BANGKO SENTRAL NG PILIPINAS
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Abstract

The study examines the effectiveness of cyclical capital flow measures (CFMs) and domestic macro prudential policy in restraining credit across nine Asian emerging market economies, with varying stages of financial openness and with different monetary policy setting. These countries include China, Hong Kong, India, Indonesia, South Korea, Malaysia, the Philippines, Singapore and Thailand.

The study introduces new database for tightening capital inflow measures and episodes of sterilization of capital inflows and updates Shim et al's (2013) domestic policy actions on housing markets across nine Asian emerging market economies from 2004 to 2015. These three sets of database are then used to assess the effectiveness of restrictions on capital inflows and domestic macro-prudential policy in curbing real bank credit to non-financial sector, real housing credit and real house prices and to draw implications for monetary policy using a dynamic panel Generalized Method of Moments (GMM).

Following diagnostic and robustness checks, the results reveal important findings. First, after controlling for episodes of sterilization of capital inflows, tightening capital inflow restrictions and domestic macro prudential policy are effective in curbing overall real bank credit, real housing credit and real house prices across nine Asian emerging market economies. Second, this study highlights the bigger negative impact of tightening measures on real house prices. Third, following the inclusion of a direct measure of capital flows into the models, cross-border loans and deposits are found to be an important channel of tightening capital inflow measures which can help reduce credit growth and real house prices. Fourth, real exchange rate appreciation drives real bank credit to non-financial sector and real house prices. Fifth, monetary policy tightening complements tight domestic macro prudential policy in restraining movements in real bank credit and real house prices. However, when domestic macro prudential policy and monetary policy action are combined with tightening capital inflow measures, the significance of either one policy in addressing real credit and real house price movements disappears.

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Keywords: capital flows, capital flow measures, macro prudential policy, emerging market economies

[1] Director, Center for Monetary and Financial Policy, Bangko Sentral ng Pilipinas. This study was prepared in my capacity as Visiting Research Economist at the Bank for International Settlements, Hong Kong SAR, 11 January – 8 April 2016. I am grateful for guidance and comments from Eli Remolona (BIS), Madhusudan Mohanty (BIS), Frank Packer (BIS), Ilhyock Shim (BIS), James Yetman (BIS), Feng Zhu (BIS), Thorsten Beck (Cass Business School), Vicente B. Valdepeñas, Jr. (BSP), Mary Jane T. Chiong (BSP), and Lorelei S. Fernandez (BSP). I am equally thankful to Jimmy Shek (BIS), Ferdinand Co (BSP), Lilia Elloso (BSP), John Michael Rennie Hallig (BSP) and Marites Oliva (BSP) for excellent research assistance. The views expressed in this Working Paper are those of the author and do not necessarily represent those of the BSP or BSP policy. BSP Working Papers describe research in progress by the authors and are published to elicit comments.

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1. The Context

This study examines the effectiveness of cyclical capital flow measures (CFMs)[2] and domestic macro prudential policy in restraining credit from the perspective of nine Asian emerging market economies (EMEs), with varying stages of financial openness and with different monetary policy setting. These countries include China, Hong Kong, India, Indonesia, South Korea, Malaysia, the Philippines, Singapore and Thailand. Based on the Updated Chinn-Ito Financial Openness Index (data from 1970 to 2014), for instance, China, India, Thailand, Malaysia and the Philippines have relatively lower level of capital openness compared to the other Asian countries.[3] Meanwhile, India, Indonesia, Korea, the Philippines and Thailand are currently adopting inflation targeting, while Singapore is using exchange rate targeting and, China is following monetary aggregate targeting as framework for monetary policy. Moreover, Hong Kong follows a currency board.

The role of global factors in capital flows and credit movements has been at the center of policy and academic discussions on global funding conditions especially among emerging market economies after the Global Financial Crisis (GFC) in 2008.[4] The literature on the impact of global factors on credit has evolved from studies that differentiate global "push" factors for capital flows from the country-specific "pull" factors (Calvo et al 1996) to the influence of cross-border banking in the transmission of financial conditions (BIS 2011). However, capital flow surges have become more frequent and volatile following the easing of restrictions to international movements of capital inflows during the last decades or so.

In the literature, capital flows to EMEs can finance investment and promote economic growth, as well as increase welfare by encouraging consumption smoothing. Surges in capital inflows can cause overheating in credit markets, including housing markets, and other financial imbalances, such as excessive borrowing in foreign currencies, by increasing the supply of funds and lowering yields and, in a managed exchange rate regime, by triggering foreign exchange market interventions that expand the money supply, if not sterilized.[5] Sudden stops or reversals of inflows can trigger financial crisis.

Several countries used CFMs, such as portfolio inflow and banking inflow restrictions, along with domestic macro prudential policies to curb excessive credit growth and prices in

[2] Klein (2012) calls these controls as episodic capital controls while Forbes et al (2012) as temporary capital controls.
[3] See Chinn and Ito (2006) and 2014 Updates (As of 30 June 2016). The 2014 Updates are based on the IMF AREAER 2014, which contains the information on regulatory restrictions on cross-border financial transactions as of end-December 2014. The dataset covers the period of 1970 to 2014 for 182 countries. Using Chinn-Ito Financial Openness Index (Updates for 2014), China, India, Thailand, Malaysia and the Philippines remain as those with relatively lower level of financial openness compared to other Asian countries, such as Hong Kong, Singapore, South Korea and Indonesia.
[4] Or, often referred to in recent studies as global liquidity.
[5] See Magud et al (2011).

recent past years.[6] While discussions on the net benefit of using such policies on macroeconomic indicators continue to be relevant, some studies have explored the analysis on the links among global factors, domestic credit, housing credit and house prices. Some studies focused on the relationship between cross-border flows and their global drivers. Others delved into the relationship between global credit supply and the current account which captures the excess of saving over investment, both of which are determined by households' and firms' resource allocation decisions. There are also studies that explored the link through asset prices, such as equity and exchange rates, and interest rates.

Against this backdrop, managing the financial stability implications of large capital inflows and the build-up of systemic risks is important to emerging Asia.[7] Given Asia's past experience with credit and/or asset valuation boom-bust cycles and that episodes of rapid credit growth have been characterized by a higher incidence of crises relative to other emerging economies, a crucial question remains - what is the right policy in such circumstances?

Cyclical capital flow measures typically refer to those introduced along the economic fluctuations. In the conduct of policy, cyclical capital flow measures can either be procyclical or countercyclical. A measure that is procyclical refers to that measure that could magnify economic or financial fluctuations. By contrast, a measure that is countercyclical runs against cyclical tendencies in the economy. That is, a countercyclical policy is one that cools down the economy when it is in an upswing, and stimulates the economy when it is in a downswing. Capital flows measures include both inflows and outflows, tightening and loosening, and may include both FX-related or credit-related prudential measures. Building on Bruno et al's (2015) paper, cyclical CFMs in this study include tightening controls on capital inflows only which are meant towards particular categories of assets (Klein 2012), or that which are credit-related transactions.[8]

Meanwhile, domestic macro prudential policy includes measures adopted to address excessive movements in bank credit to non-financial sector, housing credit and house prices. Reserve requirements on bank domestic deposits can be imposed to limit excessive growth of credit extended by banks to the private sector. To address unwarranted movements in housing credit and house prices, changes in the maximum debt-service-to-income (DSTI) ratio, the maximum loan-to-value (LTV) ratio, limits on exposure to the housing sector and housing-related taxes can be adopted. This study then estimates the efficiency of these policies in curbing real bank credit, real housing credit and real house prices using dynamic panel

[6] Klein (2012) noted that some countries (Brazil, Iceland, Ireland, Peru and Turkey) that had liberalized their capital accounts prior to the Global Financial Crisis in 2008 re-introduced controls on capital inflows to address concerns about inflow-induced appreciation of domestic currency and potentially destabilizing asset price booms.

[7] See Cecchetti et al (2010).

[8] By contrast, Klein (2012) defines measures that are long-standing and are therefore permanent capital controls.

Generalized Method of Moments (GMM) and finally, draws implications for monetary policy reaction.[9]

Although the study recognizes that a study on the effectiveness of capital flows and domestic macro prudential measures should be symmetrical, that is both loosening and tightening end are taken into account, this study builds on the study by MacDonald (2015). Basically, MacDonald (2015) found that tightening measures have greater effects when credit is expanding quickly and when house prices are high relative to income. By contrast, loosening measures seem to have smaller effects than tightening, but the difference is negligible in downturns. Moreover, loosening measures are found to have small effects and are dependent on the cycle. A focus on both tightening and loosening measures remains an area for future research.

This study is broadly related to a growing area of empirical research on financial stability. The literature on the effectiveness of measures to control capital inflows and domestic macro prudential policy in dampening credit cycles across economies has remained relevant since the GFC. Meanwhile, studies on the efficacy of cyclical capital controls on inflows imposed by several EMEs post-GFC have received greater attention following findings that there is a strong correlation between capital flows and some financial systemic indicators, such as credit growth, during high capital flow volatility. However, a joint assessment of the effectiveness of both cyclical capital flows and macro prudential policies continues to be desired.

This study raises three main questions:

First, are both cyclical capital flow measures and domestic macro prudential policy effective in restraining movements of domestic bank credit, housing credit and house prices?

Second, do capital flow measures affect cross border flows?, and

Third, is monetary policy reaction still relevant in controlling credit when cyclical capital inflow measures and domestic macro prudential policy are in place?

The rest of this study is organized as follows. Section 2 presents some major empirical findings from selected literature. Section 3 discusses baseline database and empirical methodology, while Section 4 highlights the main findings of the paper. Section 5 concludes.

2. Survey of Empirical Findings

This study cuts into two broad research areas. The first area includes findings on the pattern of controls on cross-border capital inflows and their association with measures of

[9] Such an approach has been used in Bruno et al (2015).

financial vulnerability, real gross domestic product (GDP) growth, and exchange rates. This area has received some support from a number of sources. Several emerging market economies, including Brazil[10], had used controls in the past years to address financial vulnerabilities. In fact, the International Monetary Fund (IMF) has included capital controls on inflows as part of a country's policy tool kit (Ostry et al 2011).

Some empirical papers have shown that taxes on capital inflows can reduce financial vulnerabilities by changing the composition of inflows, if not the volume (Forbes 2012). Forbes et al (2012) used changes in Brazil's tax on capital inflows from 2006 to 2011 to test for direct portfolio effects and externalities from capital controls on investor portfolios. They found that an increase in Brazil's tax on foreign investment in bonds causes investors to reduce their portfolio allocations significantly to Brazil in both bonds and equities. Investors simultaneously increase allocations to other countries that have substantial exposure to China and decrease allocations to countries viewed as more likely to use capital controls. Much of the effect of capital controls on portfolio flows appears to occur through signaling, or changes in investor expectations about future policies, rather than the direct cost of the controls. Meanwhile, there are also theoretical papers that focused on modeling the optimal ways taxes on capital inflows can be imposed, given the presence of other distortions (Korinek 2010; Jeanne and Korinek 2010; and Costinot et al 2011).

