Financial Globalization and Macroeconomic Policy

Wishnu Mahraddika

A thesis submitted for the degree of Doctor of Philosophy at
the Australian National University
December 2020

Declaration

I certify that this is my original work except where otherwise acknowledged in the text. Alternative versions of chapter 2 and chapter 3 have been published in International Economics:

Mahraddika, W., 2019. Does international reserve accumulation crowd out domestic private investment?. International Economics, vol. 158, pp.39-50. https://doi.org/10.1016/j.inteco.2019.02.003

Mahraddika, W., 2020. Real exchange rate misalignment in developing countries: The role of exchange rate flexibility and capital account openness. International Economics. vol. 163, pp.1-24. https://doi.org/10.1016/j.inteco.2020.04.004

Wishnu Mahraddika
30 December 2020

To my father, Adjar Danudja (1938 – 2020)

Acknowledgements

Alhamdulillahirabbilalamiin. The process of completing this work has been supported by sincere advice, guidance, and encouragement from many people. This dissertation and my studies at the Australian National University (ANU) could not have been completed without their support.

I would like to express my utmost gratitude to my supervisory panel chair, Professor Prema-chandra Athukorala. His extensive and thorough understanding of the subject, perpetual guidance, constructive critiques, and sincere encouragement have been one of the main sources of inspiration and strength for me to finish the program at the ANU and have made the completion of this work possible.

I convey my appreciation for other members of the supervisory panel, Professor Hal Hill for sharing his extensive knowledge and excellent advice, and to Associate Professor Tatsuyoshi Okimoto for his advice on time-series econometrics.

During the program I also benefitted from the support and advice given by Dr. Stephen Grenville, Associate Professor Ross McLeod, Professor Peter Warr, Dr. Peter McCawley, Professor Budi Resosudarmo, Professor Ragbhbendra Jha, Professor Ligang Song, Professor Robert Breunig, Associate Professor Paul Burke, Professor Ippei Fujiwara, Dr. Arianto Patunru, Dr. Ryan Edwards, and Dr. Larry Liu. I also would like to extend my gratitude to key administrative persons in the department during my time in the program, Heeok Kyung, Sandra Zec, and Tracy McRae. Special thanks also goes to Dr. Megan Poore who has been very helpful and supportive in

administrative matters and editing the chapters in this thesis. I also thank Tony Edwards for his help in the copy editing of the manuscript.

I am thankful to my colleagues Agung Widodo, Alongkorn Tanasritunyakul, Phitawat Poonpulkul, Krisna Gupta, Ruth Nikijuluw, Joseph Marshan, Rus'an Nasruddin, Deasy Pane, Donny Pasaribu, Chris Cabuay, Umi Yaumiddin, Nurina Merdikawati, Sulistyo Ardiyono, Adrianus Hendrawan, Yuventus, Anna Falentina, Inggrid, Chandra Putra, Chitra Septyandrica, Abdul Nasir, Barli Suryanta, Martha Primanti, Riswandi, Denny Irawan, Eko Sumando, Riandy Laksono, Phan Le, Wannisa Suanin, Siti Ghazali, Umbu Raya and all other friends for sharing their intellectual thoughts, discussions, and also for their kind attention.

My participation in the program would not be possible without the scholarship provided by the central bank of Indonesia, Bank Indonesia. Therefore, I am grateful for the trust and the support given.

Lastly, I present this work to my lovely wife, Yuniar and my wonderful daughter, Shazia, as well as my parents and relatives. Without their sincere support, all of this would not be possible.

Abstract

This thesis comprises three self-contained essays that contribute to the debates on macroeconomic policy configuration in the context of financial globalization. Following the introductory chapter, which provides an overview of the implications of financial globalization for macroeconomic policymaking, the first essay (Chapter 2) examines the relationship between foreign reserve accumulation and domestic private investment. Reserve accumulation is one of the preferred strategies to protect against susceptibility to financial crises. However, the implications of this policy choice for domestic investment remains a debatable issue. On the one hand, sterilization operations implemented as part of reserve accumulation strategy could crowd out financing for domestic investment. On the other hand, maintaining a healthy international reserve position has the potential to promote domestic investment by reducing the cost of foreign borrowing through improving international creditworthiness. The econometric analysis is based on a newly-constructed panel data set covering 58 countries over the period 2000–2014. The results provide support for the policy of relying on reserve accumulation for a cushion against external shock: notwithstanding a mild negative effect in the short run, maintaining a healthy reserve position seems to promote investment in the long run.

The third chapter examines the implications of exchange rate regime choice and capital flow management (CFM) for real exchange rate (RER) misalignment using panel dataset for 60 developing countries over the period 1980 – 2014. The analysis is based on an alternative index of RER that is more consistent with the theoretical

concept of RER than the commonly used IMF index. RER misalignment is estimated by paying due attention to country-specific underlying factors. The results suggest that the exchange rate regime and capital account policy are significantly related to the degree of persistence and the magnitude of RER misalignment.

The fourth chapter examines the effectiveness of capital flow management through a case study on Indonesia, a country that figures prominently in the debate on the sequencing of liberalization reforms as a unique case of liberalizing the capital account well before trade liberalization and domestic financial sector reforms. The analysis covers the Indonesian experience during the period 2000 – 2019. The methodology involves constructing a new capital flow management policy restrictiveness index (CFMIX) and examining impulse responses of these flows to CFMIX adjustments through structural vector auto-regression (SVAR) estimation. The index shows that the Indonesian CFM policy stance has been more accommodative of capital inflows and restrictive on outflows over time. The results indicate that capital inflows in the form of portfolio investment are significantly responsive to CFM measures. However, there is no evidence of a significant impact of CFM policy on capital outflows. The last chapter of the thesis provides an overall conclusion and identifies potential research areas for further explorations.

Contents

List of Figures

List of Tables

Acronyms

AE	Advanced economies
AFC	Asian financial crisis
ARDL	Autoregressive distributed lag
AREAR	Annual Report on Exchange Arrangement and Exchange Restrictions
CFM	Capital flow management
CFMIX	Capital flow management index
CPI	Consumer price index
DFE	Dynamic fixed effect
DOLS	Dynamic ordinary least squares
EMDE	Emerging and developing economies
ERER	Equilibrium real exchange rate
FDI	Foreign direct investment
GDP	Gross domestic product
GFC	Global financial crisis
GMM	Generalized methods of moments
IFS	International Financial Statistics
IMF	International Monetary Fund
MG	Mean Group
OLS	Ordinary least squares
PMG	Pooled Mean Group
PWT	Penn World Table

RER	Real exchange rate
SVAR	Structural vector autoregression
UK	United Kingdom
US	United States
VAR	Vector auto-regression
VIX	Chicago Board of Exchange volatility index
WDI	World Development Indicators
WEO	World Economic Outlook

1. Financial Globalization and Macroeconomic Policy: Context and Issues

1.1. Introduction

An integral facet of the ongoing process of globalization is increased cross-border mobility of capital alongside the expansion of international trade. The volatility of capital flows poses challenges for policymakers in macroeconomic management, particularly in emerging and developing economies, where domestic capital markets have not yet gained the maturity to match those in developed countries.

Financial globalization has both economic benefits and costs for a given country. There are at least three potential benefits that flow from accessing international financial markets: broadening sources of financing, enabling risk-sharing, and disciplining policymakers through exposure to international competition (Obstfeld et al., 2010). On the cost side, capital inflows could adversely impact on an economy's international competitiveness through appreciation of the real exchange rate (RER). Significant and prolonged RER misalignment could result in misallocation of resources and impede long-term economic growth (Agénor and Montiel, 2015;

Aguirre and Calderón, 2005; Schröder, 2013). Furthermore, capital flows are sensitive to panics and manias (Kindleberger, 1996). The sudden shifts of market risk perception in the global financial market due to idiosyncratic or contagion factors could cause a reversal or a sudden stop of capital inflows, particularly portfolio capital and other short term capital flows compared to direct investment and other long-term flows. There is evidence that periods of high capital mobility are associated with financial crises (Broner and Ventura, 2016; Isard 2005; Reinhart and Rogoff, 2011; Stiglitz, 2014). This was demonstrated in the Asian financial crisis (AFC) of 1997 – 1998 when even countries that were once considered as 'growth miracles' were not immune to 'manias, panics and crashes' ala Kindleberger (1996). The global financial crisis (GFC) of 2008 – 2009 vividly illustrated that even mature economies with well-developed financial markets are still susceptible to a sudden exodus of capital, resulting in economic collapse (Bayoumi, 2017; King, 2016; Shiller 2012).

Major financial crisis episodes within the last three decades have shown that monetary and fiscal policy alone are not enough to protect economies from the negative externalities arising from the swings of capital flows (Blanchard et al., 2014; Reinhart and Rogoff, 2011; Stiglitz, 2014). Although fiscal measures could be used as automatic stabilizers, political considerations and time delay constrains their effectiveness. Meanwhile, adjusting the monetary policy stance to address specific financial risks and sectoral booms that resulted from excessive capital inflows is considered to be less cost-effective considering its economy-wide implication. Adjusting the monetary policy stance would not only affect the specific sector of interest but would also have implications for the whole economy as well. Therefore,

there has been a significant emphasis in recent years on alternative policy instruments categorized under macroprudential policy and capital account management as the 'third leg' of open economy macroeconomic policy.

Vulnerability to capital flow volatility necessitates countries, particularly those with less developed financial markets, to accumulate ample foreign exchange reserves as a cushion against a possible, yet unpredictable exodus of capital. However, there are costs associated with this strategy. The most obvious negative implication is the 'carrying cost' due to the positive spread between the nation's external borrowing rate and the return from the investment of the foreign asset (Rodrik, 2006). Another possible negative implication is on the domestic investment where the savings that could have been used for financing the investment is funnelled into international reserves (Cook and Yetman, 2012; Lee and Choi, 2010; Reinhart et al., 2016).

Another strategy for cushioning against adverse implications volatile capital is some form of 'capital control', a notion that has received increased attention in recent years under the new label of 'capital flow management' (CFM). There is a growing literature, both theoretical and empirical, on the potential complementary role of CFM in open-economic macroeconomic management (Ahmed and Zlate, 2014; Forbes et al., 2015, 2016; Caballero and Krishnamurthy, 2006; Korinek, 2011, 2018). The International Monetary Fund (IMF), which is known for its position in championing capital account convertibility, has become increasingly receptive to the new policy advocacy of using CFM measures to limit the unwanted impacts from capital flows fluctuations (IMF, 2012, 2016, 2020).

The purpose of this thesis is to contribute to the growing literature on the implications and effectiveness of open macroeconomic policy adjustments amidst financial globalization. Following this introductory chapter, three selected issues are examined in three self-contained chapters: the implications of foreign reserves accumulation on domestic private investment (Chapter 2), the implications of exchange rate regime choice and capital account openness on real exchange rate (RER) misalignment (Chapter 3), and a case study of the effectiveness of CFM in Indonesia (Chapter 4). An overall conclusion and potential future research agenda are provided in the last chapter of the thesis.

