio flows are assumed to affect all the domestic variables with lags, except the inflation and cash rates.

Credit is assumed to respond to all domestic variables with lags, which follows from its placement as one of the most endogenous variables in the system. While credit was assumed to have no impact on the domestic variables contemporaneously, it is assumed to affect all domestic variables with lags, reflecting the timing in the pass-through of credit to the domestic sector.

4. Preliminary Data Analysis and Model Specification

We first estimate the SVAR model using quarterly data from September 1989 to March 2008.[4] The end date of March 2008 was chosen as it is prior to the onset of the GFC in Australia. Subsequently, the period of study is extended up to March 2013 to include the more volatile GFC period which allows for examination of the impact of the crisis on the selected variables. To account for the GFC period, a dummy variable, equal to 1 from the June 2008 quarter onward and 0 otherwise is included in the SVAR model.[5]

The lag length specification tests suggest that one (Schwartz Bayesian Information Criterion), four (Likelihood Ratio) or five (Hannan-Quinn and Akaike Information Criteria) lags should be included. If too few lags are included in the model, serial correlation may remain in the residuals, resulting in standard inference being inappropriate. Conversely, inclusion of too many lags risks over-parameterising the model. Given these considerations, a lag length of $p = 2$ was chosen as it provides for dynamics between the variables without shortening the estimation sample too much. Other Australian SVAR studies have also tended to adopt short lag lengths with Jacobs and Rayner (2012) including two lags, and Dungey and Pagan (2000), Berkelmans (2005), and Lawson and Rees (2008) including three lags.

The interest rate variables (FFR, CASH) enter the model in levels, and are expressed in percentage. The inflation rate (INF) appears as a quarterly percentage change and the capital flow variables (NETFLOWS, DEBT, EQUITY) are expressed as total quarterly flows, scaled down by the largest data point in the series. The remaining variables (ICP, USGDP, GNE, GDP, CREDIT and ETWI) enter the model in natural logarithms. All variables except for

[4] A number of Australian SVAR studies begin their sample periods from December 1983, given this is quarter in which the Australian dollar was floated, and the overnight cash rate was employed as the chief instrument of monetary policy. In this study, a later sample start date is adopted due to data availability for the capital flows series.

[5] An SVAR model for the extended period without the GFC dummy was also estimated and the results are reported in Appendix B.

inflation are linearly detrended, which is consistent with Dungey and Pagan (2000) and Dungey, Fry and Claus (2008).

Unit root tests are reported on Table 2A. in Appendix A, highlighting that there are mixed stationarity issues present in the data. Consequently, the model can be estimated as a VAR or as vector error correction model (VECM). Given there is little literature to inform the long run relationships between capital flows, credit growth and the macroeconomy, a SVAR approach was chosen in order to prevent imposing an incorrect long run structure on the variables in the system. Though the data present mixed stationarity issues, the estimated SVAR models have stable roots.

5. Empirical Results

This section presents the impulse responses and variance decomposition results of the estimated SVAR model.[6] It includes an analysis of the interaction between the domestic credit and capital flow variables and their impact on the Australian economy. Standard impulse response functions describe the response of the system to an exogenous shock and the sizes of these shocks are reported in Table 2. Including the GFC in the sample period has little impact on the domestic variables but alters the magnitude of the US shocks. The US output shock becomes larger during the GFC, while the Federal Funds rate becomes smaller, as a result of US interest rates reaching the zero lower bound.

Table 2. Size of Exogenous Shocks

Variable	*ICP*	*USGDP*	*FFR*	*NET FLOWS*	*DEBT*	*EQUITY*	*GNE*	*GDP*	*INF*	*CASH*	*CREDIT*	*ETWI*
Shorter Sample	0.027	0.005	0.331	0.245	0.146	0.141	0.003	0.004	0.465	0.301	0.004	0.020
Extended Sample	0.044	0.350	0.004	0.257	0.193	0.153	0.003	0.004	0.488	0.305	0.004	0.022

This section mainly analyses the effects of shocks from the capital flow variables, credit and monetary policy (both domestic and foreign) as they help to identify and understand the nature of the relationships of the Australian macro-financial linkages. The impulse response functions are normalised by dividing through by one standard deviation of

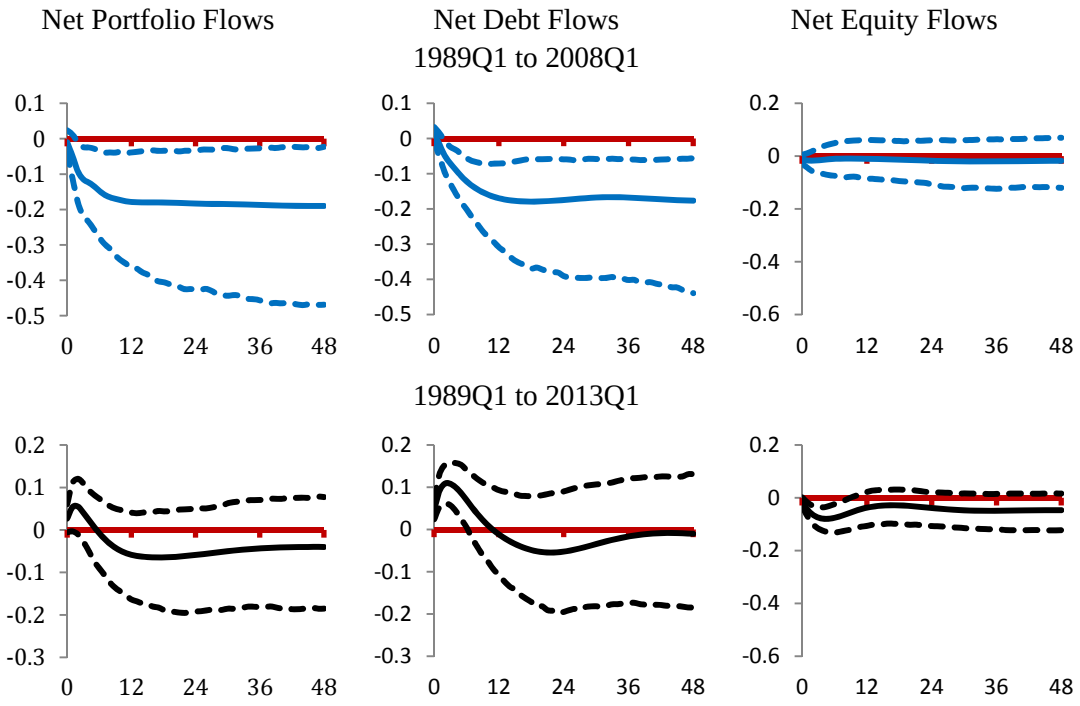
[6]The system is over-identified; as there are more restrictions than are required to exactly identify the model. Exact identification of the system requires $\frac{10(10-1)}{2} = 45$ restrictions. As 58 restrictions have been imposed, there are 13 more zero restrictions than necessary to just identify the model. The likelihood ratio test for over identification revealed that the null hypothesis of valid over identification restrictions could not be rejected at the 10 per cent level for the full sample period (1989:Q3 to 2013:Q1). Over identification statistics are provided in Appendix A.