Klein (2012) examined the pattern of controls on cross-border capital inflows and their association with measures of financial vulnerability, GDP, and exchange rates from 1995 to 2010 using Ordinary Least Squares (OLS) estimation. The study made a distinction between long-standing controls covering a broad range of assets and episodic controls covering a narrower set of assets. Using such a distinction and a data set that differentiates between controls on inflows and on outflows as well as among asset categories for 44 developed and emerging market economies from 1995 to 2010, the study showed that the imposition of capital controls will not reduce financial vulnerabilities if they are episodic. Although Klein (2012) did not present reasons behind such a finding, he argued further that long-term and widespread capital controls may have some effects and that episodic controls do not significantly moderate currency appreciation. Hence, Klein (2012) maintained that controls on capital inflows, as a whole, do not provide an effective policy option.

Using a quarterly dataset on changes in capital controls and currency-based prudential measures in 17 major EMEs over the period 2001 to 2011, Pasricha et al (2015) provided evidence on domestic and spillover effects of capital controls before and after the GFC. Based on panel Vector Autoregressive (VAR) model, the results revealed that capital control actions do not allow countries to avoid the trade-offs of the monetary policy trilemma. While results showed the desired effect on the trilemma variables, such as net capital inflows, monetary policy autonomy and the exchange rate, the size of such an impact is generally small. Pasricha et al

[10] Brazil used Imposto sobre Operacoes Financieras in 2010 and in 2011.

(2015) also found that while there was some evidence of effectiveness before the GFC, the usefulness of such measures weakened in the post-GFC, following an environment of ample global liquidity and relatively strong economic growth in EMEs. Moreover, the study highlighted that capital controls can have unintended consequences, as resident outflows offset the impact of capital control actions on gross inflows (or vice versa). These findings underscored the increasing role of resident flows in understanding the usefulness of capital inflow management.

The second area includes findings on the joint effectiveness of capital flow measures and macro prudential policies. The empirical studies so far underscored the growing evidence that macro prudential policy tools can increase resilience and have the ability to contain procyclical dynamics between asset prices and credit across tools. These empirical studies highlighted the relationship between capital flow measures and macro prudential policies to be, in certain situations, complementary or overlapping.[11] This study builds on research by Habermeier et al (2011)[12], Bruno et al (2015), Forbes et al (2015), and Cerutti et al (2015). In their review of the effectiveness of capital controls and related prudential measures, they showed that macro prudential policies are relatively effective in reducing systemic risk. In a similar manner, Cerruti et al (2015) found that macro prudential policies can have a significant effect on credit developments and that the effectiveness of policies is both instrument and country specific, and that circumvention of policies is a challenge for policy makers. However, Habermeier et al (2011) and Forbes et al (2015) highlighted limited impact on capital flows while Bruno et al (2015) showed efficacy in slowing down banking and bond inflows.

In particular, Habermeier et al (2011) examined the following episodes in four countries, such as the foreign exchange tax in Brazil (2008), the Unremunerated Reserve Requirements (URR) in Colombia (2007–2008) and in Thailand (2006–2008), and extensive outflow liberalization in South Korea (2005–2008). The study assessed the success of controls in achieving four objectives: (a) stemming capital flows; (b) lengthening the maturity of capital flows; (c) allowing greater room for raising domestic interest rates; and (d) easing currency appreciation pressures. Using Vector Autoregressive (VAR) model, the study showed mixed evidence, although prudential measures appeared to have been somewhat more successful than capital controls.

Meanwhile, Forbes et al (2015), using a propensity-matching methodology, showed that macro prudential policies imposed on international transactions from 2009 to 2011 across 60 countries can significantly reduce some measures of financial fragility. However, capital flow measures cannot significantly affect other key targets, such as exchange rates, capital flows, interest rate differentials, inflation, equity indices and different volatilities.[13]

[11] The IMF defines an overlapping measure as designed to limit capital flows in order to reduce systemic financial risks stemming from such flows.
[12] See also Baba and Kokenyne (2011) and Lim et al (2011).
[13] BIS Senior Economist discussed this paper.

In a separate paper, Cerruti et al (2015) investigated whether the size of cross-border claims can be associated with the use of macroprudential policies. The authors found that larger cross-border financial claims coincided with the adoption of macroprudential measures. Given the difficulty in tracing the relationship between macro prudential and cross-border financial claims, the authors argued that there are still "unknowns" on how regulators should reinforce market governance and policy formulation.

Meanwhile, using sets of comprehensive database of domestic macro prudential policies and capital flow management measures across 12 Asia Pacific economies, Bruno et al (2015) found that banking sector and bond market capital flow management policies are effective in slowing down banking and bond inflows, respectively.[14] Moreover, Bruno et al (2015) showed that capital flow measures and domestic macro prudential policy can have diverse impacts across countries with varying capital controls. Meanwhile, Magud et al (2012) revealed that bank credit in foreign currency expands more rapidly for economies with less flexible exchange rate regime.

Relatedly, using a set of indexes of macro prudential policies in 57 advanced and emerging market economies from the first quarter of 2000 to the fourth quarter of 2013, Akinci and Olmstead-Rumsey (2015) documented how these indexes are correlated with other policy measures, such as monetary and capital flow management policies.[15] Moreover, using a panel data model, they found that macro prudential policies are usually implemented along with bank reserve requirements, capital flow measures, and monetary policy to curb excessive credit growth. In particular, they found that in the case of emerging market economies, macro prudential policies and capital inflow restrictions (except portfolio flows) targeting the banking sector are effective in curbing credit growth. Further, their counterfactual exercise showed that these measures are useful in addressing house price inflation.

This survey so far emphasizes that the effectiveness of both restrictions on capital inflows and domestic macro prudential policy remains mixed and depends largely on specific objectives. The LTV and DSTI/Debt-to-Income (DTI) ratio tend to have the strongest effect in dampening risks on the property market and safeguarding bank asset quality. Empirical studies indicate that banks with higher share of wholesale funding and less capitalized are affected more by changes in macroprudential policy. Moreover, tools that enhance resiliency have stronger effects on reducing bank risks than tools that focus on mitigating financial boom and bust cycles.

However, the transmission mechanism of macroprudential policy is relatively complex and therefore subject to considerable uncertainty (IMF 2013).[16] While it is possible to trace the

[14] Moreover, Bruno et al (2015) showed some evidence of spillover effects of these policies.

[15] Bruno et al (2015) also showed correlations among monetary policy, macro prudential policy and capital flow measures.

[16] International Monetary Fund (IMF, 2013). Key Aspects of Macroprudential Policy. 10 June 2013.

channels of transmission of macroprudential tools conceptually, the strength of these effects is still uncertain and limited (Cerutti 2015). Moreover, the strength of the different channels – credit cycle, resilience, output, expectations – is expected to differ based on the specific macro prudential tool used (BIS 2012).[17] Uncertainties about the transmission channels may not only create difficulties in assessing the effectiveness of a particular macro prudential instrument, they also create the potential for unintended consequences.

Importantly, most of the studies highlight the relative impact of such measures on macroeconomic indicators such as bank and housing credit, but less so on house prices. There are perceived challenges in measuring effectiveness as cyclical CFMs are typically part of a broader package of policies, all of which can affect the specified objectives. In Asia, Packer (2012) noted that, in general, macro prudential policy has primarily relied on the discretionary use of prudential tools rather than on a clearly articulated framework, although discussions in recent years have focused on the implementation of more rule-based macro prudential policy.

All the above findings point to implications for monetary policy implementation. In past few studies, there seems to be no clear pattern regarding the effective use of macro prudential policy and monetary policy in addressing excessive bank and house prices in EMEs. The results of empirical studies argued that while monetary policy should not be the principal tool to address financial stability issues and particularly property market bubbles, many suggested that it should not be taken out menu of policy options for the sake of focusing on inflation targeting either. Studies have underscored that what may be needed is an enhanced understanding of the effectiveness of non-monetary policies, and in particular macro prudential policies, in combination with monetary policy.[18]

In recent past years, Kuttner and Shim (2013) have investigated the effectiveness of nine non-interest rate policy tools, including macroprudential measures, in stabilizing house prices and housing credit, using data from 57 countries spanning more than three decades. Their results showed that using conventional panel regressions, housing credit growth has been significantly affected by changes in the maximum DSTI ratio, the maximum LTV ratio, limits on exposure to the housing sector and housing-related taxes. However, only the DSTI ratio limit has a significant effect on housing credit growth when they used mean group and panel event study methods. Among the policies considered, a change in housing-related taxes is the only policy tool with a discernible impact on house price appreciation. Moreover, Kuttner and Shim (2013) and Bruno et al (2015) showed that macro prudential policies are more successful when they complement monetary policy by reinforcing monetary tightening, than when they act in opposite directions.

[17] Committee on the Global Financial System (CGFS, 2012). Operationalizing the selection and application of macroprudential instruments. BIS, CGFS Papers No. 48, December 2012.

[18] See Packer (2011).

Meanwhile, an important aspect of monetary policy implementation, particularly when surges in capital flows followed the GFC, has been the strategy of central banks to participate in the foreign exchange (FX) markets. Between end-December 2004 and end-December 2015, the foreign exchange reserves of nine emerging Asian economies rose from US$1.5 trillion to US$5.4 trillion.[19] Since end-December 2013, these economies' reported foreign exchange reserves have declined by US$430 billion. Nevertheless, relative to nominal GDP, average FX reserves rose from 55.1% in end-December 2004 to 63.3% in end-December 2015. Another component of monetary policy implementation has been the approach of many Asian economies to use varying methods of sterilization to absorb the liquidity created by FX intervention, thus maintaining monetary independence (Kuttner and Yetman 2016). There were also cases where FX interventions have been complemented by a more active use of other instruments to manage capital flows, such as the use of reserve requirements and the more traditional capital controls.[20]

Indeed, the impact of external shocks on macro prudential policies through the exchange rate and interest rate on local currency bonds has been widely discussed in the literature. Turner (2015) stressed that these two prices are key endogenous variables in the transmission of external shocks (financial and real) to small open economies and that in the end the analysis of macroprudential policies need to have a convincing narrative for both variables.

This study focuses on the effectiveness of imposing tightening capital inflow restrictions and domestic macro prudential policy to overall bank credit, housing credit and house prices from the first quarter of 2004 to the fourth quarter of 2015 using dynamic panel GMM.

This study has four possible contributions to literature. First, it documents the new cyclical CFMs and episodes of sterilization of capital inflows and updates previous macro prudential measures on housing markets adopted by nine EMEs in Asia by Shim et al (2013). There are good reasons why the study uses a sample of countries in Asia with varying financial openness and with different monetary policy setting. Many studies have observed that following the lessons during the 1997-1998 Asian Financial Crisis, Asian central banks have the experience in implementing macro prudential policy.[21] Another reason is that most central banks in emerging Asia continue to be responsible for banking supervision; hence, are required to maintain stability of the financial system using macro prudential and supervisory tools.

Second, it develops new sets of database for cyclical CFMs covering tightening controls on capital transactions and some measures specific to financial sector and episodes of sterilization of capital inflows from 2004 to 2015 and updates the domestic macro prudential policy targeting the housing market based on Shim et al (2013) to include measures from 2013 to 2015.