The next section provides the context for the three core chapters by reviewing recent trends and patterns of global capital flow and the current state of debate on the macroeconomic policy configuration in the context of capital mobility. The third section of this chapter presents an overview of the current state of the open economy macroeconomic policy configuration in face of the three predilections of openness to capital mobility, exchange rate stability and domestic monetary policy independence. This chapter concludes with a preview of the subject and the key findings of the core chapters.

1.2. Financial globalization: Trends and patterns

One of the main global economic trends from the early 1980s has been the rapid increase in global capital flows. Unlike capital surge episodes in the previous decades of the post-war era which were driven by one-off events, this trend was driven by the combination of developments on the pull factors (ie, better prospects of countries receiving the capital in form of more open capital markets, more financial instruments,

higher expected returns) and the push factors (ie, low interest rates and deceleration of economic growth in advanced economies). The interaction between these factors is supported by other important elements such as the global policy advocacy to favour capital account liberalization,[1] the development of global production sharing activity, advances in information technology, and the need to diversify asset allocation from investors in advanced economies. Given these factors and increasing interdependencies between countries, it is most probable that large capital flows will remain an important global economic feature with macroeconomic implications that need to be addressed by policymakers (Athukorala and Rajapatirana, 2003; Bosworth et al., 1999; Calvo et al., 1996; Lane and Milesi-Ferreti, 2007).

The global capital flows have increased significantly from an annual average of around $353 billion[2] in the first half of the 1980s to nearly $8,000 billion by the end of 2000s (Table 1.1). Following a notable decline in the wake of the GFC, these flows still stood at about $5,546 billion by 2015 – 2018. Flows to emerging and developing economies (EMDE) are dominated by foreign direct investment (FDI) and foreign aid (lumped together under 'other flows'). However, there are periods where portfolio investment and other investment inflows become a significant source of external funds in EMDE, particularly before the onset of the AFC and the GFC. This indicates that alternative sources of funds such as bonds and equities have become more important in these economies. Another point that is highlighted in Table 1.1 is the size

[1] The tendency of advocating greater capital account openness was reflected in the IMF's and US Treasury's policy advocacy concerning developing economies (Bhagwati, 1998; Rodrik, 2011).
[2] Unless otherwise indicated, all $ are US dollars.

of capital flows that is related to international reserves transactions. This transaction is mainly contributed by EMDE, especially in the post AFC period. Different countries might have different motives behind the reserve accumulation strategy; however, one most likely common objective is to form a self-insurance to anticipate sudden swings of capital flows.

Table 1.1 Annual average global gross capital inflows (billions of US dollar)

Capital flows[1]	1980-1984	1985-1989	1990-1994	1995-1999	2000-2004	2005-2009	2010-2014	2015-2018
Global								
Direct investment	54	114	198	633	1,166	2,520	2,886	2,485
Portfolio investment	43	199	369	921	1,828	3,415	2,544	1,673
Other investment[2]	256	308	367	614	819	1,948	877	1,388
Total	353	621	934	2,168	3,814	7,883	6,306	5,546
Advanced economies (AE)								
Direct investment	39	99	149	443	775	1,651	1,596	1,520
Portfolio investment	40	195	309	794	1,451	2,640	1,770	1,323
Other investment	197	282	329	525	543	1,117	692	901
Total	276	576	787	1,762	2,769	5,408	4,058	3,744
Emerging and developing economies (EMDE)								
Direct investment	15	15	50	190	392	869	1,290	965
Portfolio investment	3	3	60	127	378	775	774	350
Other investment	60	26	37	89	276	831	185	487
Total	77	44	147	405	1,045	2,475	2,249	1,803
Memo: Reserve assets transaction[3]								
Global	9	34	68	109	289	894	762	17
Advanced economies	7	34	21	52	128	138	236	181
Emerging & dev. Economies	2	1	47	57	161	756	526	-163

Note: (1) Gross capital flows at the global level are calculated as the sum of capital inflows or the sum of capital outflows. Categories included in the calculation of gross capital flows presented in the table are net incurrence of liabilities of direct investment, portfolio investment, and other investment. Financial derivatives and net error and omissions are excluded from the calculations. (2) Other investment covers other equity; currency and deposits; loans; insurance, pension and standardized guarantee schemes; trade credit and advances; other accounts receivable/payable-other; and special drawing rights (SDRs)). (3) Reserve assets transaction records transactions by monetary authorities in foreign reserve assets management that are separately recorded from the flows categories presented in the table.

Source: Compiled from IMF Balance of Payments database (https://www.imf.org/external/np/sta /bop/bop.htm)

In the 1980s, global capital flows were predominantly among advanced economies (AE), mostly in the form of portfolio investment. During this period capital flows to EMDE accounted for only about one-fifth of total global flows. At this time, flows to these countries were dominated by foreign aid and loans to governments (recorded under other investment flows category). Capital flows to EMDE started to increase from about the late 1980s, particularly to Asia and Latin America. In a remarkable turnaround since the early 1990s, EMDE starts to embrace financial liberalization, which was then, followed by a significant increase of foreign direct investment and portfolio capital inflows. In nominal terms, net capital inflows[3] to EMDE almost reached $200 billion in the 1990s, which then increased to around $700 billion within two decades (Figure 1.1 – top graph). Expressed as the proportion of the aggregate GDP, on average, the net capital inflows in EMDE amount to around 2 per cent of GDP. The lower graph of Figure 1.1 reveals two distinct peaks of net capital inflows between 1985 and 2018, which is before the AFC and around the period of GFC. Both peaks are associated with large inflows in the form of portfolio investment and other investment, which are typically volatile (Bluedorn et al., 2013; Eichengreen et al., 2018).

The surge in inflows in the first half of the 1990s was followed by capital reversal during the AFC mainly in the form of portfolio capital and other investment. Conversely, direct investment flows, which are less volatile compared to the other two types of capital flows, acted as the main source of foreign financing for EMDE during

[3] Calculated as the sum of net direct investment, net portfolio investment and net other investment.

the downturn cycle (Athukorala, 2003). In addition to the AFC, in the 1990s there were several financial crises involving EMDE. The crises were caused by a combination of contagion effects, herding behaviour of foreign investors, high-level foreign short-term debt, institutional quality gaps, and limited/weak financial regulation (Isard, 2005 chapter 4). Aside from idiosyncratic factors, the common source of vulnerability that Mexico, Thailand, Indonesia, Malaysia, Korea, Russia, and Brazil had at the time was the combination of pegged exchange rate policy and open capital account regime (Summers, 2000).

Despite the crises in several EMDE in the 1990s, the pace of financial globalization continues to increase driven by capital flows in the form of portfolio capital and international banking loan within AE. Following the AFC, capital flows to EMDE started to gradually increase mainly driven by direct investment. However, the positive trend was interrupted by the GFC in 2008. The bursting of the US housing bubble in the second half of 2007, combined with excessive risk-taking by banks and lax regulation in the US and Europe affected the values of securities linked to US real estate and causing them to fall, delivering negative shocks to financial institutions globally and triggering the European debt crisis and Icelandic financial crisis (Bayoumi, 2017).

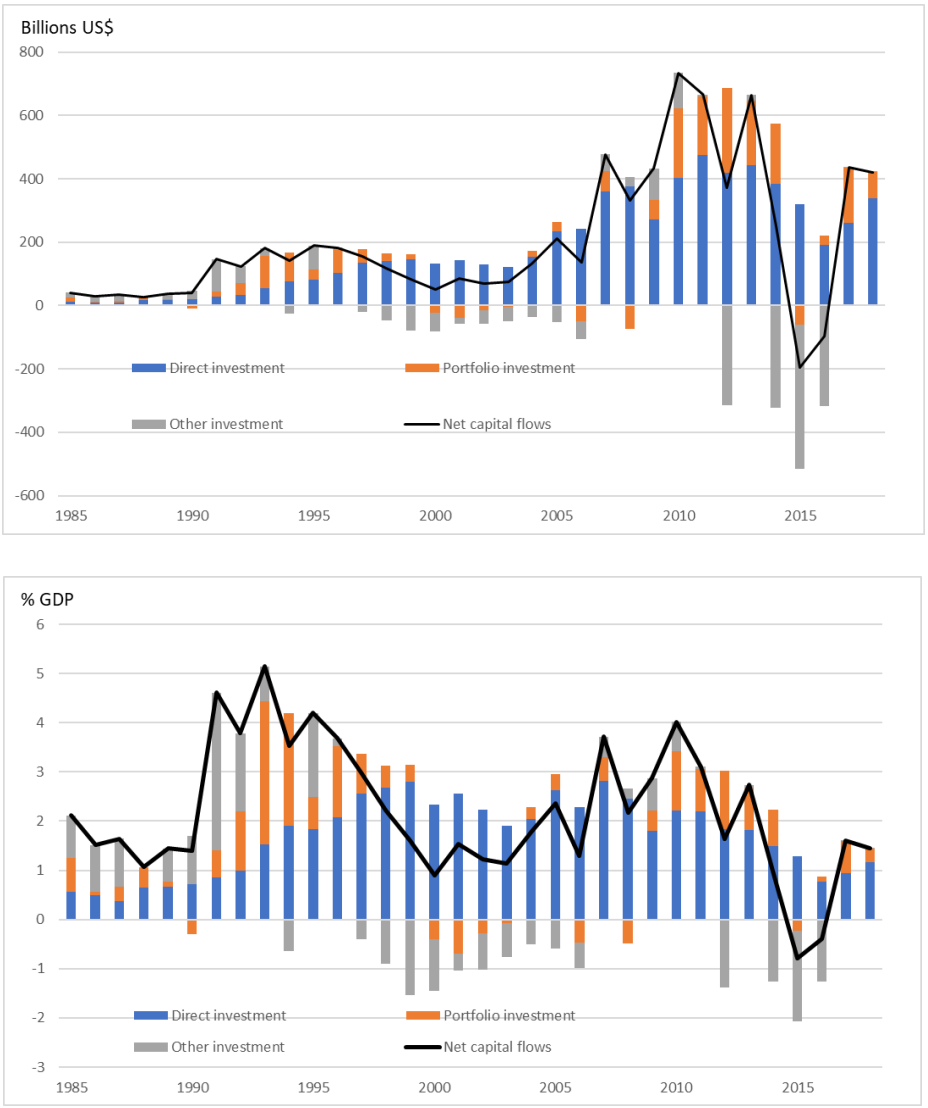


Figure 1.1 Net capital flows to emerging and developing economies 1985 – 2018

Note: Net capital flows presented in this figure is calculated as the summation of net direct investment, net portfolio investment and net other investment in billions of US dollar (top graph) and as a percentage of GDP (bottom graph).