the structural shocks. For the impulse responses reported, the solid line represents the impulse responses, while the dashed lines represent the 68% bootstrapped confidence bands computed from 5000 replications using the 'bootstrap-after-bootstrap' methodology of Kilian (1998).[7]

5.1 Response of Capital Flows to Foreign and Domestic Monetary Policies

Impulse responses of the capital flow variables to both foreign and domestic monetary policy shocks are considered in order to examine their role in driving movements in portfolio flows. Figure 1 shows the impulse responses of net portfolio, net debt and net equity flows to a positive innovation to the Federal Funds rate (FFR). In the reduced sample period, a shock to the FFR results in a significant outflow of net portfolio flows from Australia. This result is in line with theoretical expectations; a positive shock to the FFR results in increased US interest rates relative to Australia, resulting in capital outflows, ceteris paribus. Examining the impact on net debt and equity flows, it is evident that most of the movement in net portfolio flows is driven by net debt flows, with equity flows essentially unresponsive to a FFR shock.

Figure 1. Impulse Responses of Capital Flow Variables to an FFR Shock

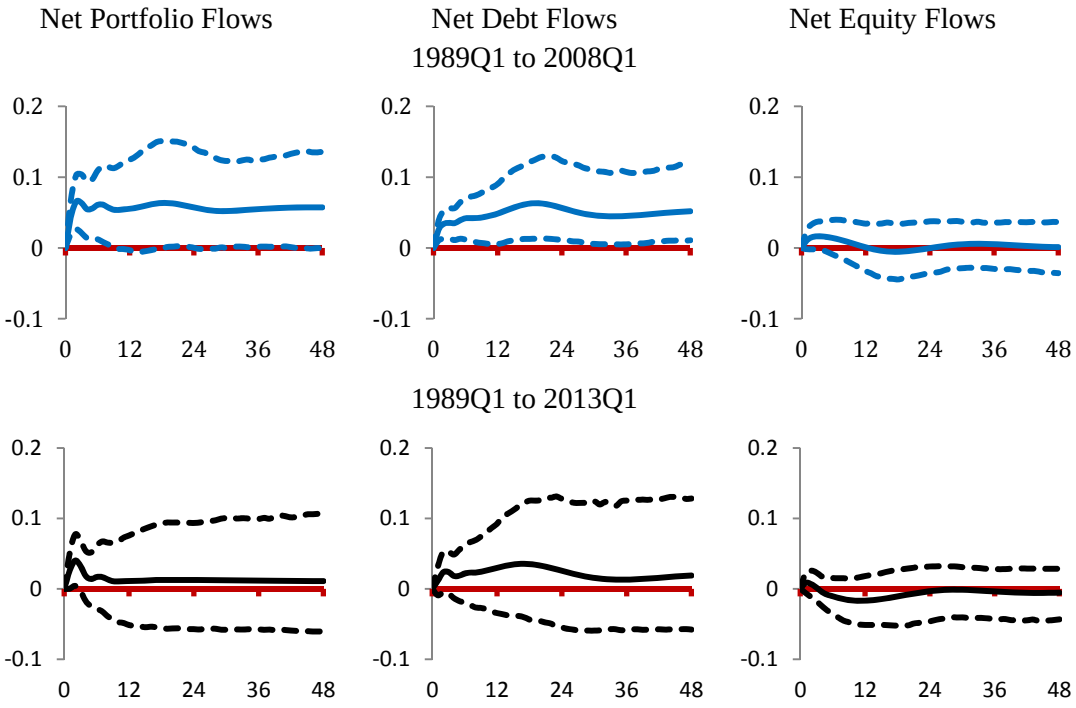


Notes: Impulse responses are shown as unbroken lines with 68% confidence bands obtained from 5000bootstrap replications) shown as dashed lines.

[7] The full results are reported in Appendix B, which includes the reduced period, the extended period and the extended period with the GFC dummy.

While the results from the reduced sample period are in line with theoretical expectations, extending the sample period causes the trends to reverse; a positive FFR shock leads to immediate positive responses for both net portfolio and net debt flows. The net inflows of debt are likely the result of including the GFC period in the sample. Foreign investment in public debt substantially increased, with the share of Australian government bonds held by foreigners increasing from 57 per cent in 2006 to 84 per cent in 2012 (Bloxham and Hartigan, 2012). Such changes in the composition of capital flows to Australia during the GFC period reflect that in times of financial crisis, movements in capital flows can be due to factors other than those traditionally considered drivers of capital flows (such as interest rates). Accordingly, the net inflow of debt to Australia as a result of a positive Federal Funds rate shock suggests that Australia may have been considered a 'safe haven' for investors during the crisis period. Net equity flows appear to be more responsive in the extended period, which highlights that during the crisis period, the composition of net capital flows shifted more towards equity flows due to large movements in foreigners' portfolio equity investment in Australia (D'Arcy and Ossolinki (2009).

Figure 2. Impulse Responses of Capital Flow Variables to an FFR Shock



Notes: Impulse responses are shown as unbroken lines with 68% confidence bands obtained from 5000bootstrap replications) shown as dashed lines.

Figure 2 shows the response of the capital flow variables to a domestic monetary policy (CASH) shock. As expected, the response of net portfolio flows is positive, reflecting

an inflow of funds into Australia. This result is the counterpart to a foreign monetary policy shock; a positive shock to the domestic cash rate results in higher interest rates relative to the foreign sector leading to increasing capital flows into Australia, ceteris paribus. Disaggregating net portfolio flows into net debt and equity flows again highlights that net debt flows are driving most of the movement in net portfolio flows. The results are similar across the two periods, though the responses are less significant in the extended period.