[19] Data based on Haver Analytics.

[20] BIS (2016), "Foreign exchange market intervention: what has changed?", A note for the meeting of Governors on 9 May 2016, Basel, Switzerland.

[21] For instance, see Packer (2012).

Third, the study uses these sets of database to examine the effectiveness of tightening capital flows and domestic macro prudential policies in restraining movements in real domestic bank credit growth, real housing credit growth and real house prices. The importance of monetary policy reaction to address bank and housing credit as well as house prices is then examined, alongside CFMs and domestic macro prudential policies. To the best of my knowledge, a study that examines joint efficacy of tightening CFMs and domestic macro prudential policy in addressing domestic credit, housing credit and house prices such as this has not been published.

To a large extent such an approach is based on McDonald's (2015) and Kuttner and Shim's (2013) findings that the effects of loosening policy measures have been insignificant. It may also be instructive to consider aspects of cyclical CFMs such as loosening of controls on capital inflows and that of capital outflows and bank-level data such as total assets, leverage ratio (Bruno et al 2015; Beirne and Friedrich 2015). Hence, this study does not provide a full cost-benefit analysis of the policy. As argued by Forbes (2003; 2007), among others, it is highly likely that this type of controls has important microeconomic costs. Moreover, a complete policy evaluation of the controls would consider both macro and micro economic aspects. A future research may address such a task.

3. Data and Empirical Methodology

3.1 Baseline data

Database for tightening restrictions on capital inflows. A contribution of this study is the construction of a new database for restrictions on capital inflows by type of instrument. Table 1 shows the types of restrictions by instrument as well as the years when these were imposed. An important assumption is that the build-up of risks may also originate from cross-border transactions or borrowings. To obtain information on restrictions on capital inflows, this study used the IMF's Annual Report on Exchange Rate Arrangements and Exchange Restrictions (AREAER), supplemented with information from the central banks' Annual Reports and studies, International Monetary Fund's (IMF) country papers, and partly cross-checked against Chantapacdepong and Shim (2014) database on capital flow measures.

By definition, non-residents are typically the subject of capital controls. In this respect, measures specific to the financial sector that discriminate based on residency (such as, restrictions on lending to or borrowing from non-residents) could be considered as financial sector-specific capital controls (Ghosh et al 2014). The base data includes 606 controls on inflows and outflows from 2004 to 2015 across nine Asian emerging economies. These measures include capital controls disaggregated by instrument (or, asset class), such as direct investments, capital and money market instruments, derivatives and other instruments, credit operations, real estate transactions and personal capital transactions, excluding measures related to repatriation

Table 1: Number and Years of Capital Inflows Restrictions, By Instrument and By Country, 2004-2015 [1/]

Instrument/ Country	Total Number	Capital and Money Market Instruments	Derivatives and Other Instruments	Credit Operations	Real Estate Transactions	Direct Investments	Personal Capital Transactions
Total Number of Restrictions	**232**	**72**	**39**	**71**	**11**	**32**	**7**
China							
Number of Restrictions	**30**	**16**	**1**	**3**	**2**	**8**	**0**
Years		2007,2009,2010,2011, 2013 (Q1-Q4), 2014,	2008	2008, 2014 (Q2-Q4)	2006, 2014	2004, 2008,2011, 2014 (Q1-Q3),	
Hong Kong, SAR							
Number of Restrictions	**5**	**0**	**3**	**0**	**2**	**0**	**0**
Years			2006, 2007 (Q1-Q4), 2008		2012, 2014		
India							
Number of Restrictions	**104**	**26**	**14**	**46**	**2**	**11**	**5**
Years		2007, 2007 (Q1-Q4), 2008 (Q2-Q4), 2009,	2008 (Q3-Q4), 2010, 2011, 2014 (Q1-Q3),	2004, 2007 (Q1-Q3),2008, 2009 (Q1-Q2), 2010 (Q1-Q3), 2011 (Q3-Q4), 2012 (Q1-Q4), 2013 (Q1-Q4), 2014 (Q1-Q4)	2004, 2006	2004 (Q1-Q4), 2006, 2007, 2011,	2006, 2007,2011,2014
Indonesia							
Number of Restrictions	**11**	**7**	**4**	**0**	**0**	**0**	**0**
Years		2010,02011, 2012, 2013 (Q1-Q3), 2014	2005, 2007, 2014				
Korea							
Number of Restrictions	**13**	**0**	**6**	**1**	**0**	**5**	**1**
Years			2005, 2010 (Q1-Q3), 2011, 2013	2006		2005,2006, 2007	2012
Malaysia							
Number of Restrictions	**43**	**11**	**8**	**17**	**2**	**4**	**1**
Years		2004, 2006, 2007, 2009 (Q1-Q3), 2013	008, 2010, 2012, 201	2004, 2007, 2008, 2010, 2011, 2013	2007, 2012	07, 2009, 2012, 201	2008
Philippines							
Number of Restrictions	**5**	**1**	**1**	**0**	**0**	**3**	**0**
Years		2015	2014			2011, 2012	
Singapore							
Number of Restrictions	**3**	**0**	**0**	**0**	**3**	**0**	**0**
Years					2005, 2011, 2013		
Thailand							
Number of Restrictions	**18**	**11**	**2**	**4**	**0**	**1**	**0**
Years		2006 (Q2-Q4), 2007, 2008, 2013, 2014	2006, 2008	2006, 2007, 2008		2013	

[1/] Capital inflow controls include loosening and tightening controls.

Sources of basic data: International Monetary Fund (Various Years), Annual Report on Exchange Rate Arrangements and Exchange Restrictions, central bank Annual Reports.

and surrender requirements.[22] There are some adjustments following pockets of double counting.[23] This study used the 232 restrictions on capital inflows classified largely as cross-

[22] There are measures specific to the financial sector particularly those related to non-resident transactions. In 2012, the IMF adopted the terminology of capital flow management measures (CFMs) for capital controls and prudential

border bank flows. Table 1 shows that from 2004 to 2015, 28.9% are restrictions on credit operations, followed by capital and money market instruments at 26.3%, and by derivatives and other instruments at 15.9%. By country, India adopted the most number of controls on capital inflows at 44.8%, followed by Malaysia at 18.5%, and China at 12.9%.

From 232 controls on capital inflows, 84 tightening restrictions on capital inflows have been identified, or 36.2% of total controls on capital inflows.[24] The remaining 148 measures or 63.8% of total controls on inflows are loosening restrictions on capital inflows. Table 1 shows that there were instances when cyclical capital inflows were imposed twice a year, such as those of Thailand, Malaysia, India and China. From the main instrument (asset) categories in Table 1, capital and money market instruments, credit operations and real estate transactions are included.[25]

However, not all measures in such categories are included in the final list of tightening controls on capital inflows. The list refers to those instruments perceived to affect the overall credit and housing credit as well as property prices. There is indeed judgment in identifying tightening controls under such categories. Some examples of these measures include restrictions on local and foreign lending (non-resident lending, including lending to property sector), taxes on capital inflows (including real estate transactions), reserve requirements on capital inflows (e.g., unremunerated reserve requirements) such as in Thailand, minimum holding period for capital inflows, and stamp duties on real estate purchases by non-residents.

Measure of tightening controls on capital inflows (CCFI). In empirical studies, there are few ways that can be used to measure capital controls. Some studies used a binary variable indicating the existence of a specific measure, a combination of a few binary variables, a number of regulation changes, tax equivalent intensity. Some indices represent de jure controls, that is, the presence of controls in domestic laws and regulations. In this study, binary variables, with a value of one indicating the presence of a restriction (and zero otherwise), are used to mean tightening CFMs. That is, for each measure, a dummy variable is assigned to a value of positive one (1) if the measure tightened capital inflow restrictions and, 0 if no action or a loosening measure was taken in a given month. To match the frequency of the dependent variables in the baseline model, the quarterly average of these measures is used.

Measures of domestic policy actions. There are two components of this database. The first component is an update of the Shim et al (2013) database for policy actions on housing markets which is collectively called in this study as domestic macro prudential policies (or

measures designed to limit capital flows. Meanwhile, Ghost et al (2014) collectively referred to measures (both capital controls and prudential) that are likely to affect cross-border capital transactions as capital account restrictions (CARs).

[23] For instance, there was double counting in controls reported specific to financial sector and institutional investors and in controls in real estate transactions.

[24] In the database, the Philippines did not impose cyclical capital inflow measures from 2004 to 2015.

[25] Direct investments, equity flows, derivatives and other instruments and personal capital transactions are excluded.

DMAPAD). *DMAPAD* includes actions that ultimately restrict the build-up of financial imbalances in housing credit and house prices.[26] Basically, *DMAPAD* is an index of the sum of changes in LTV, DSTI, bank exposure to housing loans, other lending criteria (such as, risk weights applied to mortgage loans, mortgage servicing ratio, loan prohibition, supervisory actions affecting bank exposure to property sector) or administrative measures (real property gains tax, insurance coverage for residential properties) and bank reserve requirements on domestic currency deposits (including cash reserve ratio, liquidity reserve ratio, statutory reserve requirement ratio) imposed by nine central banks. Similar to *CCFI*, for each measure, a dummy variable is assigned to a value of positive one (1) if the measure tightened the existing measure and, 0 otherwise. These measures are computed as quarterly average to match the frequency of the dependent variables in the model.

The second component is called the Central Bank Official Rate Index *(CBRI)*. Basically, *CBRI* is an index of tightening policy actions by nine central banks combined with either one of the measures of domestic macro prudential policy (either an increase in reserve requirements or restriction in housing market measures) using a one year window. A variation of CBRI excludes the increase in reserve requirements from domestic macro prudential policy *(CBRIw)*. Following the approach by Kuttner and Shim (2013) and McDonald (2015), the one year window (or, four-quarter effect) is used to account for lag effects in the implementation of tightening monetary policy stance and domestic macro prudential policy. Similar to *CCFI* and *DMAPAD*, for each of the central bank official policy rate, a dummy variable is assigned to a value of positive one (1) if tight monetary policy (hike in policy rate) is accompanied by either a rise in reserve requirements or any tight policy action in housing market; or, 0 otherwise. Meanwhile, using *CBRIw,* for each of the central bank official policy rate, a dummy variable is assigned to a value of positive one (1) if tight monetary policy (hike in policy rate) is accompanied by any tight policy action in housing market and, 0 otherwise.

In the study, there were 203 domestic tightening episodes recorded in nine countries from the first quarter of 2004 to the fourth quarter of 2015, mainly in the form of hikes in central banks' policy rates. Actions in the housing markets and increases in banks' reserve requirements against deposits accompanied such increases in central banks' policy rates.