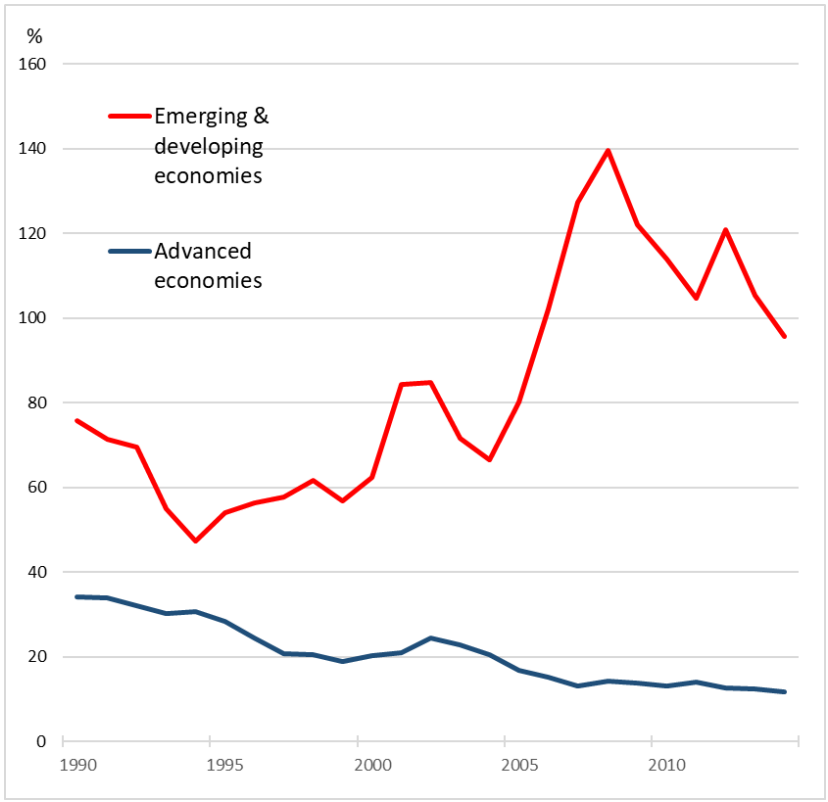
Source: Based on data compiled from the IMF's balance of payments database and the World Bank's World Development Indicator.

As part of the policy response to the GFC, monetary authorities of the US, Europe and Japan implemented an exceptionally accommodative policy combination that drove global interest rates toward the zero-lower bound. The accommodative global policy stance and better growth prospects of EMDE, which were relatively

resilient during the GFC, have driven international capital flows into these countries. This situation is reflected by the increasing share of portfolio capital in EMDE's net capital flow composition which is similar to the condition in the first half of the 1990s. In recent periods, the surge of capital flows to EMDE seems to have slowed following the prospect of gradual normalization of the monetary policy of AE and the general decline of growth in EMDE. However, the notable compositional shift from FDI and foreign aid and other government-related flows to portfolio capital and other flows related to private-sector activities remain an enduring feature of financial globalization.

One of the distinctive features in the dynamics of global capital flows since the early 2000s is the increased international reserves. Mainly driven by EMDE, the world international reserve position had increased by a factor of around 6 between 2000 and 2016 with China as the largest holder of the international reserves. Several factors support the accumulation of foreign reserves in the last two decades. Following a series of financial crises in the 1990s, countries, where crises had occurred, have been more aware of the importance of having sufficient international reserves to reduce the likelihood of a financial crisis to occur.[4] This is reflected in the increasing trend of the average international reserve relative to the portfolio and debt liabilities stock ratio (Figure 1.2).

[4] Other than precautionary motive, foreign reserves accumulation was also aided by the increasing commodity prices before the global financial crisis, which benefited net natural resources exporting countries.



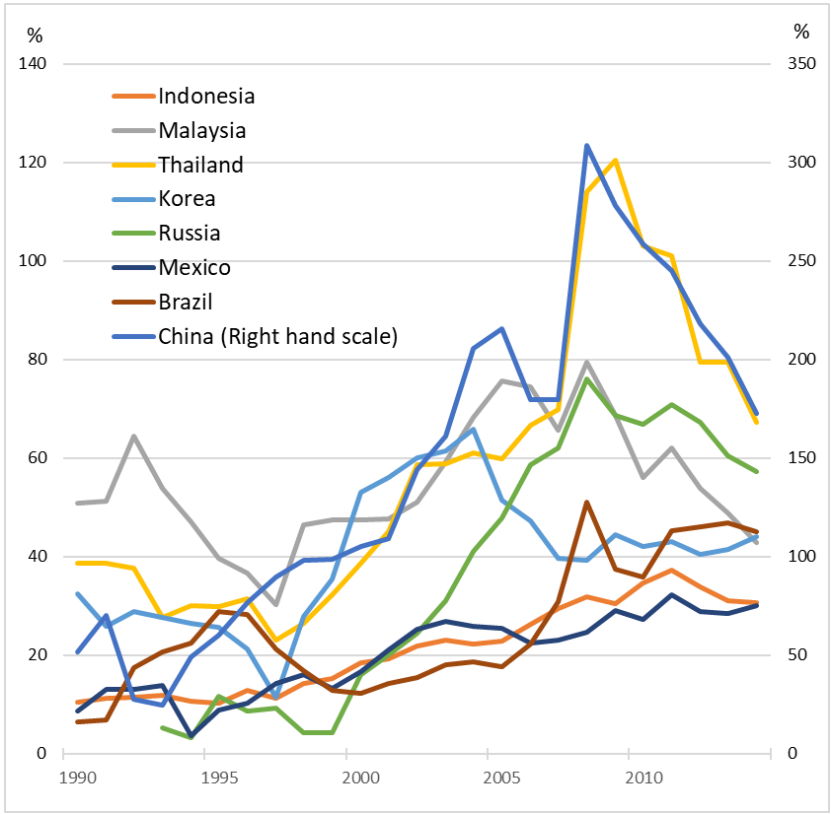


Figure 1.2 Foreign reserves position as a percentage of foreign liabilities excluding direct investment liabilities

Source: Based on data reported in Lane and Milesi-Ferretti (2018)

The depreciation trend of the US dollar during the 2002 – 2008 period also contributed to the increase of international reserves holdings. In response to the depreciation of the US dollar, countries that peg their currencies to the US dollar increased their foreign reserves holding to align the exchange rate at targeted levels (Sunner, 2017). Additionally, the accommodative monetary policy stance taken by advanced economies responding to the GFC caused international capital to flow into EMDE. The surge of foreign capital could drive EMDE currencies to appreciate which could deteriorate their international competitiveness. To mitigate this implication, some of the foreign capital received was allocated as international reserves (Aizenman and Lee, 2007; Aizenman et al., 2015; Bird and Mandilaras, 2005; Rossini et al., 2011).

1.3. The open macroeconomic policy configuration

The dynamics of the magnitude and composition of capital flows is related to the adjustments of open macroeconomic policy configurations implemented by individual countries. Before the financial liberalization era that started in the 1970s, under the Bretton Woods arrangement, the exchange rate was pegged and only adjustable in the case of a balance of payments disequilibrium. The US dollar was pegged to gold at $35/ounce while other currencies was pegged to the US dollar. To maintain the stability of the exchange rate and enable domestic monetary policy independence, capital controls were permitted. The International Monetary Fund (IMF), which was established at the Bretton Woods conference in 1944, was assigned to monitor national economic policies and extend financing to countries with balance of payments difficulties (Eichengreen, 2019).

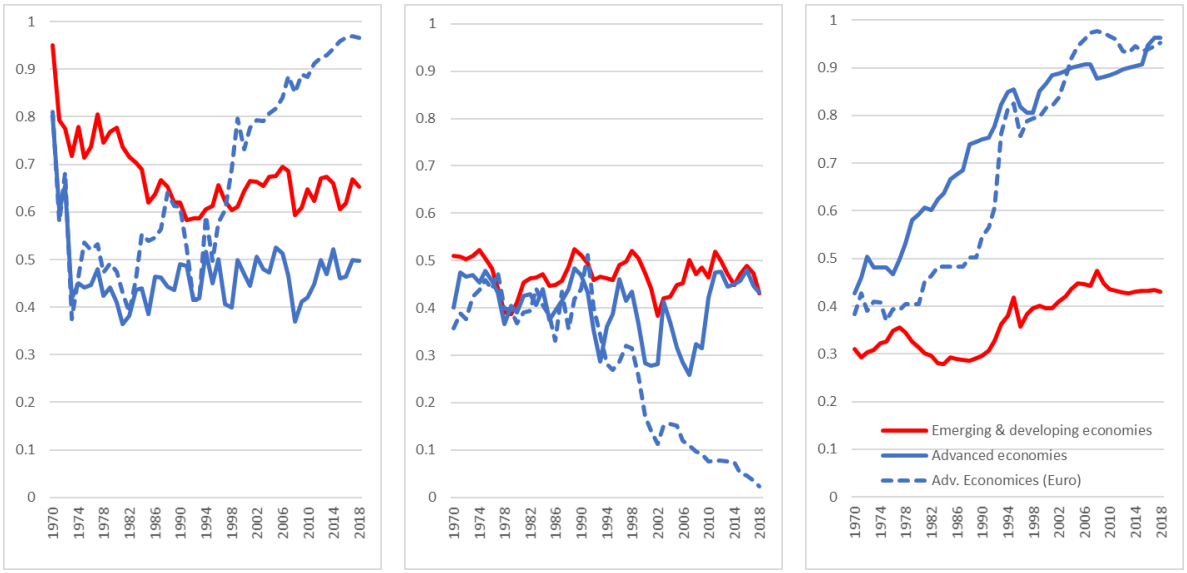
The severance of the link between the US dollar and gold in 1971 marked the end of the Bretton Woods system. The collapse of the system paved the way for a paradigm shift in favour of capital account liberalization and monetary policy autonomy under free-floating exchange rate arrangements. The shift was driven by the view that capital account liberalization delivers economic benefits as in the case of trade liberalization. This view was also incorporated in policy advice to developing countries and in 1995 the IMF initiated an amendment to its articles to include capital account convertibility into its jurisdiction (Fischer, 2005; Summers, 1998).

The debate on macroeconomic policy configuration in the context of capital mobility originated in the work of Mundell (1963) and Fleming (1962) who independently developed a framework for an open macroeconomic policy configuration. The key postulate of the Mundell-Fleming model is that an open economy can only sustainably maintain two out of three policy priorities: exchange rate stability, monetary policy autonomy, and full capital mobility. The theory, which is known as the macroeconomic policy trilemma, implies that an economy that prioritizes independent monetary policy and minimum exchange rate fluctuation cannot have full capital mobility, which was the policy configuration during the Bretton Woods period. If monetary policy independence and capital mobility become the priority, the economy cannot maintain a fixed exchange rate regime for a long period (the post-Bretton Woods period). Finally, the economy cannot have monetary policy autonomy under a fixed exchange rate regime and liberalized capital account, which was the general macroeconomic policy setting of most countries during the

gold standard period and the present arrangement within the Euro area (Obstfeld and Taylor, 2005).

To illustrate the movement of the global open macroeconomic policy configuration since the 1970s, Figure 1.3 plots the monetary trilemma index developed and compiled by Aizenman et al. (2013). The trilemma index consists of three indices that measure exchange rate stability, domestic monetary policy independence, and capital account openness with values that range from 0 to 1. The exchange rate stability is calculated based on the annual standard deviation of the exchange rate between the home country and the base country. The monetary independence is measured based on the reciprocal correlation between the monthly interest rates of the home country and the base country. The measurement for capital account openness is constructed based on the capital account transaction restriction reported in the IMF's Annual Report on Exchange Arrangement and Exchange Restrictions (AREAER).