5.2 Responses of Domestic Variables to the Capital Flows Variables

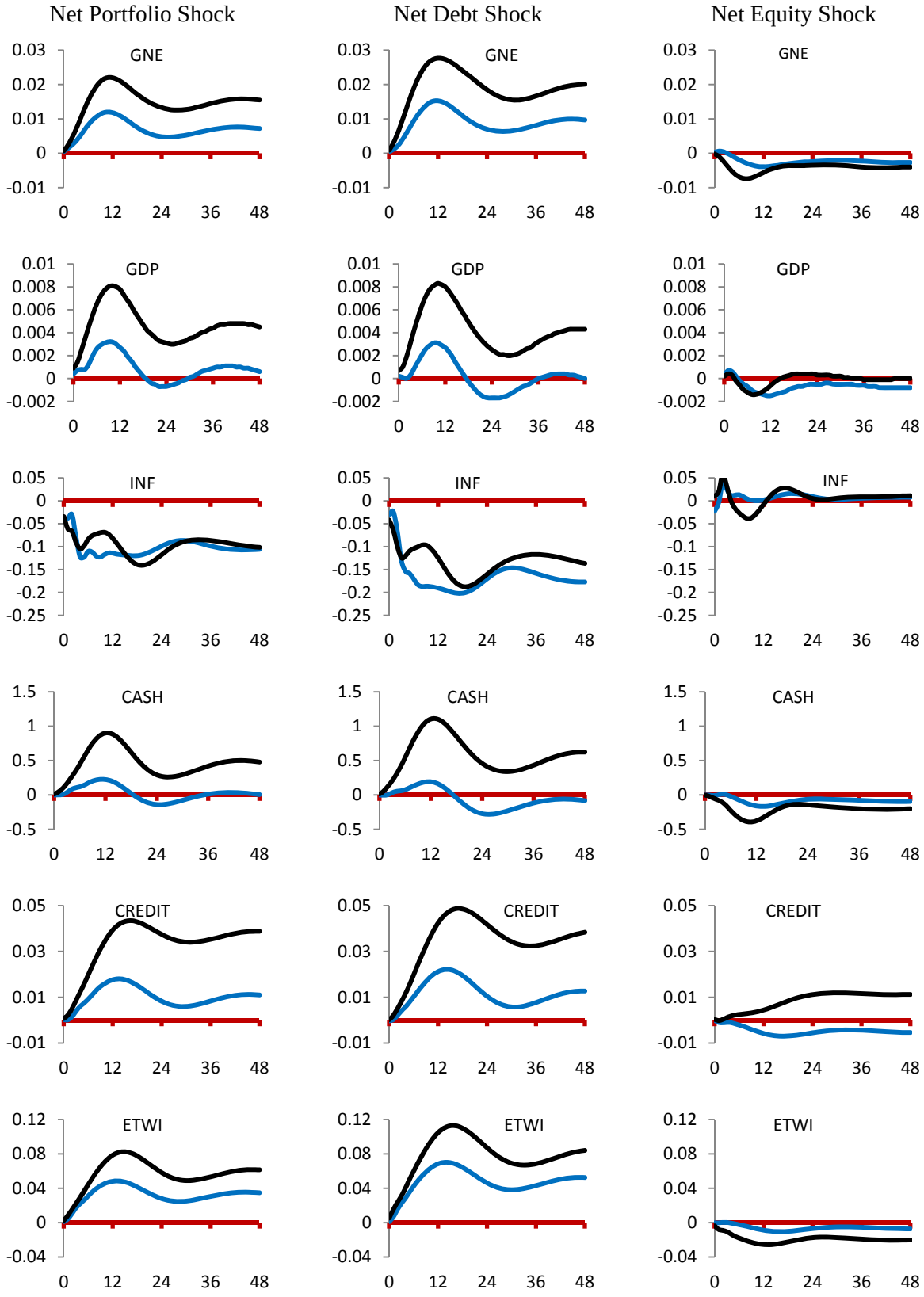
In Figure 3 each column provides the impulse responses for a shock to net portfolio flows, net debt flows and net equity flows respectively. Including responses generated using the reduced and the extended sample periods means the impact of the GFC period on the macro-financial linkages between capital flows and domestic macroeconomic variables can be examined.

Comparing the columns in Figure 3, it is evident that there are substantial differences between the responses of the domestic variables to a net debt and net equity flow shocks. Most noticeably, the impulse responses corresponding to a net debt flows shock are generally significant, and largely mirror those corresponding to a net portfolio flows shock. Conversely the impulse responses resulting from a net equity flows shock are both negligible and statistically insignificant, suggesting that the domestic variables are largely unresponsive to a net equity flows shock. These results indicate that debt flows are more relevant in explaining movements in the domestic variables as a result of capital flows.

Generally, Australia has experienced a net debt inflow, which as a percentage of GDP has predominately been larger than net equity flows. Furthermore, until the onset of the GFC in 2008, Australia experienced a consistent net equity outflow; see D'Arcy and Ossolinki (2009) and Bloxham and Hartigan (2012) for discussions on the changing composition of Australia's capital flows. As a result, it is net debt flows that have more influence on Australian macroeconomic variables.

In terms of the impact of capital flows on the Australian economy, the estimated responses for a positive net portfolio flows shock are generally in line with a priori expectations. A shock to net portfolio flows reflects an inflow of funds into the economy, and as would be expected, results in increased real domestic activity. The impact on GNE as a result of a net portfolio flows shock is much stronger than on GDP, which suggests that spending on imports is absorbing part of the increase in funds.

Figure 3. Impulse Responses of Domestic Variables to a Capital Flows Shock



Blue line –1989:Q3 to 2008:Q1 (Reduced Sample); Black line – 1989:Q3 to 2013:Q1 (Extended Sample)

The exchange rate also appreciates in response to a net portfolio flows shock, which is consistent with the results of Sun and An (2009), who concluded that capital flows and in particular, portfolio investment, is the most important factor in explaining fluctuations in the Australian dollar. As expected, a positive net portfolio flow shock results in an increase in credit, reaching a peak around 15 quarters after the initial shock. Comparing the responses for the different sample periods, it is evident that including the GFC period in the sample results in a net portfolio flows shock having a greater impact on credit. This is potentially a reflection of the increase in volume of net portfolio inflows to Australia during this period. With the exception of the last two quarters of 2008, during the GFC period Australia experienced a net inflow of both debt and equity portfolio investment. As the Australian financial system was considerably more resilient than many other developed economies, and banks continued to be profitable during the crisis period (ABS, 2010), the domestic banking sector had the ability to extend more credit as a result of the increase in net portfolio inflows.