Moreover, Table 2 shows that actions on the housing markets have intensified post-GFC following the widening of policy actions on top of LTV and DSTI measures to include other lending criteria, administrative measures and prudential measures. Among the nine countries, China showed the highest number of tightening measures on the housing market at 11 measures. These include changes in LTV for housing loans, DSTI for borrowers to purchase homes, risk weights for residential housing loans, rules to tighten the use of personal loans for

[26] In many studies, there are at least two inter-related reasons for using macro prudential policies. One reason is to create a buffer so that banks do not suffer significant losses during downturns, and the other reason is to restrict the build-up of financial imbalances such as excessive credit growth and housing price inflation and thereby reduce the large correction in financial imbalances.

speculation on property markets and lending criteria in selecting potential new house purchases. Following closely are Singapore, Korea and Malaysia. By contrast, the Philippines and Indonesia showed the least number of tightening actions on the housing market. For instance, in the case of the Philippines, the measures largely included prudential regulations on banks, such as changes in regulatory limit on banks' real estate loans (including residential loans), reporting guidelines of banks' real estate exposure, and the introduction of real estate stress test limit for universal, commercial and thrift banks.

Across these nine countries, India recorded the highest number of tightening episodes at 42, followed by China, Singapore, Korea and Malaysia. By contrast, the Philippines and Hong Kong showed the least number of tightening episodes at 17 and 12, respectively.

Table 2: Tightening Episodes Across Nine Asia Emerging Market Economies [1/]
(First Quarter 2004-Fourth Quarter 2015)

Policy Actions / Period	Increase in Bank Reserve Requirements [2/] (1)	Actions on Housing Markets [3/] (2)	Increase in Central Bank Policy Rates (3)	Domestic Policy Actions (DMAPAD) (4=1+2+3)
Full sample (Q1 2004-Q4 2015)	43	60	104	207
Pre-GFC (Q1 2004-Q4 2007)	18	16	51	85
Post-GFC (Q1 2008-Q4 2015)	25	44	53	122

[1/] Includes China, Hong Kong, India, Indonesia, Korea, Malaysia, the Philippines, Singapore, and Thailand.
[2/] Includes increase in cash reserve ratio, liquidity reserve ratio, statutory reserve ratio.
[3/] Include actions related to LTV, DSTI, bank loan exposure, other lending criteria, administrative measures and in some jurisdictions, prudential regulations.
Sources of data: Shim et al (2013) from 2004 to 2012; Author's Updates from 2013 to 2015.

Database on sterilization episodes. A separate index for episodes of sterilization of capital inflows *(STER)* for the nine Asian emerging market economies was constructed. *STER* captures the extent of sterilization measures, including liquidity management tools to mop up the additional liquidity resulting from foreign exchange intervention of the nine Asian emerging market economies.

In this study, the balance sheets of central banks available in the IMF International Financial Statistics (IFS) are used. Quarterly positive changes of net foreign asset accumulation by the central banks (claims on non-residents) correspond to foreign reserve inflows. Quarterly negative changes of net domestic assets correspond to reductions in domestic assets held by the monetary authorities typically due to increases in open market operations or liquidity management tools. Another indicator of sterilization is the increase in claims on Central Government – liabilities that correspond to the use of central banks' holdings of central government Treasury securities (including bonds) to mop up liquidity in the system. However, in the absence of more precise data on the magnitude of sterilization, the index only captures the

episodes where an increase in net foreign reserves is accompanied by either an increase in claims on Central Government or a decline in net domestic claims or both and, in turn assigned a value of one, and 0 otherwise.

In the study, there were 199 sterilization episodes observed in nine countries from the first quarter of 2004 to the fourth quarter of 2015. Excluding the crisis years (2008-2009), there were 167 sterilization episodes. Moreover, Table 3 shows that sterilization actions have intensified post-GFC, with and without the crisis years. Across these nine countries, India recorded the fewest episodes of sterilization at 13 quarters, followed by Hong Kong, Singapore, Indonesia, South Korea and the Philippines. By contrast, China and Thailand showed the highest sterilization episodes.

Table 3: Sterilization Episodes Across Nine Asia Emerging Market Economies (First Quarter 2004-Fourth Quarter 2015)

Indicator	2004-2015 (Full sample)	2004-2007 (Pre-GFC)	2008-2015 (Post-GFC)	2010-2015 (Post-GFC, excluding crisis years, 2008-2009
Episodes of sterilization, with crisis years, 2008-2009	199	81	118	
(Share in total episodes of sterilization)	(100.0%)	(40.7%)	(59.3%)	
Episodes of sterilization, without crisis years, 2008-2009	167	81		86
(Share in total episodes of sterilization)	(100.0%)	(48.5%)		(51.5%)

Sources of data: IMF-International Financial Statistics; Author's

Selected macro and financial indicators. In some countries in the study[27], overall domestic bank credit to non-financial sector has been a bigger concern than housing credit and house prices, hence, the inclusion of bank credit to non-financial sector in this study. Data on nominal and real bank credit to non-financial sector are obtained from the BIS credit series, except for the Philippines, which are taken from the IMF-International Financial Statistics (IFS). Data on nominal and real housing credit are taken from the CEIC Database, except for Hong Kong, Indonesia and Singapore, which are taken from the BIS database. Meanwhile, nominal and real house prices are obtained from the BIS residential housing price series, CEIC database and Datastream.[28]

[27] Such as the Philippines, Indonesia.

[28] For Hong Kong, Korea, Malaysia, Indonesia based on the BIS Residential Prices Database. For India, average of 15 cities (Datastream) and backdated with Mumbai (CEIC). For Singapore, All Residential Property Price Index (2009Q1 = 100, Datastream. For the Philippines, gross value added deflator for ownership of dwelling and real estate based on national income accounts (CEIC). For Thailand, Housing Price Index: average of single detached house and town house, including land. For China, Property Price Index (Secondary Mkt: Residential), average of 70 cities.

Following Blank and Buch (2010), Herrmann and Mihaljek (2010), Bruno and Shin (2013), selected macro and financial variables used in the study include real GDP, real GDP growth, real GDP per capita, real GDP per capita growth (to proxy for the economic size and level of economic development), inflation, real bank lending rate, current account balance, expressed in percent of GDP (to reflect the external financing requirement), real effective exchange rate (to reflect asset prices), equity prices (to reflect asset prices), VIX (to indicate risk aversion of global investors), cross-border flows (loans and deposits, to represent capital flows) reported by banking offices located in the BIS-reporting area and population. Data are taken from the BIS database, Haver Analytics, CEIC, Datastream, and central bank websites.

3.2 Empirical Methodology

Baseline model. Changes in real bank credit to non-financial sector, real housing credit extended by banks and real house prices (residential property prices) are estimated to capture the economic variables and policies (capital flow measures, domestic macro prudential limits) that have caused shifts in their behavior from March 2004 to December 2015. In most estimations, the approach by Kuttner and Shim (2013) or the four-quarter effect is used to account for lag effects in the implementation of cyclical capital flows and domestic macro prudential policy. A positive sign for the lag effect implies tightening of capital inflow restrictions and domestic macro prudential measures leads to growth in real bank credit to non-financial sector, real housing credit and house prices, whereas a negative sign reduces the growth of the three indicators.

The general specification for real bank credit to non-financial sector and real housing credit in equation (2) below is based on previous empirical works, such as Bruno et al (2015).

$$Y = Log\ (RCRE_j)\ or\ Log\ (RHOU_j) \quad \textbf{(1)}$$

$$Y = \alpha_j + \beta(Z_j) + \pi(CCFI_j) + \gamma\ (CCFI_j\ X\ BTCLAIMS_j) + \mu(DMAPAD_j) + \varepsilon_j\ (residual), \quad \textbf{(2)}$$

where, *RCRE* = real bank credit to non-financial, outstanding, end-quarter
RHOU = real housing credit by banks, outstanding, end-quarter
Z[29] = macro and financial variables (real domestic deposit, real GDP per capita, real bank lending rates, real effective exchange rate, VIX [30])
BTCLAIMS = cross-border flows (loans and deposits)
CCFI = tightening capital inflow measures
DMAPAD = domestic macro prudential measures

[29] These variables include other factors that could influence real bank credit to non-financial sector and real housing credit.
[30] Refers to implied volatility of S&P 500 index options.

Meanwhile, studies on aggregate house price movements have emphasized demographics (such as population), income trends, and government policy on housing as fundamental drivers of real house prices. Moreover, house price movements in some studies have been associated with a common set of macroeconomic variables, market specific conditions, and housing finance characteristics. These indicators include economic growth, inflation, interest rates, bank lending, and equity prices. In addition to equity prices, Glindro et al (2011) noted that house prices tend to co-move with other asset prices, such as exchange rates. In particular, a real effective exchange rate appreciation exerted positive influence on property market prices, particularly in markets where there is substantial demand from non-residents for investment purposes, such as in Asia. In this study, equation 3 shows the general specification of real house prices as,

$$Log\ (RRRP) = \alpha_j + \beta(Z_j) + k(Dem) + \pi(CCFI_j) + \gamma\ (CCFI_j\ X\ BTCLAIMS_j) + \mu(DMAPAD_j) + \varepsilon_j\ (residual), \quad \textbf{(3)}$$

where, *RRRP* = real house (residential) price, average, quarterly
Z = macro variables (inflation, real GDP per capita, real lending rate, outstanding real housing credit, equity prices, real effective exchange rate)
Dem = demographics (population)
CCFI = tightening capital inflow measures
BTCLAIMS = cross-border flows (loans and deposits)
DMAPAD = domestic macro prudential measures

Measures of effectiveness of CCFI, DMAPAD and CBRI. In equations (2) and (3), *CCFI and DMAPAD* are indicator variables that measure the direct effect of the *CCFI* and *DMAPAD* on both overall and housing credit and house prices. A core element of these equations is the interaction term of *CCFI* with cross-border flows whose impact on bank credit to non-financial sector, housing credit and house prices as seen in coefficient *γ*. This coefficient ultimately indicates the impact of *CCFI* on cross-border flows, and on the overall credit to non-financial sector, housing credit and house prices.

Meanwhile, to assess the relevance of monetary policy reaction in controlling the overall credit, housing credit and house prices when tightening capital inflow measures and domestic macro prudential policy are in place, the parameters in equation 5 below are estimated using dynamic panel GMM. The focus in equation 5 is *CBRI* measured by coefficient Ʊ.

$$Y = Log\ (RCRE_j)\ or\ Log\ (RHOU_j)\ or\ Log\ (RRRP_j) \quad \textbf{(4)}$$

$$Y = \alpha_j + \beta(Z_j) + k(Dem_j) + \text{Ʊ}(CBRI_j) + \varepsilon_j(residual), \quad \textbf{(5)}$$

where, *CBRI* = Central Bank Official Rate Index

Moreover, it is equally important to differentiate the policy effects from the natural correction or the turning of the cycle. Defined in equation 6 below as the deviation of actual from the HP-filtered trend (long-run trend), the impact of the cycle is estimated on the movements of real bank credit to non-financial sector, real housing credit and real house prices.

$$Y = \alpha_j + \beta(Z_j) + k(Cycle_{RCRE}) + \phi(Cycle_{RHOU}) + \gamma(Cycle_{RRRP}) + \varepsilon_j\,(residual), \qquad \textbf{(6)}$$

where,

RCRE = real bank credit to non-financial sector
RHOU = real housing credit
RRRP = real house price, average, quarterly
Z = macro variables (inflation, real GDP per capita, real lending rate, housing credit, equity prices, real effective exchange rate, demographics)
Cycle = % deviation from HP-filtered trend *(RCRE, RHOU, RRRP)*

To check the robustness of the results, year-on-year growth of real bank credit and real bank credit relative to real GDP as dependent variables are also used. The focus is on coefficients of the cycle K, ϕ and γ which are expected to be negative.