The drive for capital account convertibility in AE is indicated by the increasing trend of the financial openness index (Figure 1.3 – right graph). By prioritizing open capital account and exchange rate stability, countries under the Euro arrangement (dashed blue line) forego monetary policy independence, while other countries of AE that are not under the Euro arrangement (solid blue line) maintain a relatively higher degree of monetary policy independence by adopting a flexible exchange rate regime.



Exchange rate stability
(higher value indicates a more stable exchange rate)

Monetary policy independence
(higher value indicates more independent monetary policy)

Financial openness
(higher value indicates more open capital account)

Figure 1.3 The trilemma index

Source: Based on data compiled from Aizenman et al. (2013)

Figure 1.3 also suggests that EMDE (solid red line) have been adjusting their open macroeconomic policy configuration by keeping financial openness relatively low compared to their advanced counterparts. Instead of opting for corner solutions, these countries adjust to their specific circumstances and adapt the 'intermediate regime' by constantly fine-tuning the degree of exchange rate flexibility, maintaining some degree of monetary policy independence, and managing capital account openness. One of the lessons learnt from a series of EMDE crises in the 1990s is that unsustainable exchange rate management reinforces capital flow volatility. However, policymakers in these countries might find that the appropriate level of the exchange rate or its excessive volatility to disincentivize capital flows might not be suitable for their growth strategy. Therefore, rather than risking their economy being 'hostage' to the global financial market's sentiment, EMDE adjust their policy by adopting

precautionary use of international reserves, implementation of macroprudential regulations, and establishment of foreign currency swap lines among central banks (Aizenman, 2019; Frankel, 1999).

The intermediate policy configuration of EMDE is generally in line with the suggestion of Feldstein (1999). Given the gaps in the financial development and institutional quality of these countries, Feldstein has put forward three policies that could be implemented for self-protection against financial crises: (i) reducing short-term capital inflows, (ii) increasing foreign exchange reserves, and (iii) establishing collateralized credit facilities. By reducing their exposure to short-term capital, countries would have a lower probability of having sudden-stop episodes and therefore become more resilient when international liquidity is limited. The implementation of this strategy has become more prevalent among EMDE as reflected by capital control policies that were reimposed by authorities of several countries that had previously liberalized their capital accounts. The practice to manage risks associated with full capital mobility using CFM measures has also become more tolerated by the IMF (IMF, 2012, 2016, 2020; Ghosh et al., 2018; Grenville, 2014). By having adequate international reserves and access to stand-by credit facilities, under capital reversal or sudden stop episodes, countries would be able to temporarily intervene in the foreign exchange market to maintain macroeconomic stability until the external pressure subsides or be given time for policymakers to formulate and introduce appropriate policy adjustments.

1.4. Preview

The three core chapters are written in the form of self-contained articles. A preview of the contents and the key findings of each chapter is given below.

Chapter 2 contributes to the fledgling literature on the implications of international reserve accumulation for domestic private investment. The chapter presents three significant improvements compared to previous studies. First is the specific focus on private investment. Previous attempts have focussed on total investments that consist of both public and private investment. Nevertheless, the underlying assumption of combining the two categories of investment is debatable since the former is driven by different considerations, including some non-economic factors. Second, the association between reserve accumulation and domestic private investment is analysed using a modified neoclassical investment function, which incorporates fundamental determinants of investment such as the cost of capital and output. Third, the dynamic panel data estimator (ARDL) used in the study enables the distinction between the long-run (steady-state) and short-run relationship between reserve accumulation and investment, while controlling for country-specific heterogeneity. The use of this method accommodates estimation using variables in the form of level and differences with different lags, and also reduces the endogeneity problem. The estimation uses a panel data set covering 58 countries over the period 2000–2014.

The findings suggest that a one percentage point positive change in the stock of reserves is associated with a 0.1 per cent increase in private domestic investment,

which more than counterbraced a mild negative association (- 0.06%) in the short-run. The findings are robust to the estimation of investment function with various combinations of explanatory variables and different sample compositions. Overall, the results provide support for the policy of relying on reserve accumulation for a cushion against external shock: notwithstanding a mild negative effect in the short run, maintaining a healthy reserve position seems to promote investment in the long run. The mild negative short-run association could represent a cost worth incurring given the favourable long-term relationship and, more importantly, given the individual country's vulnerability to financial crises in this era of financial globalization.

Chapter 3 examines the implications of exchange rate regime choice and the degree of capital account openness on the misalignment of the real exchange rate (RER). Compared to previous studies, this chapter offers four methodological improvements. Firstly, the RER index is measured as the ratio of the trade-weighted wholesale price index of trading partner countries expressed in domestic currency and the domestic GDP deflator. This measurement is more consistent with the fundamental concept of RER compared to the frequently used consumer price index (CPI)-based RER index. Second, the RER misalignment is estimated using individual country regression instead of the commonly used panel or cross-section approach that heavily relies on cross-country homogeneity assumption. This approach is considered to be more likely to produce a consistent proxy of RER misalignment since the fundamental drivers of the RER movement are mostly country-specific. Third, for estimating the RER function, the determinants considered are not only real

fundamental variables, as mostly applied in the particular strand of literature, but also variables relating to the financial sector. Finally, in generating the sustainable values of the fundamentals, a modified HP filter procedure is applied to determine the most appropriate smoothing parameter based on individual data characteristics. The empirical analysis covers 60 developing economies from 1980 through 2014 and pays proper attention to the sensitivity of results due to the use of alternative measures of the exchange rate and capital account regimes and alternative specifications.

The results indicate that in general, exchange rate flexibility and capital account openness is associated with the magnitude and persistence of RER misalignment. A higher degree of exchange rate flexibility and openness to capital flows is associated with faster adjustment of the RER to the equilibrium value. This is consistent with the argument of Corden (1994) that the RER adjustment will likely be slow under the fixed exchange rate regime. The result is also in line with the conclusion of Montecino (2018) who asserts that countries with capital controls tend to have a longer duration of RER misalignments. The asymmetric estimation results found limited evidence of asymmetry in the contribution of the exchange rate flexibility on the persistence term when the RER is undervalued. In terms of the magnitude of the RER misalignment, the result implies that liberalized policy configuration is associated with larger misalignments both in the form of overvaluation and undervaluation.

The final chapter examines the effect of capital flows management (CFM) policies on the magnitude and the composition of capital flows through a case study of Indonesia, a country that figures prominently in the debate on the sequencing of

liberalization reforms as a unique case of liberalizing the capital account. Indonesia undertook capital account liberalization well before trade liberalization and domestic financial sector reforms. However, presumably based on the lessons learned from the AFC, and in response to the emerging ideological shift in favour of macroprudential and capital account management as additional instruments in open-economy macroeconomic management, a series of CFM measures have been introduced to balance the need for fulfilling the required external financing and managing risks related to international capital flows.

The empirical analysis uses an alternative CFM policy index (CFMIX) that indicates the restrictiveness of policies regarding the capital inflow and outflow implemented by the Indonesian authorities. The CFMIX movement during the recent period of analysis (2000 – 2019) indicates that the general direction of the capital flows management policy tends to be less restrictive for inflows, and has become more restraining on outflows.

To investigate the implications of changes in the CFM policy restrictiveness on capital flows, a push and pull drivers of capital flows model was constructed and estimated using a structural vector autoregression. The impulse response estimates indicate that increase in the restrictiveness of CFM on the inflow side significantly reduces the size of portfolio inflows. There is also evidence of the compatibility of capital inflow measures and interest rate policy to address domestic macroeconomic imbalances. By combining the two policy instruments, potential externalities that

originate from the volatility of portfolio capital flows responding to the domestic interest rate adjustment could be better managed.

On the capital outflow side, the analysis does not find significant evidence supporting the efficacy of the policies in affecting all types of outgoing capital. This finding is in line with previous findings that suggest policies to contain outflow tend to have limited effectiveness. The limited effectiveness may be attributed to the low level and limited variability of the capital outflow data series and to the institutional setting of Indonesia, which is not designed to enforce controls on capital outflows.

The findings indicate that Indonesia is at a higher risk of exposing itself to volatile global financial market sentiment, following the recent shift towards easing CFM regulations on capital inflows. In order to cushion the economy against risk, it is important to combine this policy shift with strengthening domestic financial institutions' balance sheets, reducing foreign direct investment constraints, and keeping foreign exchange reserves in line with increased exposure to the risk of capital exodus.

2. Does international reserve accumulation crowd out domestic private investment?

Summary

Foreign exchange reserve accumulation is one of the preferred strategies to protect against susceptibility to financial crises. At the same time, maintaining a healthy international reserve position has the potential to promote domestic investment by reducing the cost of foreign borrowing through improving international creditworthiness. However, contractionary monetary policy in the form of sterilization operations implemented as part of reserve accumulation strategy could crowd out financing for domestic investment. This chapter examines the relationship between foreign reserve accumulation and domestic private investment by undertaking a dynamic panel data econometric analysis covering 58 countries over the period 2000 – 2014. The findings suggest that reserve accumulation is positively associated with domestic private investment in the long-run.

2.1. Introduction

After a series of economic crisis in various parts of the world during the 1990s, there has been a significant increase in the world international reserves. The stock of international reserves (excluding gold) in 2016 was more than $9 trillion, up from around $0.5 trillion in the early 1980s. While China, Japan, and Saudi Arabia account for the lion's share of world reserves, reserve holdings of countries directly affected by financial crises, in particular, those in East Asia, have increased at a faster rate over the past two decades [5].

Reserve accumulation is a strategy to cushion the domestic economy in the face of significant capital reversals or a sudden stop of capital inflows due to abrupt changes in the assessment of global market risk. Another benefit of having an adequate amount of reserves is the capability to intervene in the domestic foreign exchange market to manage the exchange rate in order to maintain the international competitiveness of the economy (Aizenman et al., 2015; Aizenman and Lee, 2007; Bird and Mandilaras, 2005; Obstfeld et al., 2010).

Aside from these benefits, there are both positive and negative economic implications associated with reserve accumulation. The most obvious negative implication is the 'carrying cost' due to the positive spread between the nation's external borrowing rate and the return from the investment of the foreign asset (Rodrik, 2006). Another possible implication, which remains relatively understudied,

[5] Based on the statistics from 113 countries with complete series of international reserves position for 1980 – 2016 period from International Monetary Fund, *International Financial Statistics* database (http://data.imf.org/?sk=4C514D48-B6BA-49ED-8AB9-52B0C1A0179B).

is the impact on domestic investment. Fukuda and Kon (2012) find a positive relationship between foreign reserves and domestic gross fixed capital formation. The authors interpreted this finding as an outcome of the ability to draw on foreign financing under favourable terms thanks to macroeconomic resilience assured by a healthy reserve position. However, studies by Cook and Yetman (2012), Lee and Choi (2010), and Reinhart et al. (2016) indicate a negative relationship between reserves accumulation and domestic investment. The authors infer this result as evidence of funnelling domestic savings that could have been used to finance domestic investments into international reserves.