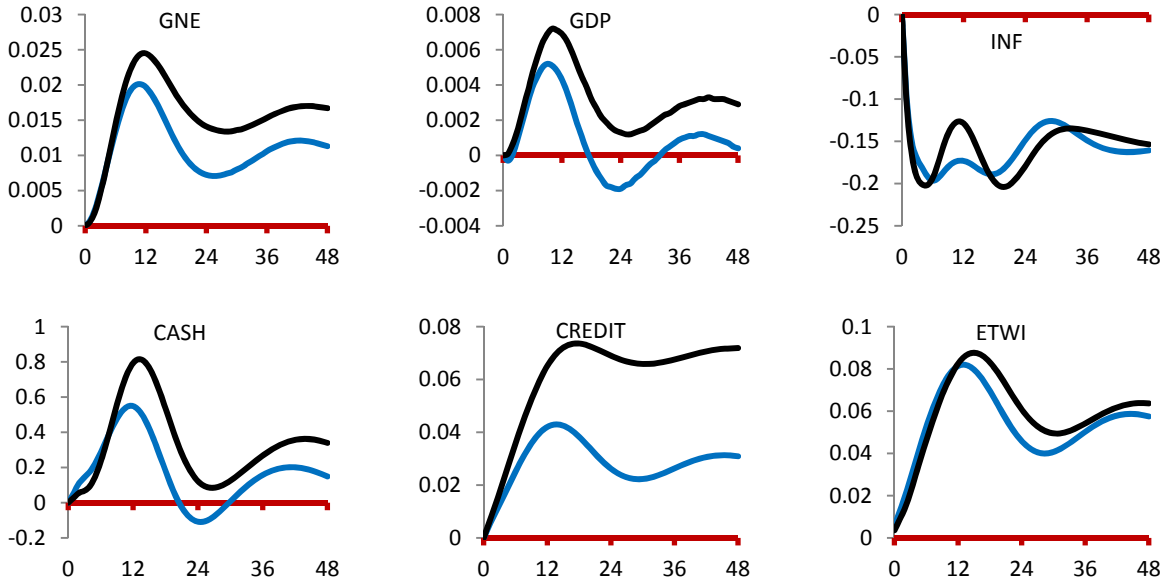
The results also indicate that in addition to having a greater impact on credit, net portfolio flows during the GFC had a greater influence on the majority of the domestic variables relative to the pre-crisis period. This can be attributed to the greater volatility in capital flows during the GFC. D'Arcy and Ossolinki (2009) highlighted that during the crisis, offshore issuance of bank debt and asset-backed securities largely accounted for the volatility in private capital inflows over 2008 and 2009, with equity flows less volatile. This trend is evident in Figure 3; net debt flows are driving the movements in net portfolio flows, with net equity flows showing minimal changes between the sample periods.

For both sample periods, a net portfolio flow shock leads to an increase in the cash rate, though the increase is also likely to be a response to increases in GNE and GDP. Given inflation has a negative response to a net portfolio flows shock, monetary policy appears to be effective in diminishing the effect of capital flows on inflation.

5.3 Responses of Domestic Variables to a Credit Shock

An innovation to credit is considered in order to examine the impact that an unanticipated credit shock has on the key Australian macroeconomic variables considered in the system. Figure 4 shows the impulse responses of the domestic variables to a positive credit shock. Comparing the responses between the sample periods illustrates that credit appears to have a greater impact on the domestic economy during the GFC period. This can likely be attributed to the stronger effect of external factors on credit during the crisis period, which subsequently translates into a greater impact of credit on the domestic variables.

Figure 4. Impulse Responses of Domestic Variables to a Credit Shock



Blue line –1989:Q3 to 2008:Q1 (Reduced Sample); Black line – 1989:Q3 to 2013:Q1 (Extended Sample)

For both sample periods, the pattern of the impulse responses presented in Figure 4 are largely consistent with the results of Berkelmans (2005) who also examined the impact of a credit shock on domestic macroeconomic variables. As expected, an increase in the availability of credit results in increased domestic real activity, with the peak impact occurring around 12 quarters after the initial shock. The impact on GNE is much stronger relative to GDP, which suggests that changes in credit have a greater effect on demand than on output, with spending on imports absorbing part of the increase in credit.

The exchange rate also appreciates in response to a credit shock, which is likely a result of the inclusion of capital flows in the model. An unanticipated credit shock results in an increase in the cash rate, this attracts net portfolio inflows which then leads to an exchange rate appreciation.

Similarly to Berkelmans (2005), a credit shock leads to an increase in the cash rate, though the increase is not immediate in this study due to differences in the specification of the model. Monetary policy appears to be quite effective at mitigating the effect of credit on inflation, as reflected by the negative response of inflation to a credit shock.

5.4 Variance Decomposition

Table 3 reports the variance decomposition of credit to innovations in each of the variables included in the system for both the reduced and extended sample periods. The

results are reported for four different forecast horizons; one quarter, one year, three years and six years. In the short run, shocks to GNE and credit's own shocks are important for credit while as the forecast horizon lengthens, shocks to US GDP, and to a lesser extent domestic GDP play a greater role in explaining variation in credit.

Table 3. Variance Decomposition of Credit

	Proportion of forecast error variance for credit							
	1989:Q3 to 2008:Q1				**1989:Q3 to 2013:Q1**			
Innovation	**1**	**4**	**12**	**24**	**1**	**4**	**12**	**24**
ICP	1.17	8.14	15.33	16.15	0.02	3.55	4.39	6.43
USGDP	0.05	2.34	13.85	31.08	0.42	0.60	6.88	22.67
FFR	0.00	0.01	0.07	1.26	0.00	0.00	0.00	0.19
NETFLOWS	0.14	2.68	1.48	1.12	0.20	0.88	1.01	0.19
DEBT	0.25	2.56	1.90	1.47	0.31	2.94	3.90	3.49
EQUITY	0.03	0.32	0.16	0.12	0.03	0.42	0.59	0.56
GNE	28.71	51.62	50.21	36.37	27.78	52.58	63.52	49.24
GDP	2.93	7.33	5.50	3.75	2.47	8.50	6.69	5.75
INF	6.31	2.76	0.67	1.46	8.23	5.68	2.55	2.51
CASH	1.71	1.00	4.36	3.38	0.17	0.38	2.30	2.70
CREDIT	58.98	24.07	8.41	5.66	60.70	27.75	12.55	9.41
ETWI	0.00	0.04	0.12	0.76	0.00	0.06	0.10	0.31

These results indicate that domestic credit is mostly driven by output; however there are some differences in the roles that international and domestic output play between sample periods. In the pre-GFC period, US GDP explains a higher proportion of forecast error variance than it does during the crisis period while the proportion of forecast error explained by domestic GNE and GDP increases during the GFC period. This reversal indicates that declining US GDP during the GFC period led to its reduced impact on Australian credit, while domestic output became more important.