Estimation method. To date, there is no generally accepted framework for analyzing the effectiveness of controls on cyclical capital inflows. It is well known that attempts to measure effectiveness often encounter simultaneity bias, that is, capital controls are usually tightened when capital inflows surge, creating an endogeneity problem. Many studies explored the use of instrumental variables and VAR with a variable ordering assumption to address such a problem. Moreover, the results are sensitive to the details of model specification, notably the choice of control or instrument variables.

In this study, the parameters in the model are estimated using dynamic panel GMM as introduced by Arellano and Bover (1995) and Blundell and Bond (1998). Formal panel data tests of serial correlation do not indicate the presence of first and second serial correlation in the error terms (Arellano-Bond Serial Correlation Test). To handle cross-section fixed effects, first difference (orthogonal deviation in some estimations) or a transformation method for eliminating the effects from the specification (as in Arellano and Bover, 1995) was used. All estimated coefficients are significant, based on 5% and 10% levels of significance. Meanwhile, standard errors of regression are robust at 5% and 10% levels of significance.

3.3. Robustness checks

Diagnostic tests are used to check cointegration of variables in the three baseline models. Table 4 shows that results of the Kao residual cointegration test reject the null

hypothesis of no cointegration across three panel groups (log RCRE, log RHOU, and log RRRP) at 5% level of significance. Moreover, the ADF Test Equation of residuals showed that the coefficient is not zero and negative. This means that the dependent variable (D(RESID) and lagged dependent variable do not have a relationship and that any shock will not be permanent.

By contrast, in growth terms, the results are mixed. The Kao residual cointegration test results accept the null hypothesis of no cointegration across three panel groups (Dlog RCREG, Dlog RHOUG, and Dlog RRRPG) at 5% to 10% levels of significance. Another test was used to validate the results from using Kao residual cointegration test. Using Johansen Fisher panel cointegration test, the results show that at most eight cointegrating relationships are found out of 11. However, the ADF Test Equation of residuals show that the coefficient is not zero and negative. This means that the dependent variable (D(RESID) and lagged dependent variable do not have a relationship.

Table 4: Results: Kao Panel Cointegration and Stationarity Test of Residuals
Nine Asia Emerging Market Economies, First Quarter 2004-Fourth Quarter 2015

In level terms	**Panel Log(RCRE)**	**Panel Log (RHOU)**	**Panel Log(RRRP)**
ADF statistic [1/]	-5.217 (*t-stat*)	-5.025 (*t-stat*)	-2.149 (*t-stat*)
(Probability)	(0.000)	(0.000)	(0.012)
ADF Test Equation: D(RESID)[2/]			
RESID (-1) (Coefficient)	-0.270	-2.406	-0.134
(Probability)	(0.000)	(0.000)	(0.000)
In growth terms	**Panel DLog (RCREG)**	**Panel DLog (RHOUG)**	**Panel DLog(RRRPG)**
ADF statistic [1/]	-0.377 (*t-stat*)	-0.405 (*t-stat*)	-0.334 (*t-stat*)
(Probability)	(-0.135)	(-0.116)	(0.112)
ADF Test Equation: D(RESID)[2/]			
RESID (-1) (Coefficient)	-1.006 (*t-stat*)	-1.011 (*t-stat*)	-1.013 (*t-stat*)
(Probability)	(0.000)	(0.000)	(0.000)

[1/] Null Hypothesis: No cointegration; Trend assumption: No deterministic trend.
[2/] Null Hypothesis: Coefficient is zero, that is, the residual of dependent variable and lagged dependent variable have a relationship (or, have unit root).
Source: Author's.

Meanwhile, the results are broadly robust against different specifications of instrument variables and the dependent variables (such as in stock, percent deviation from trend using Hodrick-Prescott filter, rather than in flow terms).

4. Results

Table 5 (Technical Appendix A provides the list of variables used) shows the baseline results. Using these results, five insights can be highlighted.

First, after controlling for episodes of sterilization of capital inflows, tightening capital inflow measures and domestic macro prudential policy are effective in limiting movements in overall bank and housing credit and house prices across nine Asian emerging market economies. Results in Models (1), (5) and (9) show that restricting capital inflow measures imposed on cross-border loans and deposits have negative impact on real bank credit to non-financial sector, real housing credit and real house (residential) prices from 2004 to 2015. To some extent, this finding confirms other studies' observation that narrowly-defined capital flows are more likely to find effectiveness.[31] Meanwhile, domestic macro prudential policy is equally effective in addressing broad bank and housing credit and house prices across countries. Results in Models (2), (6), and (10) show the direct negative impact of domestic macro prudential policy on real bank credit to non-financial sector, real housing credit and real housing prices from 2004 to 2015. These results are found in the presence of sterilization episodes, especially for real bank credit to non-financial sector and real housing credit (Models 13 and 15).

Table 5: Baseline Results (First Quarter 2004-Fourth Quarter 2015)

	Dependent Variables			
Independent Variables	**Log (RCRE) (1)**	**Log (RCRE) (2)**	**Log (RCRE) (3)**	**Log (RCRE) (4)**
(Log) RBER	0.588 *, a/	0.197 *,b/	0.169 *,b/	0.123 *,b/
(Log) RDEP	0.574 *.a/	0.140 *,b/		0.151 *,b/
(Log) CAP			0.194 *,b/	
CCFI	-0.034 *,b/			
CCFI*BTCLAIMS	-0.001 **/			
DMAPAD		-0.041 *, a/	-0.069 *,a/	
CBRIa				-0.085 */
Instrument Variables	Constant, Lagged RCRE, Lagged RBER, Lagged RDEP, LR-INF, VIX, CAP	Constant, Lagged RCRE, Lagged RBER, Lagged RDEP, LR-INF, VIX, CAP	Constant, Lagged RCRE, Lagged RBER, Lagged CAP, LR-INF, VIX, CAP	Constant, Lagged RCRE, Lagged RBER, Lagged RDEP, LR-INF, VIX, CAP
Standard error of regression	0.056	0.033	0.097	0.041
	Log (RHOU) (5)	**Log (RHOU) (6)**	**Log (RHOU) (7)**	**Log (RHOU) (8)**
(Log) RBER	0.216 *, a/	0.187 **/		0.123 *,b/
(Log) CAP			0.120 **/	
(Log) RDEP	0.884 *.a/	0.973 **,b/	0.988 **, a/	0.852 **,b/
CCFI	-0.011 *,a/			
CCFI*BTCLAIMS	-0.003 *,a/			
DMAPAD		-0.010 **, b/	0.126 **, a/	
CBRIa				-0.086 **/
Instrument Variables	Constant, Lagged RHOU, Lagged RRRP, Lagged RBER, lagged RDEP, LR-	Constant, Lagged RHOU, Lagged RBER, Lagged RDEP, LR-INF, VIX, CAP,	Constant, lagged RHOU, Lagged RDEP, Lagged RRRP, Lagged RBER, VIX,	Constant, Lagged RHOU, Lagged RDEP, Lagged RRRP,

[31] See De Gregorio et al (2000).

	INF, VIX	BTCLAIMS	BTCLAIMS, LR-INF	Lagged RBER, VIX, BTCLAIMS, LR-INF
Standard error of regression	0.076	0.091	0.094	0.059
	Log (RRRP) (9)	**Log (RRRP) (10)**	**Log (RRRP) (11)**	**Log (RRRP) (12)**
(Log) RBER	0.182 *,b/	0.777 **/	0.157 *,a/	0.155 **, b/
(Log) CAP	0.269 */	0..411 */		0.273 **/
INF	-0.006 */			-0.022 */
(Log) RDEP			0.260 */	
CCFI	-0.003 **,a/			
CCFI*BTCLAIMS	-0.001 **,a/			
DMAPAD		-0.005 **, b/	0.049 *,a/	
CBRIa				-0.069 **/
Instrument Variables	Constant, Lagged RRRP, Lagged RBER, CAP, POP, INF	Constant, Lagged RRRP, Lagged CAP, Lagged RBER, Lagged INF	Constant, Lagged RRRP, Lagged CAP, Lagged RBER, Lagged INF	Constant, Lagged RRRP, Lagged RBER, Lagged POP, Lagged CAP, Lagged INF
Standard error of regression	0.058	0.052	0.052	0.050
	Log (RCRE) (13)	**Log (RCRE) (14)**	**Log (RHOU) (15)**	**Log (RHOU) (16)**
(Log) RBER	0.592 a/	0.601 a/	0.166 */	0.258 **/
(Log) RBER * STER		-0.006 ***/		0.015 ***/
(Log) RDEP	0.622 a/	0.620 a/	0.903 */	1.128 *,b/
CCFI	-0.005 *, b/	-0.009 *, b/	-0.010 */	-0.006 ***/
CCFI*BTCLAIMS	-0.008 *, b/	-0.004 *, b/	-0.003 *,b/	-0.004 *,b/
Instrument Variables	Constant, Lagged RCRE, Lagged RBER, ***STER***, Lagged RDEP, LR-INF, VIX, CAP	Constant, Lagged RCRE, Lagged RBER, Lagged RDEP, LR-INF, VIX, CAP	Constant, Lagged RHOU, Lagged RRRP, Lagged RBER, ***STER***, lagged RDEP, LR-INF, VIX	Constant, Lagged RHOU, Lagged RRRP, Lagged RBER, lagged RDEP, LR-INF, VIX
Standard error of regression	0.060	0.078	0.077	0.108

/ Significant at 5% level **/ Significant at 10% level */ Not significant a/ With 1 quarter lag b/ With 2 quarters lag*
Source of data: Author's.

Moreover, results in Models 25 to 27 in Technical Appendix B show that when year-on-year growth rates of real bank credit to non-financial sector, real housing credit and real house prices are used from 2004 to 2015, the impact of imposing capital inflow measures as well as domestic macro prudential policy are likewise significant. In a similar manner, the results are equally robust using alternative estimation such as Panel Least Squares. However, results of diagnostic and residual tests and standard error of regression are not consistently robust particularly for real housing credit.

Importantly, using a dynamic panel GMM, the impact of cyclical components on movements in real bank credit, real housing credit and real house prices are negative (Table 6), implying that the effects of tightening policy measures are effective as these effects can be differentiated from the cycles. The results are robust using year-on-year growth of real housing

credit and real house prices and using share in real GDP for real bank credit and real housing credit and against alternative estimation method such as the Ordinary Least Squares.