The purpose of this chapter is to contribute to the fledgling literature on the implications of international reserves accumulation for domestic investment. Compared to prior studies, the chapter offers significant improvements in three dimensions. First is the specific focus on private investment. Previous analyses have focussed on total investment that includes both private and public investment. However, the implicit homogeneity assumption of combining private and public investment is debatable because the latter is determined by different factors, including some non-economic considerations. Second, the association between the reserve accumulation and domestic private investment is examined using an investment function, which incorporates fundamental determinants of investment such as output and the cost of capital. Third, the dynamic panel data estimator (ARDL) used in this study enables to distinguish between the long-run (steady-state) and short-run relationship between reserve accumulation and investment, while controlling for country-specific heterogeneity.

The results suggest that, overall, reserve accumulation is positively associated with private investment: a mild negative short-run relationship, which is marginally statistically significant, is more than counterbalanced by a stronger long-run (steady-state) relationship. This result is robust to the use of alternative specifications of the investment function and its estimation for different subsamples of the countries.

The rest of the chapter is organised as follows: The second section undertakes an interpretative survey of the literature on the determinants of reserve accumulation with emphasis on the postulated impact on domestic investment to provide the context for the ensuing empirical analysis. The specification of the estimating equation is discussed in the third section. Section 2.4 discusses data sources and variable construction followed by the estimation method in Section 2.5. Results are discussed in the context of the existing literature in Section 2.6. The final section summarizes the findings.

2.2. Reserves accumulation and domestic investment

There is a sizeable literature on the underlying economic motives for reserve accumulation by individual countries. One reason behind reserve accumulation is providing insurance against temporary external shocks. In this case, the monetary authority chooses to hold reserves to meet an unanticipated increase in demand for foreign exchange to avert a domestic financial crisis (Heller, 1966). Flood et al. (2001) find that, aside from the variability in the balance of payments, there is a significant role for exchange rates volatility and openness to trade and capital flows in explaining the behaviour of reserves accumulation. Maintaining international competitiveness

through undervalued real exchange rate is another possible motive for countries to accumulate international reserves (Aizenman et al., 2015; Aizenman and Lee, 2007; Bird and Mandilaras, 2005; Obstfeld et al., 2010).

Side by side with the sizeable literature on the motives for reserve accumulation, some studies have focused on its economic costs. Rodrik (2006) asserts that the cost of holding international reserves amounts have been increased to about 1% of GDP per annum for developing countries from 1990 to 2004. This cost is estimated based on the disparity between the return of liquid foreign assets and the nation's external borrowing rate. Also, the authority that chooses to hold a certain amount of foreign reserves must be willing to bear the opportunity cost of not investing in assets with a better return. Other studies postulate that international reserve accumulation could lead to distortions in the banking sector, asset price bubbles and welfare losses due to forced saving and reduced consumption under limited capital account openness (Filardo and Yetman, 2012; Jeanne, 2012; Mohanty and Turner, 2006).

The impact of the accumulation of foreign exchange reserves on domestic investment can occur through various channels. First, the domestic liquidity management of the central bank to limit the inflationary and exchange rate appreciation pressure resulting from the accumulation of reserves[6] can negatively

[6] The central bank can accumulate foreign exchange reserves in two ways: by borrowing foreign foreign exchange by directly issuing securities or through swap arrangements with the domestic banks and buying from the domestic foreign exchange market. The latter approach has the consequence of increasing domestic money supply resulting in inflationary pressure and hence real exchange rate appreciation.

affect private domestic investment through the lower availability of liquidity or higher cost of fund. To offset the excess liquidity caused by the intervention, the central bank can sell some of its stock of government bonds or issuing central bank certificates (sterilized intervention). In a thin and imperfect financial market, this strategy often increases the interest rates on securities used for intervention (Frankel, 1994; Turner, 1991). Another less costly way for the central bank to reduce the liquidity is by increasing the required reserves of the banking sector. Observations by Filardo and Grenville (2012) and Garton (2004) show the increase of international reserves in the asset side of the central bank's balance sheet does not always correspond to an equivalent increase of the base money. Therefore, the domestic liquidity management necessitated by the accumulation of foreign reserves could lower the liquidity or push-up the cost of fund, both of which can adversely impact the domestic private investment.

The second possible effect is through the fiscal balance. In a situation where the return on domestic bonds is higher than the return from the investment of foreign reserves, an increase in reserve holdings by the central bank reduces the amount of profits going to the treasury.[7] This, in turn, could reduce government expenditure or increase taxes, both of which could impair domestic private investments.

Third, foreign reserves level can have a positive impact on investment by lowering the cost of foreign borrowing or through real exchange rate undervaluation.

[7] This forgone income does not enter the central bank's balance sheet as a loss since it is only an imputed opportunity cost.

Fukuda and Kon (2012) develop a framework that shows that as the economy build-up its reserves, the ratio between foreign liabilities of the country and reserves decreases, which lowers the cost of foreign borrowing by improving market confidence of the external financial position of the country.

On the empirical side, Fukuda and Kon (2012) provide evidence based on cross-section regression of 134 countries and period of 1980-2004 that confirms the positive relationship between the level of reserves and domestic investment. By contrast, Reinhart et al. (2016), by applying VAR approach to data for eight Asian countries (India, Indonesia, Japan, Republic of Korea, Malaysia, Philippines, Singapore, Thailand) over the period 1980 - 2014, find that increase in reserves reduces domestic investment. They attributed the negative impact to the channelling of domestic savings from domestic investment to acquiring foreign reserves. The authors note that this finding is consistent with the failure of the investment rate in Asian countries during the post the 1997 crisis years to recover to the pre-crisis levels. This inference is consistent with the discussion reported in Cook and Yetman (2012) and Lee and Choi (2010). Cook and Yetman (2012) depict a negative relationship between the central bank's balance sheet expansion and domestic investment in Asian countries. The results reported in Lee and Choi (2010) for a sample of advanced and emerging-developing Asian economies for the period of 1980 – 2008 indicate a negative association between domestic investment and excess accumulation of international reserves accompanied by sterilization.

2.3. The model

To test the relation between foreign reserves accumulation and domestic private investments, this chapter estimates an investment function that includes foreign reserves as one of its explanatory variables. There is a large volume of literature on the determinants of investment in the economy. The empirical strand of the literature has explored a range of approaches such as the accelerator, neoclassical, Tobin's Q models and Euler equations (Chirinko, 1993; Caballero, 1999). Regarding prediction performance and data availability, models based on the accelerator and neoclassical models are preferable compared to Tobin's Q and Euler equation-based models (Oliner et al., 1995), which emphasize the financial market's ability to assign prices for investment opportunities properly. Dixit and Pindyck (1994), Bloom et al. (2007), Bloom (2009), and Baum et al. (2010) provide another extension of the investment literature by investigating the effect of uncertainty on investment.

The investment function used in this study is a modified version of the neoclassical approach pioneered by Jorgenson (1967). The original version of the function is derived for the profit-maximising representative firms using a Cobb Douglas production function, which assumes that the firm is a price taker in the factor market. According to this approach, the two main determinants of private investment are output (Y)[8] and the cost of capital (CoC). The desired capital stock (K^*) has a negative relationship with CoC and a positive association with Y (equation 2.1).

[8] The output variable should be the expected output of the representative firm. To adopt the model in the aggregate setting, it is assumed that the representative firm's output is proportional to the total output of the economy.

$$K_t^* = \frac{\rho Y_t}{CoC_t} \tag{2.1}$$

Three key factors determine the cost of capital:[9] the interest rate i_t, which is a measure of the opportunity cost of investing in other assets; the depreciation rate of the capital goods (δ_t); and capital gain/loss due to changes in the price of capital goods (P_t^k). To express the cost in real terms, the interest rate is adjusted by the expected inflation of capital goods π_t^k and other terms normalized by the general deflator (P_t).

$$CoC_t = \frac{P_t^k}{P_t}(i_t - \pi_t^k + \delta_t) \tag{2.2}$$

Changes in the capital stock is the adjustment of the previous capital stock with the desired capital stock

$$\Delta K_t = \beta(K_t^* - K_{t-1}) \tag{2.3}$$

or

$$K_t = \beta K_t^* + (1-\beta)K_{t-1} \tag{2.3a}$$

where K_t is the actual capital stock, hence ΔK_t is the net investment. β is the coefficient of adjustment that accommodates the partial adjustment mechanism, which could be related to changing economic conditions (Blejer and Khan, 1984).

[9] In general, the calculation of the cost of capital (CoC) follows the work of Athukorala (1998) and Terrones and Cardarelli (2005). The approach chosen here is based on data availability to maximize the coverage of countries in the analysis.

The investment data recorded on the national accounts refer to the gross investment that consists of net investment and the replacement investment. Assuming the replacement investment follows a linear function of the lagged capital stock, the representation of the gross investment (I_t) is as follows

$$I_t = \Delta K_t + cK_{t-1} \tag{2.4}$$

alternatively, by using lag operator L, we have

$$I_t = (1 - (1 - c)L)K_t \tag{2.5}$$

Based on equation (2.3a), (2.5) and (2.1), we can re-express the basic investment equation as follows[10]

$$I_t = \beta\rho(1 - (1 - c)L)\frac{Y_t}{CoC_t} + (1 - \beta)I_{t-1} \tag{2.6}$$

Based on equation (2.6), investment is not only determined by the output (Y_t) and the cost of capital (CoC_t), but also by the adjustment coefficient β. This study hypothesizes β varies with the economic factors namely government investment, institutional quality, and the international reserves, which is the focus of this study. Under constrained financial and physical resources, government investment can negatively affect private investment. On the other hand, government investments in the form of provision of physical infrastructures, and essential health and education services can support private investment (Devarajan et al., 1996; Khan, 2014). Supportive institutional quality is also important for investment (Svensson, 1998;

[10] For details on the derivation procedure refer to Blejer and Khan (1984)

Buchanan et al., 2012). As for the international reserves, following the discussion in the previous section, the direction of the relationship with the domestic investment is debatable.