Consistent with the impulse response results, variance decomposition reveals it is net debt flows that are more important in explaining credit, than net equity flows. Comparing between sample periods, both net debt and net equity flows play a greater role during the GFC period. This supports the impulse response results that including the GFC period in the sample results in portfolio flows having a greater impact on credit, and reflects that as the volume of net portfolio inflows to Australia increased during this period, the domestic

banking sector had the ability to extend more credit.

Table 4. Variance Decomposition of Domestic Variables

Innovation	Qrt	Proportion of forecast error variance for each variable 1989:Q3 to 2008:Q1				1989:Q3 to 2013:Q1			
		GNE	***GDP***	***INF***	***ETWI***	***GNE***	***GDP***	***INF***	***ETWI***
NET FLOWS	**1**	2.64	0.74	0.52	0.19	2.00	0.75	0.25	0.00
	4	1.38	0.28	1.12	3.52	1.69	0.65	0.34	2.69
	12	1.89	0.66	1.40	2.43	1.50	0.74	0.32	1.78
	24	1.86	0.69	1.36	1.69	1.42	0.72	0.33	1.49
DEBT	**1**	1.69	0.25	0.33	0.21	1.54	0.14	0.19	0.10
	4	1.58	0.18	1.88	5.57	3.21	0.88	0.87	5.29
	12	2.95	0.82	1.74	3.75	5.06	2.48	0.77	4.95
	24	2.96	1.03	1.68	2.73	4.92	2.24	0.88	4.60
EQUITY	**1**	0.87	0.58	0.17	0.00	0.85	0.79	0.11	0.02
	4	0.20	0.44	0.86	0.01	0.24	0.57	0.51	0.08
	12	0.32	0.36	0.77	0.10	0.73	0.72	0.44	0.41
	24	0.26	0.22	0.75	0.08	0.68	0.59	0.45	0.45
CREDIT	**1**	0.00	0.00	0.00	4.89	0.00	0.00	0.00	4.25
	4	4.01	1.11	3.66	7.43	5.01	2.10	1.53	4.96
	12	5.97	2.08	3.12	6.27	8.00	4.09	1.29	8.10
	24	6.01	2.21	3.06	4.51	7.62	4.00	1.46	7.31

Table 4 reports the variance decomposition of the domestic variables to credit and disaggregated capital flows shocks for both the reduced and extended sample periods. For all forecast horizons, a net debt flows innovation explains a greater proportion of forecast error variance for each of the domestic macroeconomic variables than a net equity flows innovation, again highlighting the importance of debt flows as opposed to equity flows. The greater role for portfolio flows during the GFC period is also evident, with both net debt and net equity flows explaining more of the forecast error of the GNE and ETWI during this period than in the pre-crisis period.

As for the effect of credit on the Australian economy, the variance decomposition results demonstrate that including the GFC in the sample period results in credit explaining a greater proportion of forecast error variance in GNE, GDP and the exchange rate. A net portfolio flows shock, as reported in Table 3, appear to have a larger effect on credit during the GFC, which subsequently contributes to a greater impact of credit on the domestic

variables. This result highlights the larger influence of credit on the Australian economy during the crisis, seen in the impulse responses.

6. Conclusions

Although the GFC impacted Australia less severely than it did many other countries, it is nevertheless important to understand the linkages between international capital flows and domestic credit growth for the Australian economy. This study has analyzed the link between portfolio capital flows and domestic credit growth as well as established the subsequent impacts of these variables on the Australian economy. To date there are limited studies focusing on the importance of these factors for the Australian economy. In order to assess the impact of credit growth and international capital flows a structural vector autoregressive (SVAR) model was constructed which extended the SVAR models constructed in existing Australian studies by including both portfolio capital flows and domestic credit variables.

Net portfolio flows have a significant impact on Australian domestic variables, with gross national expenditure (GNE), gross domestic product (GDP) and credit significantly increasing following a positive net portfolio flows shock. The exchange rate also appreciates. A key finding from this study is that net debt flows are driving the impact of net portfolio flows on the Australia economy. Conversely, net equity flows have no real effect on the domestic macroeconomic variables. This finding supports those of Lane and McQuade (2013), who examined cross-country variation between credit growth and international capital flows for a sample of European countries and found that the connection between these variables came from international net debt flows.

Domestic credit also has significant impact on the Australian economy, in line with the literature that suggests rapid credit growth can have implications for the domestic economy. A positive credit shock leads to increased real domestic activity; both GNE and GDP significantly increase. The exchange rate also appreciates. However monetary policy appears to be effective at mitigating the effects of capital flows and credit growth on inflation, which does not significantly increase following either a credit or net portfolio flows shock.

The similar responses of the Australian macroeconomic variables to credit and net portfolio flows shocks reflect the interrelated nature of these financial variables. As expected, a positive net portfolio flows shock results in an increase in credit, which subsequently feeds through to the domestic economy. Consequently, the impact of portfolio flows on the

Australian economy may be magnified through a credit channel. Both capital flows and credit were also shown to have a greater impact on the domestic variables during the GFC period, which highlights the importance to policy makers of monitoring these variables, as large fluctuations have the potential to lead to periods of financial turbulence.

Given shocks to both portfolio flows and credit have significant effects on domestic variables; the findings from this study suggest that these variables are relevant in guiding macro-prudential and monetary policies in Australia. The central finding for policy makers is that it is net debt flows that are driving the impact of net portfolio flows on the Australia economy, indicating that monitoring net debt flows could be the relevant measure in protecting macroeconomic and financial stability.