Table 6: Average Impact of Cycles on Real Bank Credit to Non-Financial Sector *(RCRE)*, Real Housing Credit *(RHOU)* and Real House Prices *(RRRP)* Using Four-Quarter Window
Nine Asia Emerging Market Economies, First Quarter 2004-Fourth Quarter 2015

In level terms	**Log(RCRE)**	**Log (RHOU)**	**Log(RRRP)**
Cycle (% Deviation from HP-filtered trend)	-0.020	-0.010	-0.039
In growth terms	**Dlog(RCRE)**	**DLog (RHOU)**	**DLog(RRRP)**
Cycle (% Deviation from HP-filtered trend)	-0.010 **/	-0.007 */	-0.003 */
In share to real GDP	**RCRE/RGDP**	**RHOU/RGDP**	
Cycle (% Deviation from HP-filtered trend)	-0.008	-0.011	

Source: Author's. Dynamic panel GMM was used. Coefficients are significant at 5% and 10% levels of significance. Standard errors across regressions are robust at 5% and 10% levels of significance.
**/ Significant at 10% level of significance. **/Not significant at 5% and 10% levels of significance.*

However, the finding that the relative impacts of the cycles are significant only for real housing credit and real house prices at 10% level of significance entails caution in using year-on-year growth of real bank credit for further analysis. Moreover, it is useful to examine whether policy variables can be included to see if policy actions are effective after the cycles are considered. This study considers such an issue as possible extension of research.

Table 7: Average Impact of Tightening Measures on Real Bank Credit to Non-Financial Sector *(RCRE)*, Real Housing Credit *(RHOU)* and Real House Prices *(RRRP)* Using Four-Quarter Window [1/]
Nine Asia Emerging Market Economies, First Quarter 2004-Fourth Quarter 2015

Tightening of Policy Measures	**Log(RCRE)**	**Log (RHOU)**	**Log(RRRP)**
Capital inflow restrictions *(CCFI)*	-0.003 (Models 28-31)	-0.002 (Models 39-42)	-0.009 (Models 51-54)
Limits on domestic macro prudential policy *(DMAPAD)*	-0.050 (Models 32-34)	-0.019 (Models 43-46)	-0.028 (Models 55-58)
Combined monetary policy hike with either one measure of *DMAPAD* (*CBRIa*) [2/]	-0.003 (Models 35-38)	-0.003 (Models 47-50)	-0.108 (Models 59-62)

Note: A negative sign implies negative impact on dependent variables. Coefficients are significant at 5% and 10% levels of significance.
[1/] The results are robust using one quarter window but the standard error of regression is higher than using a four-quarter window.
[2/] Either a hike in bank reserve requirements or restrictions on housing market measures/actions (LTV, DSTI, among others).
Source: Author's. Standard error across regressions are robust. See Technical Appendix C.

Second, an interesting finding is the impact of both tightening capital inflow measures and domestic policy actions on real house (residential) prices. Table 7 shows that, on average, tightening measures have negative impact on real house prices aside from real bank credit to non-financial sector and real housing credit. Expectedly, a combined monetary policy tightening with either hike in reserve requirements or restrictions in housing market measures showed larger impact especially on real house prices.

Third, cross-border loans and deposits react to restrictions in capital inflow measures, hence, these can help reduce real credit and real house price movements. Results in Models 1, 5 and 9 show that capital inflow measures targeted at cross-border loans and deposits can significantly reduce movements in real credit and real house prices.[32] Based on the BIS data, average (net) cross-border loans and deposits of nine countries from March 2008 to September 2015 (post-GFC) grew by 156.5% from the average in March 2004 to December 2007. In terms of share in total claims of banks (BIS reporting countries), outstanding cross-border loans and deposits have declined from 80.5% from March 2008 to September 2015 to 78.7% from March 2004 to December 2007 (pre-GFC), following steep decline in the share of cross-border loans and deposits to total claims in China, Indonesia, South Korea, Malaysia, Singapore and Thailand. By contrast, the share of cross- border loans and deposits in total claims in Hong Kong, India and the Philippines have increased to 88.9% (from 86.3%), 81.4% (from 80.8%) and 74.6% (from 72.6%), respectively.

Fourth, real effective exchange rate appreciation drives real bank credit to non-financial sector and real house prices.[33] In the earlier literature, a currency appreciation typically leads to a decline in net exports and, consequently a fall in real output. In recent empirical studies, however, a currency appreciation is often associated with buoyant economic activity and rapid credit growth following the growing influence of global financing conditions. Currency appreciation can lead to the perception that risks have decreased, encouraging borrowers to increase their leverage and, in turn their vulnerability to subsequent shocks. Such a phenomenon which has become known as the risk-taking channel of currency appreciation was discussed in Bruno and Shin (2015a, 2015b) and Cerutti et al (2014) with special focus on banking sector, and was extended to bond markets in Sobrun and Turner (2015) and Feyen et al (2015), among others.

[32] In earlier estimations, cross-border flows only (loans and deposits) (Model 13 in Technical Appendix B) and the ratio of outstanding loans and deposits to total outstanding loans and deposits (Model 14 in Technical Appendix B) were used as interaction terms with CCFI. Results show that the interaction terms are not significant (Models 13 and 14) and the sign is not correct (Model 13).

[33] The impact of real exchange rate movements on real housing credit may have been affected by data limitation. In the study, quarterly data on housing credit for China, India and the Philippines are estimated based on annual actual data.

Table 8: Selected Economic and Financial Indicators of Nine Asia Emerging Economies[1/]
(Year-on-Year Growth, In %)

Indicators / Period Average	Real GDP	Real Bank Credit to Non-Financial Sector	Real Housing Credit [2/]	Bilateral Exchange Rate (Nominal, US$/Local Currency) [3/]	Broad Real Effective Exchange Rate [3/]
Full sample (Mar 2004-Dec 2015)	5.702	8.175	10.156	0.415	1.200
Pre-GFC (Mar 2004-Dec 2007)	7.191	7.477	14.146	2.880	1.502
Post-GFC (Mar 2008-Dec 2015)	4.958	8.436	8.659	-0.817	1.050

[1/] Include China, Hong Kong, India, Indonesia, South Korea, Malaysia, the Philippines, Singapore and Thailand.
[2/] Data start in 2005.
[3/] Positive/negative value means appreciation/depreciation of exchange rates.
Sources of basic data: BIS Website, Haver Analytics (for Real GDP, bilateral exchange rates).

Moreover, data in Table 8 show that the risk-taking channel of currency appreciation can be associated with higher real bank credit and real housing credit, especially during pre-GFC. The relationship between nominal bilateral exchange rates and real effective exchange rates somewhat diverged post-GFC. In particular, while average real effective exchange rate appreciated, average bilateral exchange rate depreciated post-GFC amidst rise in year-on-year growth of real bank credit to non-financial sector from pre-GFC. Meanwhile, a simple Granger causality test was performed among nominal bilateral exchange rate, real bank credit to non-financial sector and real housing credit[34] and real effective exchange rate *(RBER),* real bank credit to non-financial sector and real housing credit. The results are consistent when using both nominal bilateral exchange rate and real effective exchange rates (Model 17 and Model 19 in Technical Appendix B). That is, an appreciation in both measures of exchange rate leads to a rise in bank credit to non-financial sector as well as real house prices.[35]

However, using bilateral nominal exchange rate, the resulting influence of both cyclical capital flow measures and domestic macro prudential policy fades away, except for real house prices. In addition, in most regressions, the overall fit of the models is more significant when real effective exchange rate is used, based on standard error of regression. Meanwhile, results in Model 23 show that equity prices *(EQUA*) do not co-move with and not a significant driver of real house prices.

[34] Using a simple Granger causality test among nominal bilateral exchange rate, real bank credit to non-financial sector and real housing credit of nine countries from the March 2004 to December 2015, results show that nominal bilateral exchange rate Granger causes real bank credit to non-financial sector and real housing credit, at 5% level of significance.
[35] In Model 17, a depreciation in nominal exchange rate leads to a decline in real bank credit to non-financial sector.

Fifth, monetary policy tightening complements tight domestic macro-prudential policy in restraining movements in real bank credit and real house prices. Results in Models 4, 8, and 12 show the direct impact of using monetary policy and either one measure of domestic macro prudential policy in curbing real credit, housing credit and real house prices.[36] However, when tightening capital inflow measures, domestic macro prudential policy and central bank policy action are included in the models, the significance of either one policy disappears (Model 17, Model 18 and Model 20 in Technical Appendix B). Moreover, a monetary policy tightening without the hike in reserve requirements *(CBRIw)* leads to weaker impact on real credit and real house prices.

5. Conclusion

This study introduces database for tightening capital inflow measures and episodes of sterilization of capital inflows and updates Shim et al (2013) domestic policy actions on housing markets across nine Asian emerging market economies - China, Hong Kong, India, Indonesia, South Korea, Malaysia, the Philippines, Singapore and Thailand - from 2004 to 2015. These three sets of database are then used to assess the effectiveness of restrictions on capital inflows and domestic macro-prudential policy in curbing real bank credit to non-financial sector, real housing credit and real house prices and to draw implications for monetary policy using a dynamic panel GMM.

Following diagnostic and robustness checks, the results reveal important findings. First, after controlling for episodes of sterilization of capital inflows, tightening capital inflow restrictions and domestic macro prudential policy are effective in curbing overall real bank and real housing credit and real house prices across nine Asian emerging market economies. Second, this study highlights the bigger negative impact of tightening measures on real house prices. Third, following the inclusion of a direct measure of capital flows into the models, cross-border loans and deposits are found to be an important channel of tightening capital inflow measures which can help reduce credit growth and real house prices. Fourth, after controlling for episodes of sterilization of capital inflows, real exchange rate appreciation drives real bank credit to non-financial sector and real house prices. Fifth, monetary policy tightening complements tight domestic macro prudential policy in restraining movements in real bank credit and real house prices. However, when domestic macro prudential policy and monetary policy action are combined with tightening capital inflow measures, the significance of either one policy in addressing real credit and real house price movements disappears.

The study's findings have important policy implications. First, the finding that tightening capital inflow measures and domestic macro prudential policy are effective in reducing bank and housing credit movements, and more importantly house prices underscores the critical role for

[36] However, it should be noted that the direct impact of domestic macro prudential policy on real housing credit (Model 7) and real house prices (Model 11) did not have the correct sign, although significant at 5% level of significance.

structural policies to enhance the capacity of the economy to absorb capital inflows and cope with volatility, along with improved regulation and supervision of the financial sector. In the future, more in-depth research on the microeconomic impact of controls on capital inflows as well as the impact on both the capital flow measures and domestic macroprudential policies on financial markets, such as the foreign exchange rates, government securities and the stock markets, may be insightful. For instance, Forbes (2007) argued that inflow controls in Chile imposed a financial constraint on small firms, while Gallego and Hernandez (2003) showed that controls were associated with lower leverage and greater reliance on retained earnings.

Importantly, a research on the interaction between capital inflow measures and each of the domestic macro prudential policies deployed and the consequent impact on restraining movements of real bank credit, real housing credit and real housing prices may be equally useful. For example, an exercise where the impact on housing prices of a tightening of capital inflow restrictions and an increase in the reserve requirements can be compared with that of tightening of capital inflow restrictions and actions on the housing markets.