For the empirical analysis, the estimation equation applied is:

$$PI = f\{Y, CoC, IR, GI, IQ\} \tag{2.7}$$

where PI is private investment, and the explanatory variables, with the expected sign of the coefficients given in parentheses, are listed below:

$Y(+)$	output
$CoC(-)$	cost of capital
$IR(+/-)$	international reserves
$GI(+/-)$	government investment
$IQ(+)$	institutional quality

2.4. Data

2.4.1. Sources

Most of the data are compiled from the World Bank and the International Monetary Fund (IMF) databases.[11] Considering the data availability, the balanced panel data set used for the regression analysis consists of 58 countries,[12] which covers the recent period of 2000 – 2014. These countries accounted for more than 70% of the total

[11] World Bank database: https://datacatalog.worldbank.org/dataset/world-development-indicators; IMF database: http://data.imf.org/?sk=4C514D48-B6BA-49ED-8AB9-52B0C1A0179B

[12] **Advanced economies:** Australia, Czech Republic, Israel, Japan, South Korea, Singapore, Switzerland, United Kingdom, United States; **Emerging markets:** Albania, Algeria, Argentina, Armenia, Azerbaijan, Belarus, Botswana, Brazil, Bulgaria, Chile, China, Costa Rica, Dominican Republic, Egypt, Arab Rep., Guatemala, Hungary, India, Indonesia, Lebanon, Macedonia - FYR, Malaysia, Mauritius, Mexico, Namibia, Panama, Paraguay, Peru, Philippines, South Africa, Swaziland, Thailand, Ukraine, Uruguay; **Developing countries:** Bangladesh, Bolivia, Gambia, Haiti, Honduras, Kenya, Republic of Kyrgyz, Moldova, Mozambique, Nigeria, Rwanda, Sierra Leone, Tanzania, Uganda, Vietnam. The country grouping is based on the IMF classification. Countries that use the Euro as the common currency are not included in the sample because the foreign exchange reserves are managed by the European Central Bank, not by individual countries.

reserves in the world during this period and are representative of global trends in reserve accumulation during this period. For private investment, these countries cover 67% of total private investment recorded in the database during this period.

Data on private and government investment are from the IMF Investment and Capital Stock Dataset.[13] Data on international reserves (total reserves net of monetary gold) is obtained from the International Financial Statistics (IFS) database. Gold is excluded because it is less liquid compared to other assets that are classified as reserves. The institutional quality variable is represented by the control of corruption index obtained from the Worldwide Governance Indicators (World Bank).[14] Data for other variables are extracted from the World Bank's World Development Indicators (WDI) and the IMF's World Economic Outlook (WEO).

The cost of capital index (CoC) is constructed using the deflator of gross fixed capital formation and GDP, and the bank lending interest rate from WDI. The depreciation rate is estimated from the IMF investment and capital stock dataset. For the expected inflation of capital goods, one period lag of gross fixed capital formation deflator is utilised.

As discussed in the previous section, the investment function was derived for a representative profit-maximizing firm which may not be perfectly suitable to estimate the country level aggregate investment since in the national account, GDP

[13] The investment and capital stock dataset provides the nominal GDP in local currency unit and GDP in constant 2011 international dollars, which is used to derive the implicit conversion factor (https://www.imf.org/external/np/fad/public- investment /#5).
[14] The missing observation for year 2001 is approximated by the average of observation in year 2000 and 2002.

which is the proxy used for output, include domestic investment. Therefore, the output variable used here is constructed by deducting domestic investment from GDP to better reflect the domestic demand that is more relevant for the determination of investment.

In estimating the model, GDP (net of investment), private investment, and international reserves are converted to constant 2011 international dollars and then transformed into natural logarithms. The logarithms transformation also applied to the cost of capital. The government investment enters the estimation as a ratio to GDP to address potential collinearity problem in the estimation, while the corruption index enters the estimation without any transformation.

2.4.2. A first look at the data

In general, the level of private investment in the countries covered in this study during the sample period (2000-2014) shows an increasing trend. When countries are grouped by income levels, the increasing trend of domestic private investment is much faster in emerging and developing economies compared to the high-income countries. Between 2000 and 2014 the amount of investment in the two former groups of countries has increased by about fourfold. Meanwhile, for high-income countries, there was a modestly increasing trend in the period 2000-2007 followed by a sharp decline during the global financial crisis, and the returning to pre-crisis levels by 2014 (Figure 2.1, left panel).

As for the foreign reserves, the largest increase occurred in emerging economies. The increase was mainly driven by China. China's foreign reserves

holding represents almost 50% of the sample's foreign reserves position or equivalent to almost 60% of emerging economies' foreign reserves. Other Asian countries, especially those affected by the 1997-98 financial crisis have generally indicated faster reserve accumulation, though from low initial bases. Meanwhile, foreign reserves for other countries have also increased, but at a lower rate (Figure 2.1, right panel).

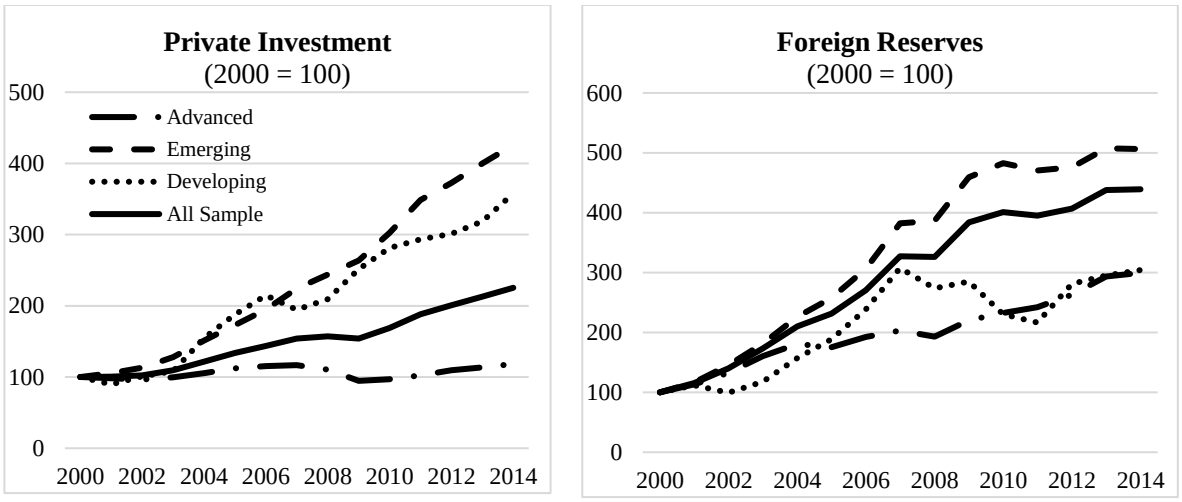


Figure 2.1 Private investment and foreign reserves 2000 - 2014

Source: Data compiled from the IMF and World Bank

Government investment also shows an increasing trend in emerging and developing economies (Figure 2.2 – left panel). For advanced economies, the level of government investment is relatively stable and showed a positive trend in the period of the global financial crisis in 2008 - 2010. The slight increase in the level of government investment during this period could be related to the initiative to withstand the economic slowdown by increasing public spending.

The cost of capital index moved relatively steady over the sample period showing, on average, a gradually declining trend. From the aspect of volatility, the

movement of the cost of capital in developing countries is more dynamic compared to other groups of countries (Figure 2.2 – right panel).

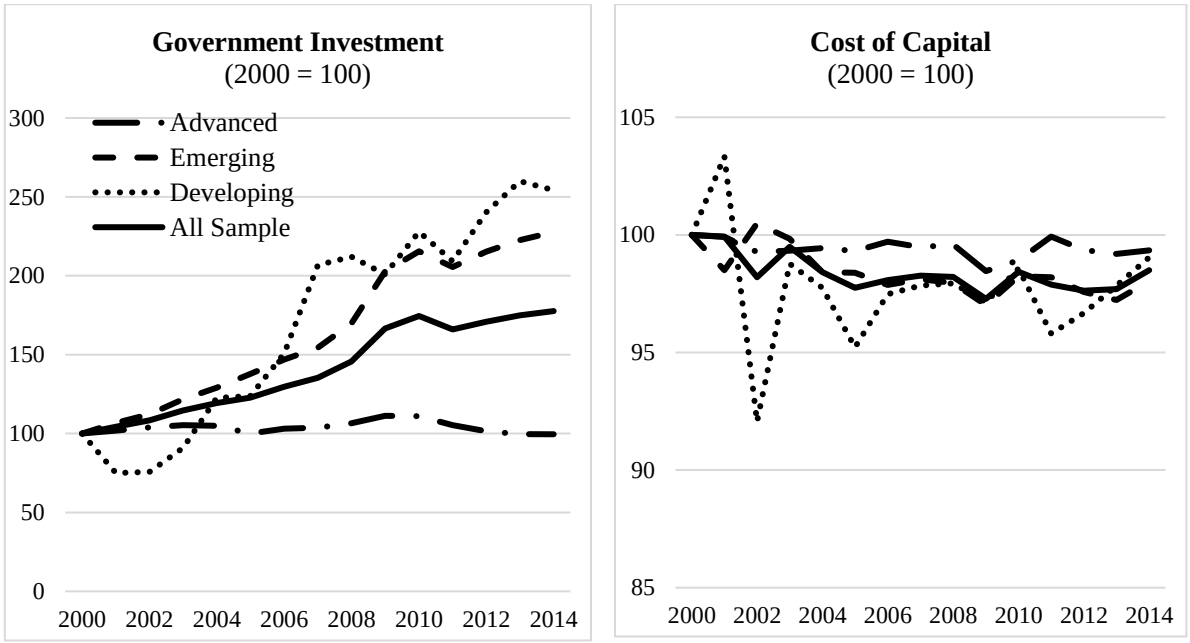


Figure 2.2 Government investment and cost of capital 2000 – 2014

Source: Data compiled from the IMF and World Bank and author's calculation

2.5. Estimation method

The model is estimated using the dynamic panel time-series approach (Pesaran, 2015). This approach is suitable for capturing cross-sectional feature among countries and the dynamic interaction between investment and international reserves in an autoregressive distributed lag (ARDL) model setting. The ARDL specification has the advantage of capturing seperately the effects of both the level and changes of international reserves on investment, while allowing for differences in time lag involved. Additionally, as explained in Pesaran (2015), the models have '*the advantage that they are robust to integration and cointegration properties of the regressors, and for sufficiently high lag-orders could be immune to the endogeneity problem, at least as far as the long-run properties of the model are concerned*'.

There are three alternative ARDL estimator suitable for datasets with a relatively large observation of *N* groups and *T* periods.[15] The mean group (MG) estimator estimates individual regressions for each group and therefore allows for coefficient heterogeneity both in the long and short-run part of the ARDL model. The dynamic fixed effect (DFE) estimator pools data from different panels into one panel, resulting in homogenous slope coefficients and error variances while only allowing heterogeneity in the intercept term. The pooled mean group (PMG) estimator forms the middle ground of MG and DFE. It presumes homogeneity for the long-run coefficients while allowing for heterogeneity in the short-run coefficients (including the error correction term coefficient) (Pesaran et al., 1999).

The autoregressive distributed version with one period lag[16] of Equation (2.7) takes the following form,

$$\begin{aligned} PI_{it} = \; & \mu_i + \delta'_{Y,0} Y_{i,t} + \delta'_{Y,1} Y_{i,t-1} + \delta'_{CoC,0} CoC_{i,t} + \delta'_{CoC,1} CoC_{i,t-1} + \delta'_{IR,0} IR_{i,t} \\ & + \delta'_{IR,1} IR_{i,t-1} + \delta'_{GI,0} GI_{i,t} + \delta'_{GI,1} GI_{i,t-1} + \delta'_{IQ,0} IQ_{i,t} \\ & + \delta'_{IQ,1} IQ_{i,t-1} + \gamma_i PI_{i,t-1} + \varepsilon_{it} \end{aligned} \tag{2.8}$$

where μ_i denotes the country fixed effects. By gathering the control variables in matrix X, the dynamic panel model with the long-run and short-run relation can be expressed as follows:

$$\Delta PI_{it} = \vartheta_i \left(PI_{i,t-1} - \beta'_i X_{i,t-1} \right) + \delta'_{1i} \Delta X_{i,t} + \mu_i + \varepsilon_{it} \tag{2.9}$$

[15] Relatively large N groups compared to time series standard and relatively large T periods compared to panel standard.