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Appendix A

Table 1A. Data Sources and Definitions

Series	Description and Source
Commodity Prices (ICP)	RBA; Quarterly, RBA Index of Commodity Prices reported in US dollars and deflated by the US GDP deflator.
US GDP (USGDP)	RBA; Quarterly, and seasonally adjusted.
Federal Funds Rate (FFR)	RBA; Quarterly, converted from monthly data using a simple three-month average.
Portfolio Flows (NETFLOWS, DEBT, EQUITY)	ABS; Quarterly, scaled down by dividing each series by its largest data point.
Australian GNE (GNE)	ABS; Quarterly, and seasonally adjusted.
Australian GDP (GDP)	RBA; Quarterly, and seasonally adjusted.
Inflation (INF)	RBA; Quarterly.
Cash Rate (CASH)	RBA; Quarterly, converted from monthly data using a simple three-month average.
Domestic Credit (CREDIT)	RBA, ABS; Quarterly, converted from monthly data using a simple three-month average. Includes owner-occupier housing, investor housing, other personal, and business. The nominal credit series provided by the RBA is converted into a real measure by deflating it by the domestic demand deflator. The domestic demand deflator (obtained from the ABS) was chosen instead of the GDP deflator, as it is a better estimate of domestic price pressures.
Exchange Rate (ETWI)	RBA; Quarterly, Real trade-weighted index.

Table 2A. Unit Root Tests

Variable	ADF Test (no trend)	Phillips-Peron Test (no trend)
	p-value	p-value
ICP	0.7956	0.7890
USGDP	0.8236	0.9724
FFR	0.0273*	0.2609
NETFLOWS	0.0000*	0.0000*
DEBT	0.0000*	0.0000*
EQUITY	0.0000*	0.0000*
GNE	0.2576	0.2996
GDP	0.2963	0.4426
INF	0.0001*	0.0000*
CASH	0.0100*	0.5633
CREDIT	0.0434*	0.8186
ETWI	0.7807	0.7304

Notes: The table provides p-values (excluding trend components) for both the Augmented Dickey-Fuller and Phillips-Perron Tests for the detrended variables; The lag length is selected by AIC with a maximum of 12 lags. * indicates the statistic is significant at 5%.

Table 3A. Likelihood Ratio Test for Over Identification Restrictions

Reduced Sample (1989:Q3 to 2008:Q1)	**Chi-Square (13)**	**p-value**
SVAR incorporating NETFLOWS	23.6073	0.0349
SVAR incorporating DEBT	27.0096	0.0124
SVAR incorporating EQUITY	22.7262	0.0451
Full Sample (1989:Q3 to 2013:Q1)	**Chi-Square (13)**	**p-value**
SVAR incorporating NETFLOWS	15.7172	0.2647
SVAR incorporating DEBT	18.5003	0.1394
SVAR incorporating EQUITY	15.4588	0.2796

Notes: Null hypothesis is that the over identification restrictions are valid.