Second, given the close connection between cross-border flows and risks to global financial stability, this study implies that the adoption of relevant restrictions on capital flows during capital inflow surges could help address the procyclicality of these flows, thereby lowering the risk of systemic financial crisis, although the impact of these measures can be short lived. In order to remain effective in the longer run, these measures need to be regularly reinforced and possibly broadened, potentially leading to a wider regulation of capital flows. However, as indicated in some studies, reinforcing controls may increase distortions. A more detailed analysis on the feasibility of adopting restrictions at both ends (inflows and outflows), instead of more intensive controls at one end, maybe interesting as an area for future research (Ghosh et al 2014).

Third, given the influence of real effective exchange rate appreciation in driving credit and house price movements, there is a need for more in-depth understanding of exchange rate dynamics, its impact on the economy and the effectiveness of policy instruments, both in the short and longer term. More importantly, more analysis on the risk-taking channel of currency appreciation that is associated with an increase in both the likelihood of future financial crisis is crucially relevant.

Fourth, an important point to consider that is related to the previous point is the role of macro prudential measures on cross-border issues. For instance, Forbes et al (2016)[37] found that regulation and macroprudential measures contributed to banking deglobalization between June 2012 and December 2013, such that cross-border lending of U.K. banks significantly contracted. This implies that global banks can generate outward transmission and unintended consequences. The welfare consequences of the pullback in financial globalization raise the

[37] See Forbes, K., D. Reinhardt, and T. Wieladek (2017). "The spillovers, interactions, and (un)intended consequences of monetary and regulatory policies," *Journal of Monetary Economics,* Vol. 85, January 2017, pages 1-22.

ongoing challenge of whether and how affected borrowers can insulate themselves from global liquidity conditions and idiosyncratic foreign policy changes.[38] Nonetheless, Avdjiev et al (2016)[39] argued that even if disruptive near term, welfare might be enhanced if the retrenchment is due mainly to weaker banks refocusing activity domestically and rebuilding capital stocks, and if there is a broader realignment of market share internationally towards stronger financial firms. These findings provide compelling evidence that cross-border issues are potentially crucial as a research area moving forward.

The cross-border effects of macroprudential measures can be both positive and negative. The positive effect concerns the public good aspect of financial stability, wherein actions enhancing financial stability in one country also benefit others. Policies that prevent the build-up of systemic risk in one jurisdiction may reduce the probability of crises that subsequently spread elsewhere.

Cross-border effects can be negative, particularly if these effects induce regulatory arbitrage. Macroprudential measures in a particular country can end up shifting some of the risks to other countries. This is an issue even within a country, when tighter restrictions on banks may result in risks shifting to less regulated non-banks.

Moreover, there is evidence of sizeable cross-border spillovers. For instance, Chilean banks responded to higher capital requirements abroad by increasing their domestic lending. Singapore experienced cross-border spillovers when foreign demand from countries implementing tighter macroprudential policies on residential real estate purchases contributed to an increase in property prices in Singapore.

Fifth, considering the role of source country monetary policies in driving cross-border flows to recipient countries, the findings in this study allude to the importance of coordination on the monetary policy dimension as well. The findings also stress the importance of understanding the consequences of advanced economies' monetary policies on cross-border flows, which are driven more and more by global risk appetite, and, to a lesser extent, by interest rate differentials. Hence, the findings in this study underscore the continuous debate on the appropriate policy mix in addressing global capital flow risks.

[38] Goldberg, L. S. (2017). "Comment on 'The spillovers, interactions, and (un)intended consequences of monetary and regulatory policies'," *Journal of Monetary Economics,* Vol. 85, January 2017, pages 23-27.

[39] Avdjiev, S., L. Gambacorta, L. S. Goldberg, and S. Schiaffi (2016). "The shifting drivers of international capital flows," Global Research Forum on International Macroeconomics and Finance, 17-18 November 2016.

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Technical Appendix A: Variables Used in the Model

Variable Name	Description	Unit	Source of Data
Dependent Variables			
RCRE	Real bank credit to non-financial sector	In billion local currency	BIS credit series; for Philippines: IMF-IFS
RHOU	Real housing credit	In billion local currency	CEIC. Except Hong Kong, Indonesia and Singapore: BIS Database
RRRP	Real residential real property prices	Various base years	BIS residential housing price series; CEIC, Datastream
RCREG *[Dlog(RCRE)]*	Real bank credit to non-financial sector, year-on-year growth	In %	Author's computation
RHOUG *[Dlog(RHOU)]*	Real housing credit, year-on-year growth	In %	Author's computation
RRRPG *[Dlog(RRRP)]*	Real residential real property prices, year-on-year growth	In %	Author's computation
RCREDD	Real bank credit to non-financial sector, percent deviation from trend	HP-filtered trend, In %	Author's computation
RHOUDD	Real housing credit, percent deviation from trend	HP-filtered trend, In %	Author's computation
RRRPDD	Real residential real property prices, percent deviation from trend	HP-filtered trend, In %	Author's computation
Dummy Indices			
CCFI	Cyclical Capital Flow Index	Index	Author's computation
DMAPAD	Domestic Macro Prudential Policy (Measures on housing market and reserve requirements)	Index	Author's computation
DPA	Domestic Policy Actions (DMAP and policy rate action)	Index	Author's computation
CBRI	Central Bank Official Rate Index	Index	Author's computation
CBRIq	Central Bank Official Rate and DMAPAD, With One Quarter Window for Tightening	Dummy	Author's computation
CBRIa	Central Bank Official Rate and DMAPAD, With One Year Window for Tightening	Dummy	Author's computation
CBRIw	Central Bank Official Rate and DMAPAD (excluding reserve		

	requirements), With One Year Window for Tightening		
STER	Sterilization Episodes	Dummy	Author's computation
Independent Variables (Instrument Variables)			
CAP	Real Gross Domestic Product per capita	In US dollars	Haver Analytics; central bank websites
RGDP	Real Gross Domestic Product	In US dollars	Haver Analytics; central bank websites
RDEP	Real outstanding local currency deposits	In billion local currency	Haver Analytics; central bank websites
CPI	Consumer Price Index, Average	Index	Haver Analytics
INF	Inflation Rate, Average	In %	Haver Analytics
CBR	Central bank official policy rate, end-of quarter	In %	Haver Analytics, central bank websites
LR	Bank lending rate, average	In %	Haver Analytics, central bank websites
CAB	Ratio of current account balance to nominal GDP	In %	Haver Analytics, central bank websites
BGFLOWS	Cross-border flows, by instrument (loans and deposits) reported by banks and banking offices in BIS-reporting countries	In Million US$	BIS banking (Locational) statistics: Table A6: Residence of Counterparty)
BTCLAIMS	Ratio of cross-border flows, by instrument (loans and deposits) reported by banks and banking offices in BIS-reporting countries to total cross-border flows [40]	Ratio in %	BIS banking (Locational) statistics: Table A6: Residence of Counterparty)
BOCLAIMS	Ratio of outstanding cross-border positions, by instrument (loans and deposits) reported by banks and banking offices in BIS-reporting countries to total outstanding cross-border positions	Ratio in %	BIS banking (Locational) statistics: Table A6: Residence of Counterparty)
VIX	VIX (S&P 500)	Index	Bloomberg

[40] Data capture outstanding claims and liabilities of banks located in BIS reporting countries, including intragroup positions between offices of the same banking group. The locational statistics are compiled following principles that are consistent with balance of payments.

RBER	Real effective exchange rate, broad, based on trade weights from 2011 to 2013, with 2010 as base year	Index	BIS effective exchange rate series
FXR	Bilateral foreign exchange rate (local currency per US dollar)	Rate	Haver Analytics, central bank websites
EQUA	Equity Prices [41]	Index	BIS Equity Prices series
POP	Population		Haver Analytics, CEIC

[41] Data include equity prices from Shanghai Stock Exchange, Hong Kong Hang Seng, Bombay Stock Exchange (SENSEX), Jakarta Stock Exchange, Korea Stock Exchange, FTSE Bursa Malaysia KLCI, Philippine Stock Exchange, All-Singapore FSTAS, and Stock Exchange of Thailand.

Technical Appendix B: Robustness Checks (First Quarter 2004-Fourth Quarter 2015)

	Dependent Variables			
Independent Variables	**Log (RCRE) (17)**	**Log (RCRE) (18)**	**Log (RCRE) (19)**	**Log (RCRE) (20)**
(Log) RBER	0.668 *, a/	0.672 *,a/		0.196 **,a/
(Log) FXR			0.101 *,a/	
(Log) RDEP	0.634 *.a/	0.625 *,a/	0.552 *,a/	0.137 *,b/
CCFI	-0.002 *,a/			
CCFI*BGFLOWS	0.001 ***/			
CCFI		-0.002 ***, a/		
CCFI*BOCLAIMS		-0.001 ***, b/		
CCFI			-0.014 **,b/	0.001 ***/b
CCFI*BTCLAIMS			0.001 ***/	0.002 ***/b
DMAPAD				-0.153 ***/a
CBRIa				0.451 ***/a
Instrument Variables	Constant, Lagged RCRE, Lagged RBER, Lagged RDEP, LR-INF, VIX, CAP	Constant, Lagged RCRE, Lagged RBER, Lagged RDEP, LR-INF, VIX, CAP	Constant, Lagged RCRE, Lagged FXR, Lagged RDEP, LR-INF, VIX, CAP	Constant, Lagged RCRE, Lagged RBER, Lagged RDEP, LR-INF, VIX, CAP
Standard error of regression	0.061	0.062	0.067	0.060
	Log (RHOU) (21)	**Log (RHOU) (22)**	**Log (RRRP) (23)**	**Log (RRRP) (24)**
(Log) RBER	0.186 *, a/	0.470 **, a/	0.698 **	0.132 *, b/
(Log) EQUA			-0.058 ***, c/	
(Log) CAP		0.813 **/a	0.462 */	0.279 */
(Log) RDEP	0.984 *.a/			
INF			-0.003 **/	-0.005 */
CCFI	0.002 **,b/	-0.007 ***,b/	0.007 ***/	-0.001 ***, a/
CCFI*BTCLAIMS	-0.001 ***,b/	-0.001 ***,b/	0.001 ***/	-0.001 **/
DMAPAD	0.119 ***, a/	0.390 ***, b/		0.137 ***, a/
CBRIa	-0.287 * a/	-0.492 *** a/		-0.189 ***, a/
Instrument Variables	Constant, Lagged RHOU, Lagged RRRP, Lagged RBER, Lagged RDEP, LR-INF, VIX	Constant, Lagged RHOU, Lagged RBER, Lagged CAP, LR-INF, VIX,	Constant, lagged RRRP, Lagged RBER, Lagged EQUA, LOG(POP), Lagged CAP, Lagged INF	Constant, Lagged RRRP, Lagged CAP, Lagged RBER, Lagged INF
Standard error of regression	0.076	0.093	0.074	0.058
	DLog (RCRE) (25)	**DLog (RHOU) (26)**	**DLog (RRRP) (27)**	
(Log) RBER	0.559 *, a/	0.4070 **, a/	0.180 **	
(Log) EQUA			-0.025 **	
(Log) CAP		0.101 **/a	0.083 */	
(Log) RDEP	0.161 *.a/			
INF			-0.001 **/	
CCFI	-0.079 **,a/	-0.017 **,b/	-0.007 **/	
CCFI*BTCLAIMS	-0.003 **,b/	-0.003 **,b/	-0.001 **/	
DMAPAD	0.012 ***, a/	0.390 ***, b/	0.015***, b/	

CBRIa	-0.056 **	-0.049 ** a/	-0.011 */
Instrument Variables	Constant, Lagged RCRE, Lagged RBER, STER, Lagged RDEP, LR-INF, VIX, CAP	Constant, Lagged RHOU, Lagged RBER, STER, Lagged CAP, LR-INF, VIX,	Constant, lagged RRRP, Lagged RBER, STER, Lagged EQUA, LOG(POP), Lagged CAP, Lagged INF
Standard error of regression	0.096	0.036	0.053

/ Significant at 5% level **/ Significant at 10% level */ Not significant [a/] With 1 quarter lag*
[b/] With 2 quarters lag [c/] Even with lags, the coefficient is not significant. Source of data: Author's.