[16] It is standard practice to use one period lag when working with annual data. As stated below, in this study an optimal lag length of one is also consistent the Schwarz criterion.

where $\Delta PI_{it} = PI_{it} - PI_{i,t-1}$, $\vartheta_i = -(1-\gamma_i)$, and β_i' is the sum of $\delta_{p,q}'$ in equation (8) normalized by $1-\gamma_i$. β_i' and δ_{1i}' is the explanatory variables' long-run and short-run parameter respectively. The coefficient ϑ_i represents the error correction term, which implies the existence of cointegration if it is negative and significant.

Before estimating the model, it is important to check the time-series properties of the data. The panel data set used in this study has a larger number of countries compared to the period (N>T). A panel unit root testing method that is suitable for this data characteristic is the Harris and Tzavalis (1999) procedure. Based on the test result (Table 2.1), most of the variables (private investment, international reserves, and GDP) are non-stationary. In the model, investment is determined by the combination of output, cost of capital, and other factors. Therefore, the combination of variables with different unit root properties could form a cointegration relation. Given the mixed unit root characteristic of the data series, the panel ARDL is applicable with both the level and differenced variables in the estimation.

Table 2.1 Unit root test using Harris – Tzavalis method

Variables	Test Statistics			
	Level		First Difference	
	Constant	Constant & Trend	Constant	Constant & Trend
Private investment	0.836	0.513	-0.044***	0.000***
International reserves	0.844	0.557	-0.106***	-0.067***
GDP	0.959	0.615	0.177***	0.259***
Cost of capital	-0.122***	-0.244***	-0.525***	-0.525***
Government investment / GDP	0.723***	0.496**	0.058***	0.082***
Institutional quality	0.763*	0.461**	-0.161***	-0.105***

Note: ***, **, * respectively denotes rejection of the null hypothesis of panels contain unit root at 10%, 5%, and 1% significance level. The test employs the small sample adjustment option.

Source: Author's calculation

2.6. Results and discussion

Bivariate relationship between domestic investment and foreign exchange reserve is first estimated as a benchmark. The control variables are then added successively. All equations are estimated using the three dynamic panel estimators. An optimal lag length of one is selected based on the Schwarz criterion. The results based on the three estimators are broadly similar, but the estimates based on PMG are preferred in terms of the consistency with the analytical priors and the statistical properties. The Hausman test results confirm that the homogeneity assumption in the long-run element of the PMG estimator is acceptable. This implies that PMG estimators are consistent and more efficient compared to MG estimator. Compared to the DFE estimator, PMG is preferred in terms of better performance in capturing the data variability.

The PMG estimates are reported in Table 2.4. The alternative estimates of MG and DFE are given in the Appendix (Table 2A.1 and Table 2A.2) for comparison. The descriptive statistics and the correlation matrix of the variables are provided in Table 2.2 and Table 2.3 to facilitate interpretation of the results.

Table 2.2 Descriptive statistics

Variables	Unit	Mean	Standard Deviation	Min	Max
Private investment	2011 PPP international $, billions	160.99	469.77	0.05	4,662.31
International reserves		152.62	592.44	0.00	6,447.58
GDP		704.15	1,851.60	1.62	13,273.40
Cost of capital	Index	280.84	16.99	0.00	496.38
Government investment / GDP	Ratio	0.06	0.05	0.00	0.33
Institutional quality	Index	-0.12	0.91	-1.72	2.33

Note: Number of observations: 870 (58 countries)

Source: Author's calculation

Table 2.3 Correlation between variables

Variables	PI	IR	GDP	CoC	GI	IQ
Log of private investment (PI)	1					
Log of international reserves (IR)	0.74	1				
Log of GDP	0.97	0.75	1			
Log of cost of capital index (CoC)	0.05	0.06	0.04	1		
Government investment / GDP (GI)	0.06	0.22	0.03	0.02	1	
Institutional quality index (IQ)	0.39	0.28	0.32	0.02	0.03	1

Source: Author's calculation

According to the baseline regression (column 1 in Table 2.4), one percent increase in reserve levels is associated with a 0.16 percent contraction in private investment in the short-run, but 0.92 percent increase in the long-run. Both coefficients are statistically significant at the 1% level. When control variables are successively added, the magnitude of the coefficients reduce as expected, but the signs remain unchanged, and the significance of the short-term coefficients diminishes. According to the full model (column 5 in Table 2.4), the long-run coefficient estimated is positive and statically significant at the 1% level, suggesting that one percentage change in reserves is associated with 0.1 percent increase in domestic private investment. By contrast, the short-run coefficient, which is significant only at the 10% level, suggest a milder negative association of reserve accumulation on investment (- 0.06). All the average error correction terms are negative and significant across all specifications with a range of -0.3 to -0.2. Thus, the results suggest that the overall (steady-state) relationship between reserve accumulation and private investment is positive: a mild negative short-run relationship is counterbalanced by a stronger positive relationship in the long-run with the adjustment period of 3 to 5 years.

The long-run coefficients of all control variables have the expected signs, and most of them are statistically significant. The output is positively and significantly associated with domestic private investment. As for the cost of capital variable, the coefficients across all specifications are statistically significant with the expected

negative sign[17]. The ratio of government investment to output has a positive association in the long-run. This is consistent with the nature of government investments that have a relatively long gestation period such as infrastructure, education, and health facilities where the benefits are not realized instantly. Finally, the results suggest a positive long-run association between improvement in institutional quality and private investment.

For the short-run coefficients, some coefficient signs are not in-line with the analytical framework. The inconsistencies may be related to the feature of PMG estimation where the short-run dynamics are determined by the estimated lag structure together with the error-correction parameter for a specific country (Gemmel et al., 2016). Also, Pesaran et al. (1999) caution that, unlike the long-run PMG parameters which are consistent and converge to their asymptotic value in a relatively short time, the time needed for the short-run parameters to converge is longer. Therefore, given these possible noises, it is not possible to interpret these coefficients with confidence.

The results run counter to the previous studies that have reported a negative association between domestic investment and the accumulation of international reserves. This divergence could be owing to different sample coverage, both in terms

[17] There is a possibility that international reserves impact on investment through the cost of capital. If this is the case, the inclusion of cost of capital a an explanatory variable would alter the coefficient of the reserve variable. However, based on the result in column 2 and 3 on Table 2.4, adding the cost of capital variable to the estimation only have little effect to the coefficient. This implies there are other ways of reserves affecting investment that are not covered by the variables included in the cost of capital index.

of country and period, methodology, variable measurement, and control variables included in the estimation. However, the results are consistent with that of Fukuda and Kon (2012) who find a positive relationship between reserves accumulation and domestic investment through lower cost of investment finance. As discussed previously (in Section 2.2), other possible channels could be related to this phenomenon. For instance, a high level of reserves enables countries to intervene in the foreign exchange market and maintain the competitiveness of its tradable sector, which in turn deliver a higher demand for investments. Another possible channel is with adequate reserves, firms could allocate less precautionary savings and able to distribute more expenditure for investments. Moreover, the accumulation of international reserves will be more likely to have a negative effect on investment through domestic liquidity contraction only if it is fully sterilized.

Table 2.4 Determinants of private investment: PMG estimation

Variable	Pooled Mean Group Estimation				
	1	2	3	4	5
Dependent variable: Δ Log of private investment					
Long-run coefficients					
Log of reserves	0.923***	0.274***	0.253***	0.156***	0.101***
	(0.019)	(0.027)	(0.026)	(0.02)	(0.024)
Log of GDP		0.999***	1.038***	1.299***	0.707***
		(0.058)	(0.054)	(0.04)	(0.053)
Log of cost of capital			-0.486*	-0.525**	-1.065***
			(0.255)	(0.21)	(0.163)
Govt. investment / GDP				2.635***	1.103**
				(0.381)	(0.429)
Institutional Quality					0.49***
					(0.033)
Short-run coefficients (average)					
Δ Log of reserves	-0.166***	-0.083**	-0.065*	-0.056	-0.064*
	(0.04)	(0.036)	(0.037)	(0.034)	(0.035)
Δ Log of GDP		-0.707*	-0.741*	-0.862**	-0.483
		(0.428)	(0.421)	(0.336)	(0.345)
Δ Log of cost of capital			-0.05	-0.186	-0.251
			(0.276)	(0.261)	(0.343)
Δ Log of Govt. investment / GDP				-3.142***	-2.681***
				(1.02)	(1.009)
Δ Institutional Quality					-0.07
					(0.087)
Dummy GFC (2007-2009)	-0.077***	-0.049*	-0.053*	-0.025	-0.014
	(0.029)	(0.028)	(0.029)	(0.028)	(0.034)
Constant	-0.002	-0.703***	0.081**	-0.186***	1.195***
	(0.028)	(0.119)	(0.039)	(0.069)	(0.255)
Error correction term	-0.236***	-0.297***	-0.297***	-0.261***	-0.216***
	(0.037)	(0.045)	(0.047)	(0.052)	(0.049)
Observation	754	754	754	754	754
Countries	58	58	58	58	58
R square	0.70	0.70	0.72	0.78	0.83
Adjusted R square	0.57	0.51	0.48	0.53	0.55
F Statistic	5.23	3.70	3.00	3.04	2.98
Prob > F	0.00	0.00	0.00	0.00	0.00
Hausman Test MG vs PMG (Chi^2 p-value)	0.43	0.86	0.83	1.00	1.00

Note: ***, **, * respectively denotes 1%, 5%, and 10% level of significance. The standard errors are reported in parentheses. The long-run coefficients have already adjusted by the error correction term. The GDP variable does not include private and public investments. The cost of capital included is lagged by one period with the assumption of investment decision is based on the cost reflected in the previous year. The Hausman test uses the covariance matrix based on the estimated disturbance variance from the efficient estimator (PMG). Using the covariance matrix based on the consistent estimator (MG) does not change the conclusion.

Source: Author's calculation

2.6.1. Robustness check

A series of diagnostic post-estimation test was conducted on the full model (column 5 in Table 2.4) to evaluate the misspecification of the functional form, residual heteroscedasticity, non-normality and the serial correlation of the residual. The Ramsey specification test shows that out of 58 countries, only eight do not pass the critical value for the functional form. Two countries do not pass the heteroscedasticity test that is conducted using the Breusch-Pagan (BP) approach. All countries pass the non-normality test of the residual (Jarque-Berra test) and the Lagrange Multiplier (LM) test for the serial correlation. Considering the heterogeneity of the countries in the sample and the assumptions placed by the estimator, based on this result, the author considers the neoclassical model specification augmented with all the control variables estimated using PMG approach is acceptable.