Appendix B

Figure B.1. Plots of Data

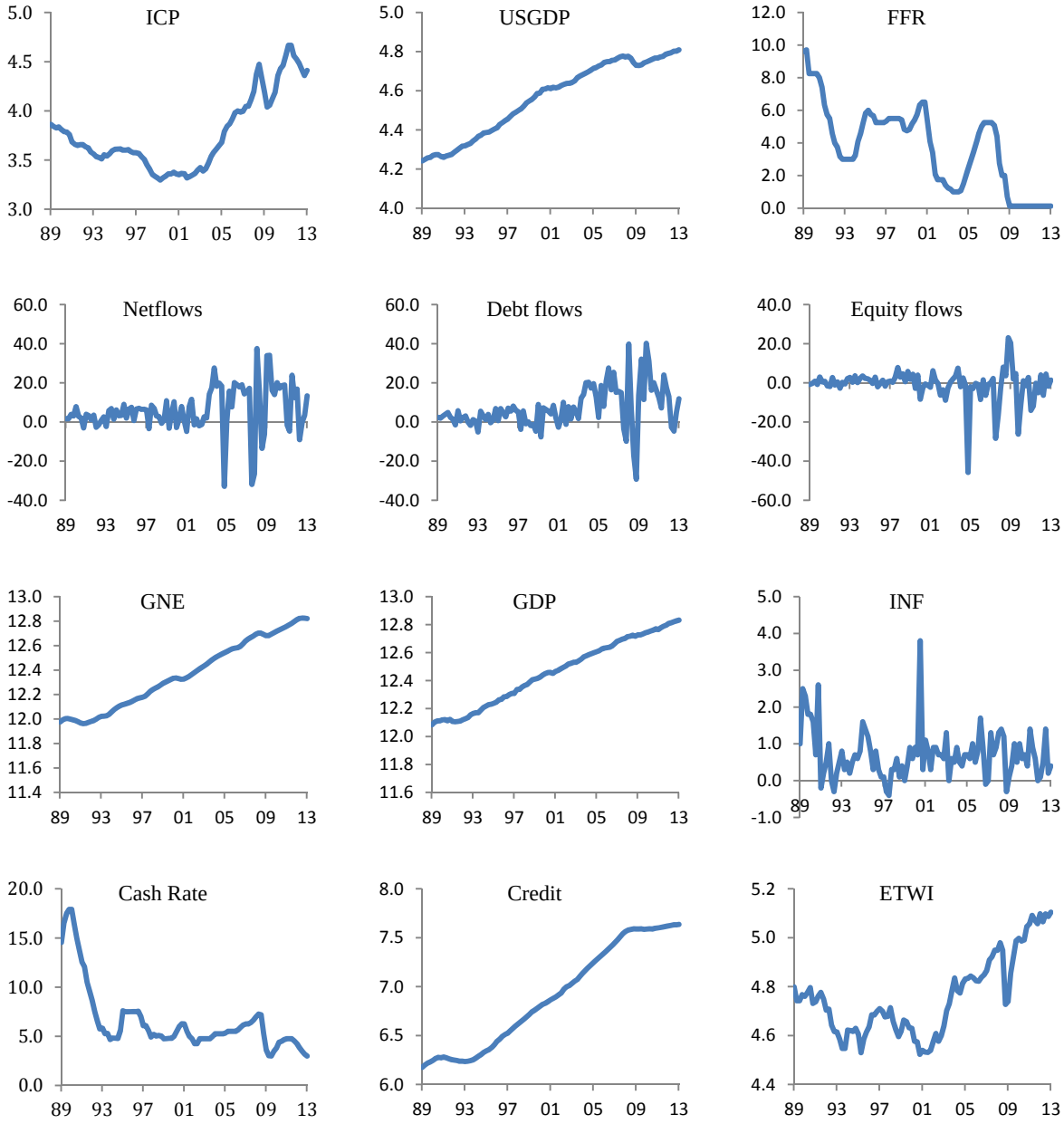
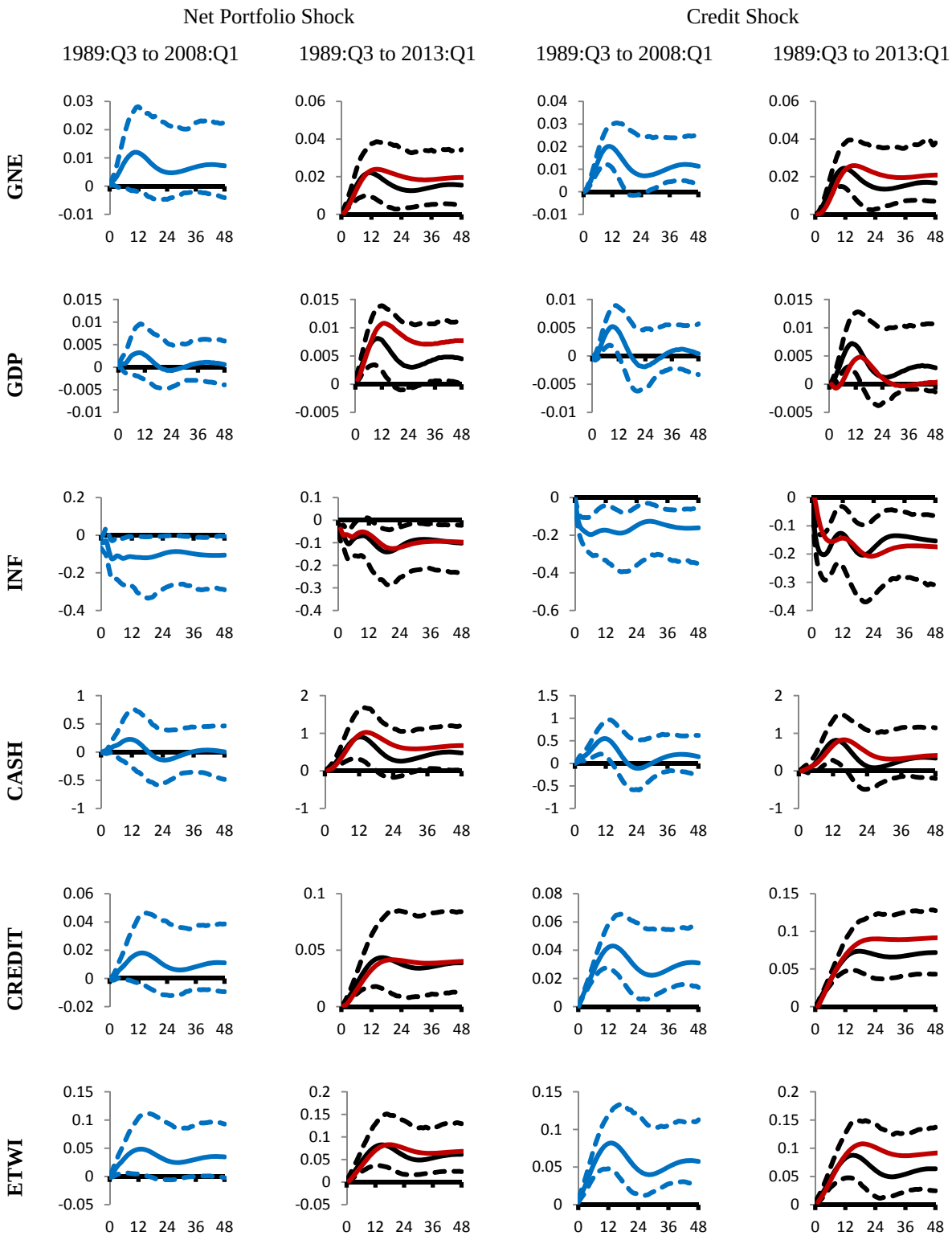
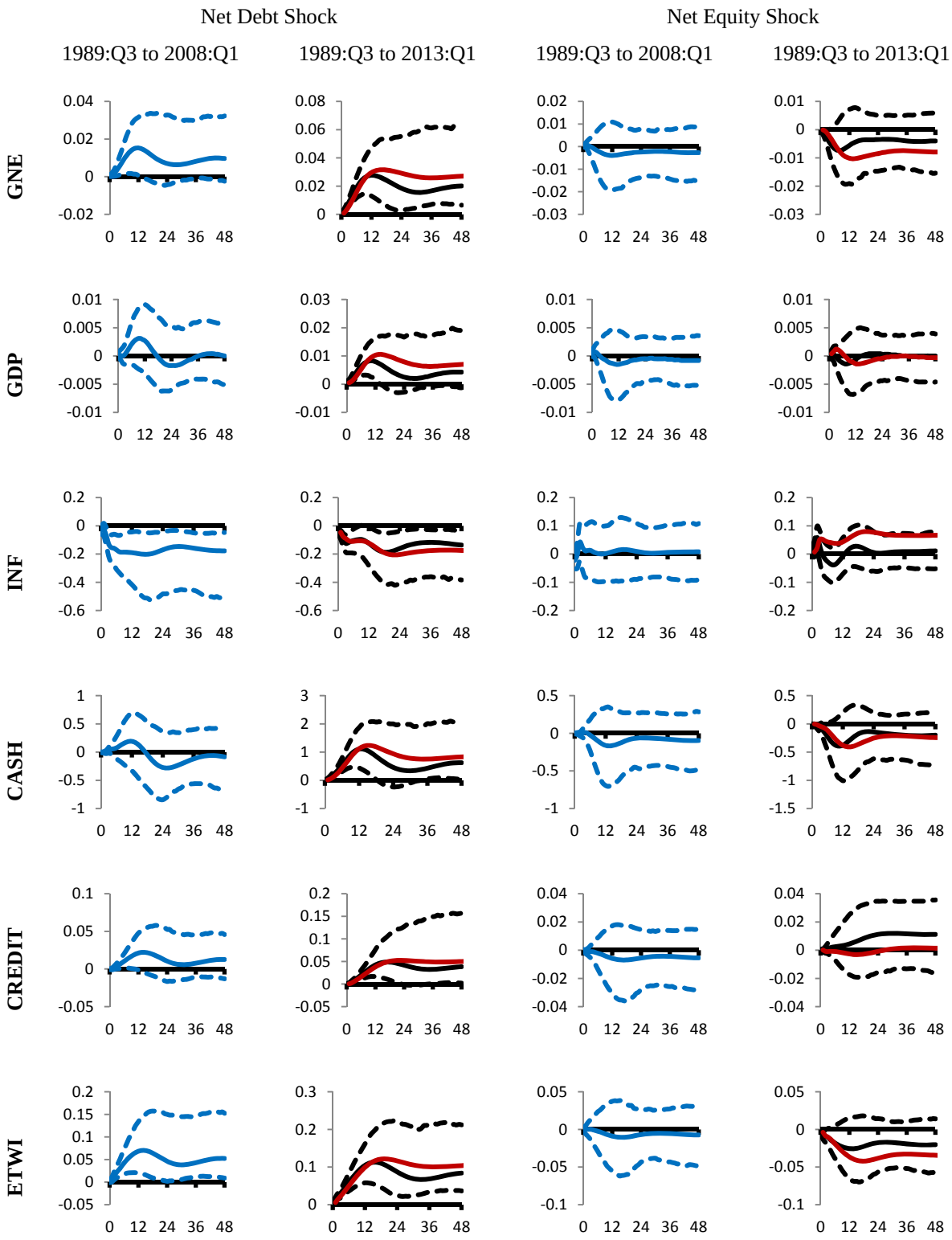