Technical Appendix C: Four-Quarter Lag Scenarios (First Quarter 2004-Fourth Quarter 2015)

	Dependent Variables			
Independent Variables	**Log (RCRE) 1-Quarter Lag (28)**	**Log (RCRE) 2-Quarter Lag (29)**	**Log (RCRE) 3-Quarter Lag (30)**	**Log (RCRE) 4-Quarter Lag (31)**
(Log) RBER	0.674 */	0.688 *,a/	0.740 *,a/	0.494 *,a/
(Log) RDEP	0.645 */	0.615 *,a/	0.601 *,a/	0.621 *,a/
CCFI	-0.002 ***/	-0.003 **/	0.001 ***/	-0.001 ***/
CCFI*BTCLAIMS	-0.008 ***/	-0.001 ***/	-0.001 ***/	-0.003 */
Instrument Variables	Constant, Lagged RCRE, Lagged RBER, Lagged RDEP, LR-INF, VIX, CAP	Constant, Lagged RCRE, Lagged RBER, Lagged RDEP, LR-INF, VIX, CAP	Constant, Lagged RCRE, Lagged FXR, Lagged RDEP, LR-INF, VIX, CAP	Constant, Lagged RCRE, Lagged RBER, Lagged RDEP, LR-INF, VIX, CAP
Standard error of regression	0.062	0.060	0.060	0.060
Independent Variables	**Log (RCRE) 1-Quarter Lag (32)**	**Log (RCRE) 2-Quarter Lag (32)**	**Log (RCRE) 3-Quarter Lag (33)**	**Log (RCRE) 4-Quarter Lag (34)**
(Log) RBER	0.204 *, b/	0.150 *, b/	0.217 *, b/	0.132 *, b/
(Log) RDEP	0.128 *,b/	0.127 *,b/	0.126 *, b/	0.129 *, b/
DMAPAD	-0.043 */	-0.048 */	-0.053 */	-0.057 */
Instrument Variables	Constant, Lagged RCRE, Lagged RBER, Lagged RDEP, LR-INF, VIX, CAP	Constant, Lagged RCRE, Lagged RBER, Lagged RDEP, LR-INF, VIX, CAP	Constant, Lagged RCRE, Lagged RBER, Lagged RDEP, LR-INF, VIX, CAP	Constant, Lagged RCRE, Lagged RBER, Lagged RDEP, LR-INF, VIX, CAP
Standard error of regression	0.033	0.033	0.033	0.032
	Log (RCRE) 1-Quarter Lag (35)	**Log (RCRE) 2-Quarter Lag (36)**	**Log (RCRE) 3-Quarter Lag (37)**	**Log (RCRE) 4-Quarter Lag (38)**
(Log) RBER	0.130 *, b/	0.119 *, b/	0.053 *, b/	0.139 *, b/
(Log) RDEP	0.104 *,b/	0.168 *,b/	0.137 *,b/	0.136 *, b/
CBRIa	0.064 ***/	0.053 ***/	-0.112 ***/	-0.015 ***/
Instrument Variables	Constant, Lagged RCRE, Lagged RBER, Lagged RDEP, LR-INF, VIX, CAP	Constant, Lagged RCRE, Lagged RBER, Lagged RDEP, LR-INF, VIX, CAP	Constant, Lagged RCRE, Lagged RBER, Lagged RDEP, LR-INF, VIX, CAP	Constant, Lagged RCRE, Lagged RBER, Lagged RDEP, LR-INF, VIX, CAP
Standard error of regression	0.037	0.089	0.047	0.035
	Log (RHOU) 1-Quarter Lag (39)	**Log (RHOU) 2-Quarter Lag (40)**	**Log (RHOU) 3-Quarter Lag (41)**	**Log (RHOU) 4-Quarter Lag (42)**
Log (RBER)	0.160 */	0.145 */	0.136 */	0.023 **/
Log (RDEP)	0.890 *,b/	0.625 *,b/	0.896 *,b/	0.802 *,b/
CCFI	-0.007 */	-0.009 */	-0.004 */	-0.003 */
CCFI*BTCLAIMS	-0.002 **/	-0.001 **/	-0.003 */	-0.003 **/
Instrument Variables	Constant, Lagged RHOU, Lagged RRRP, Lagged RBER, Lagged RDEP, LR-INF, VIX	Constant, Lagged RHOU, Lagged RRRP, Lagged RBER, Lagged RDEP, LR-INF, VIX	Constant, Lagged RHOU, Lagged RRRP, Lagged RBER, Lagged RDEP, LR-INF, VIX	Constant, Lagged RHOU, Lagged RRRP, Lagged RBER, Lagged RDEP, LR-INF, VIX
Standard error of regression	0.075	0.065	0.076	0.023
	Dependent Variables			

Independent Variables	**Log (RHOU) 1-Quarter Lag (43)**	**Log (RHOU) 2-Quarter Lag (44)**	**Log (RHOU) 3-Quarter Lag (45)**	**Log (RHOU) 4-Quarter Lag (46)**
Log (CAP)	0.112 ***/	0.187 */	0.122 **/	0.203 **/
Log (RDEP)	0.976 *,a/	0.973 *,b/	0.962 *,b/	0.802 *,b/
DMAPAD	0.063 */	-0.006 ***/	-0.062 **/	-0.072 **/
Instrument Variables	Constant, Lagged RHOU, Lagged RBER, Lagged RDEP, LR-INF, VIX, CAP, BTCLAIMS	Constant, Lagged RHOU, Lagged RBER, Lagged RDEP, LR-INF, VIX, CAP, BTCLAIMS	Constant, Lagged RHOU, Lagged RBER, Lagged RDEP, LR-INF, VIX, CAP, BTCLAIMS	Constant, Lagged RHOU, Lagged RBER, Lagged RDEP, LR-INF, VIX, CAP, BTCLAIMS
Standard error of regression	0.091	0.095	0.090	0.076
	Log (RHOU) 1-Quarter Lag (47)	**Log (RHOU) 2-Quarter Lag (48)**	**Log (RHOU) 3-Quarter Lag (49)**	**Log (RHOU) 4-Quarter Lag (50)**
Log (RBER)	0.083 **/	0.542 **/	0.460 */	0.232 */
Log (RDEP)	0.915 */	0.777 */	0.637 */	0.865 */
CBRIa	0.181 **/	-0.126 **/	-0.013 */	-0.053 */
Instrument Variables	Constant, Lagged RHOU, Lagged RBER, Lagged RDEP, LR-INF, VIX, CAP, BTCLAIMS	Constant, Lagged RHOU, Lagged RBER, Lagged RDEP, LR-INF, VIX, CAP, BTCLAIMS	Constant, Lagged RHOU, Lagged RBER, Lagged RDEP, LR-INF, VIX, CAP, BTCLAIMS	Constant, Lagged RHOU, Lagged RBER, Lagged RDEP, LR-INF, VIX, CAP, BTCLAIMS
Standard error of regression	0.117	0.110	0.101	0.055
	Log (RRRP) 1-Quarter Lag (51)	**Log (RRRP) 2-Quarter Lag (52)**	**Log (RRRP) 3-Quarter Lag (53)**	**Log (RRRP) 4-Quarter Lag (54)**
Log (RBER)	0.128 *,b/	0.081 *,b/	0.089 *,b/	0.095 **,b/
Log (CAP)	0.389 */	0.329 */	0.339 */	0.299 */
INF	-0.007 */	-0.004 */	-0.004 */	-0.004 */
CCFI	-0.004 ***/	-0.006 */	-0.007 ***/	-0.002 **/
CCFI*BTCLAIMS	-0.005 ***/	-0.004 ***/	-0.005 **/	-0.001 **/
Instrument Variables	Constant, Lagged RRRP, Lagged RBER, CAP, POP, INF	Constant, Lagged RRRP, Lagged RBER, CAP, POP, INF	Constant, Lagged RRRP, Lagged RBER, CAP, POP, INF	Constant, Lagged RRRP, Lagged RBER, CAP, POP, INF
Standard error of regression	0.046	0.045	0.044	0.043
	Log (RRRP) 1-Quarter Lag (55)	**Log (RRRP) 2-Quarter Lag (56)**	**Log (RRRP) 3-Quarter Lag (57)**	**Log (RRRP) 4-Quarter Lag (58)**
Log (RBER)	0.861 **/	0.777 **/	0.726 */	0.697 */
Log (CAP)	0.468 */	0.411 */	0.435 */	0.399 **/
DMAPAD	0.014 ***/	-0.005 ***/	-0.112 */	-0.008 */
Instrument Variables	Constant, Lagged RRRP, Lagged RBER, CAP, POP, INF	Constant, Lagged RRRP, Lagged RBER, CAP, POP, INF	Constant, Lagged RRRP, Lagged RBER, CAP, POP, INF	Constant, Lagged RRRP, Lagged RBER, CAP, POP, INF
Standard error of regression	0.055	0.052	0.050	0.051
	Dependent Variables			
Independent Variables	**Log (RRRP) 1-Quarter Lag (59)**	**Log (RRRP) 2-Quarter Lag (60)**	**Log (RRRP) 3-Quarter Lag (61)**	**Log (RRRP) 4-Quarter Lag (62)**

Log (RBER)	0.153 **, b/	0.123 **, b/	0.245 *,b/	0.155 ***,b/
Log (CAP)	0.040 ***/	0.121 */	0.033 **/	0.217 **/
INF	-0.024 */	-0.016 **/	-0.052 **/	-0.020 **/
CBRIa	-0.390 */	-0.629 ***/	0.759 ***/	-0.172 **/
Instrument Variables	Constant, Lagged RRRP, Lagged RBER, CAP, POP, INF	Constant, Lagged RRRP, Lagged RBER, CAP, POP, INF	Constant, Lagged RRRP, Lagged RBER, CAP, POP, INF	Constant, Lagged RRRP, Lagged RBER, CAP, POP, INF
Standard error of regression	0.102	0.088	0.128	0.111

/ Significant at 5% level **/ Significant at 10% level */ Not significant [a/] With 1 quarter lag [b/] With 2 quarters lag Source: Author's.*

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