Figure B2. Impulse Responses of Domestic Variables to Net Portfolio and Credit Shocks



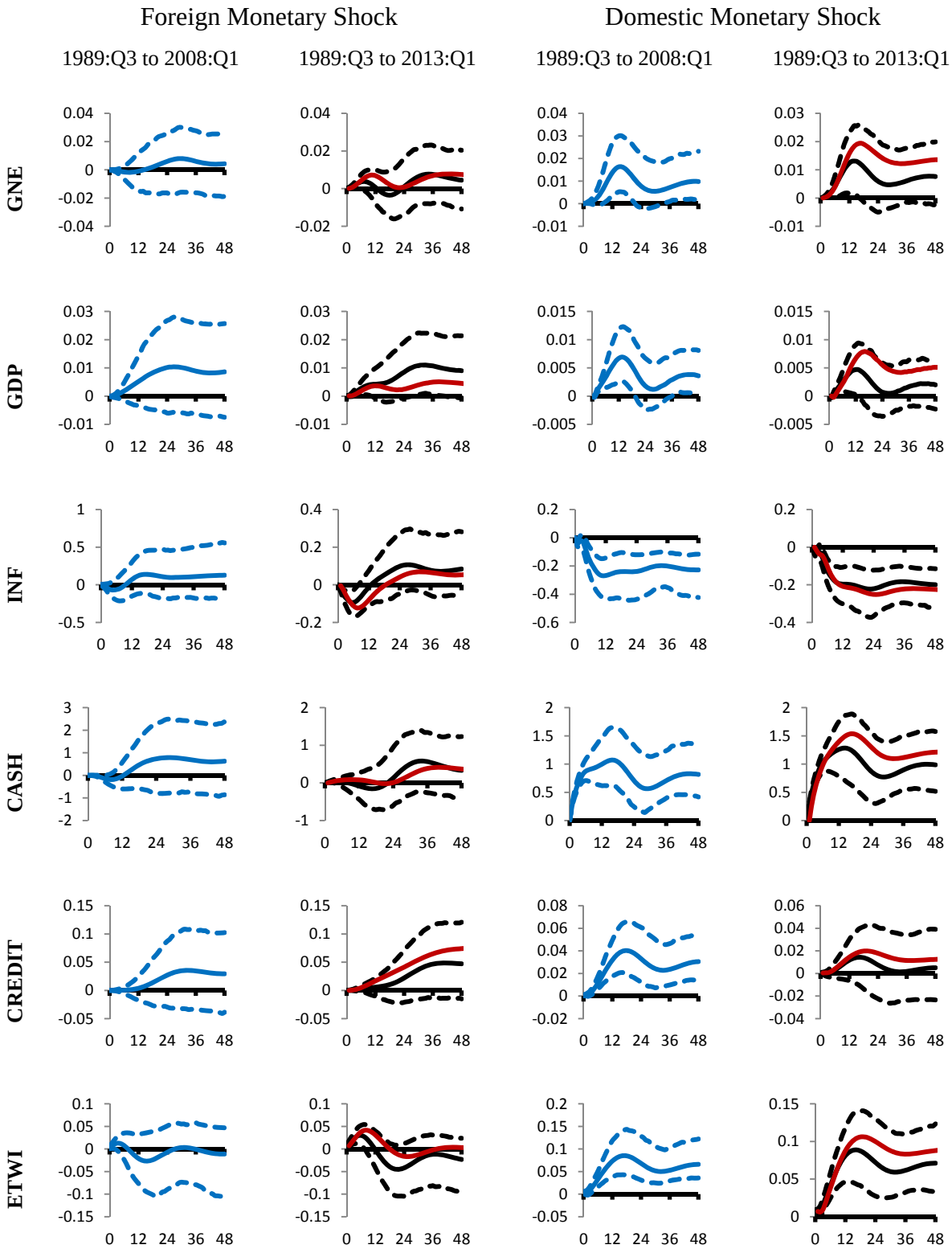
Note: Blue solid line represents the reduced sample; black solid line represents the extended period with GFC dummy and the red solid line represents the extended period without the GFC dummy. The dashed lines represent 68% confidence bands obtained from 5000bootstrap replications.

Figure B3. Impulse Responses of Domestic Variables to Net Debt and Equity Shocks



Note: Blue solid line represents the reduced sample; black solid line represents the extended period with GFC dummy and the red solid line represents the extended period without the GFC dummy. The dashed lines represent 68% confidence bands obtained from 5000bootstrap replications.

Figure B4. Impulse Responses of Domestic Variables to Foreign and Domestic Monetary Shocks



Note: Blue solid line represents the reduced sample; black solid line represents the extended period with GFC dummy and the red solid line represents the extended period without the GFC dummy. The dashed lines represent 68% confidence bands obtained from 5000bootstrap replications.