To evaluate the robustness of the estimates, a sensitivity test is done by estimating the full model using PMG estimator by dividing the 58 countries into two groups. The results are reported in Table 2.5. Compared to the estimation result using the full sample, changing the sample does not alter the direction of the international reserves coefficient in the long and short-run. The sensitivity test starts by only using emerging and developing countries as the sample. In the next estimation, exclusion of China (the country with the largest stock of international reserves) from the emerging and developing countries sample does not have a significant impact on the coefficients of interest.

The variables used to estimate the regressions in this chapter has already been carefully constructed to minimize susceptibility to endogeneity. As explained in the

data section, the output variable used in the estimation does not include domestic investment. The possibility of collinearity between output and government investment is also addressed by using the ratio of government investment to GDP instead of its level. The cost of capital variable entered estimation with one lag, assuming that private investors make their decision based on last year's cost of capital. The key explanatory variable of interest, reserves accumulation, is considered to be exogenous since the monetary authority does not consider investment as a factor in determining the level of reserves required. The exogeneity of reserves accumulation with respect to investment is confirmed by the empirical finding in Reinhart et al. (2016).

Another way to check whether the PMG estimation is affected by endogeneity is by augmenting the lags of regressors and dependent variables to make sure the residuals are serially uncorrelated and reduce the bias. Pesaran et al. (1999) assert that for the inference of the long-run parameters, an augmentation of the order of ARDL model can correct both for the endogenous regressors and residual serial correlation. However, considering the data availability, it is not possible to apply this to all the specifications. The comparison between coefficients estimated using the recommended lag and the augmented lag does not show a significant difference for most cases.

Finally, alternative estimation of the investment equation was undertaken using the system-generalized method of moments (GMM) estimator to check the consistency of the result. This approach aims to overcome the problem of endogeneity by using internal instrumental variables to replace potentially endogenous

regressors.[18] The results reported in Appendix (Table 2A.3) to support the inference of positive long-run association between the reserves and domestic private investment. The *p*-value of the second-order autocorrelation test and the Hansen overidentifying restriction test confirm the internal instruments used for all the regression are statistically acceptable.

[18] The system GMM estimated for this study follows the DFE specification due to the assumption of slope homogeneity both in the long-run and short-run.

Table 2.5 Determinants of private investment: Sensitivity test

Variable	Pooled Mean Group Estimation		
	All Sample	Emerging & Developing	Emerging & Developing excl. China
Dependent variable: Δ Log of private investment			
Long-run coefficients			
Log of reserves	0.101***	0.122***	0.112***
	(0.024)	(0.028)	(0.027)
Log of GDP	0.707***	0.666***	0.689***
	(0.053)	(0.063)	(0.061)
Log of cost of capital	-1.065***	-1.003***	-1.023***
	(0.163)	(0.17)	(0.167)
Govt. investment / GDP	1.103**	1.695***	1.456***
	(0.429)	(0.524)	(0.494)
Institutional Quality	0.49***	0.461***	0.463***
	(0.033)	(0.036)	(0.035)
Short-run coefficients (average)			
Δ Log of reserves	-0.064*	-0.069*	-0.072*
	(0.035)	(0.04)	(0.041)
Δ Log of GDP	-0.483	-0.8**	-0.823**
	(0.345)	(0.356)	(0.362)
Δ Log of cost of capital	-0.251	-0.401	-0.417
	(0.343)	(0.364)	(0.372)
Δ Log of Govt. investment / GDP	-2.681***	-2.328**	-2.358**
	(1.009)	(1.117)	(1.14)
Δ Institutional Quality	-0.07	-0.098	-0.104
	(0.087)	(0.102)	(0.104)
Dummy GFC (2007-2009)	-0.014	-0.014	-0.014
	(0.034)	(0.04)	(0.041)
Constant	1.195***	1.268***	1.311***
	(0.255)	(0.264)	(0.272)
Error correction term	-0.216***	-0.241***	-0.248***
	(0.049)	(0.054)	(0.055)
Observation	754	637	624
Countries	58	49	48
R square	0.83	0.83	0.83
Adjusted R square	0.55	0.64	0.65
F Statistic	2.98	4.42	4.58
Prob > F	0.00	0.00	0.00

Note: ***, **, * respectively denotes 1%, 5%, and 10% level of significance. The standard errors are reported in parentheses. The long-run coefficients have already adjusted by the error correction term. The GDP variable does not include private and public investments. The cost of capital included is lagged by one period with the assumption of investment decision is based on the cost reflected in the previous year.

Source: Author's calculation

2.7. Conclusion

This chapter has examined the association of international reserve accumulation with domestic private investment while controlling for the fundamental drivers of investment. The econometric analysis involved estimating an investment equation based on a panel data set covering 58 countries over the period 2000–2014, using an estimation method that helps to delineate short-run and long-run associations while allowing for country-specific heterogeneity.

The findings suggest that one percentage point change in reserves is associated with a 0.1 percent increase in private domestic investment, which more than counterbraced a mild negative association in the short-run. The findings are robust to the estimation of investment function with various combinations of explanatory variables and different sample compositions.

Overall, the results provide support for the policy of relying on reserve accumulation for a cushion against external shock as benefits gained from having a healthy reserve position seems to promote investment in the long run. The mild negative short-run association could represent a cost worth incurring given the favourable long-term relationship and, more importantly, given the individual country's vulnerability to financial crises in this era of financial globalization.

Appendix

Table 2A. 1 Mean Group Estimation

Variable	Mean Group Estimation				
	1	2	3	4	5
Dependent variable: Δ Log of private investment					
Long-run coefficients (average)					
Log of reserves	-2.676	-19.293	0.222	0.805	-0.966
	(3.166)	(19.773)	(0.134)	(1.342)	(1.32)
Log of GDP		40.405	0.608*	1.956	0.604
		(40.017)	(0.271)	(1.148)	(1.683)
Log of cost of capital			-4.577**	4.769	-4.191
			(1.761)	(4.65)	(6.984)
Govt. investment / GDP				-11.458	51.981
				(18.261)	(27.877)
Institutional Quality					-4.857
					(3.731)
Short-run coefficients (average)					
Δ Log of reserves	-0.174***	-0.125	-0.142*	-0.09	-0.521
	(0.047)	(0.065)	(0.061)	(0.11)	(0.287)
Δ Log of GDP		-0.933	-0.868	-1.554	1.936
		(0.48)	(0.507)	(0.838)	(2.382)
Δ Log of cost of capital			0.416	1.179	-0.473
			(0.434)	(0.708)	(1.441)
Δ Log of Govt. investment / GDP				3.351	8.596
				(5.456)	(11.942)
Δ Institutional Quality					0.317
					(0.327)
Dummy GFC (2007-2009)	-0.065**	-0.039	-0.049	-0.092	0.416
	(0.033)	(0.03)	(0.032)	(0.113)	(0.225)
Constant	0.421***	-1.183*	3.18	13.665	-6.077
	(0.155)	(0.486)	(4.249)	(7.195)	(17.716)
Error correction term	-0.439***	-0.545***	-0.604***	-0.769	-0.805
	(0.05)	(0.056)	(0.062)	(0.44)	(0.844)
Observation	754	754	754	754	754
Countries	58	58	58	58	58
R square	0.71	0.87	0.97	1.00	1.00
Adjusted R square	0.53	0.71	0.82	1.00	1.00
F Statistic	3.97	5.61	6.28	n/a	n/a
Prob > F	0.00	0.00	0.00	n/a	n/a

Note: ***, **, * respectively denotes 1%, 5%, and 10% level of significance. The standard errors are reported in parentheses. The long-run coefficients have already adjusted by the error correction term. The GDP variable does not include private and public investments. The cost of capital included is lagged by one period with the assumption of investment decision is based on the cost reflected in the previous year.

Source: Author's calculation

Table 2A. 2 Dynamic Fixed Effect Estimation

Variable	Dynamic Fixed Effect Estimation				
	1	2	3	4	5
Dependent variable: Δ Log of private investment					
Long-run coefficients					
Log of reserves	0.462***	0.555**	0.547**	0.633*	0.609*
	(0.105)	(0.198)	(0.193)	(0.294)	(0.273)
Log of GDP		-0.408	-0.398	-0.526	-0.491
		(0.534)	(0.529)	(0.63)	(0.593)
Log of cost of capital			0.134**	0.144**	0.150**
			(0.042)	(0.051)	(0.054)
Govt. investment / GDP				-3.239	-3.9
				(8.133)	(8.37)
Institutional Quality					0.499
					(0.449)
Short-run coefficients					
Δ Log of reserves	-0.055	-0.058	-0.055	-0.06	-0.061
	(0.035)	(0.036)	(0.036)	(0.038)	(0.039)
Δ Log of GDP		-0.812*	-0.814*	-0.922*	-0.923*
		(0.363)	(0.364)	(0.416)	(0.415)
Δ Log of cost of capital			-0.020***	-0.020***	-0.021***
			(0.004)	(0.004)	(0.004)
Δ Log of Govt. investment / GDP				-0.889	-0.825
				(1.161)	(1.199)
Δ Institutional Quality					-0.034
					(0.066)
Dummy GFC (2007-2009)	-0.053*	-0.064*	-0.064*	-0.060*	-0.060*
	(0.026)	(0.029)	(0.029)	(0.028)	(0.028)
Constant	0.432***	0.738*	0.589	0.661	0.666
	(0.07)	(0.336)	(0.329)	(0.347)	(0.344)
Error correction term	-0.227***	-0.193***	-0.193***	-0.184***	-0.187***
	(0.028)	(0.041)	(0.041)	(0.048)	(0.048)
Observation	754	754	754	754	754
Countries	58	58	58	58	58
R square	0.26	0.20	0.30	0.31	0.32
Adjusted R square	0.19	0.13	0.24	0.25	0.25
F Statistic	39.24	25.06	26.46	22.59	19.12
Prob > F	0.00	0.00	0.00	0.00	0.00

Note: ***, **, * respectively denotes 1%, 5%, and 10% level of significance. The standard errors are reported in parentheses. The long-run coefficients have already adjusted by the error correction term. The GDP variable does not include private and public investments. The cost of capital included is lagged by one period with the assumption of investment decision is based on the cost reflected in the previous year.

Source: Author's calculation

Table 2A. 3 Dynamic Fixed Effect Estimation – System GMM Estimation

Variable	Dynamic Fixed Effect – System GMM Estimation				
	1	2	3	4	5
Dependent variable: Δ Log of private investment					
Long-run coefficients					
Log of reserves	0.64	0.096	0.104	0.119	0.122
	(2.841)	(0.09)	(0.096)	(0.119)	(0.129)
Log of GDP		0.973***	0.972**	0.96*	0.955
		(0.372)	(0.42)	(0.5)	(0.718)
Log of cost of capital			-0.306	-0.3	-0.384
			(0.618)	(0.63)	(0.784)
Govt. investment / GDP				-1.587	-1.769
				(4.28)	(5.064)
Institutional Quality					-0.037
					(0.194)
Short-run coefficients					
Δ Log of reserves	-0.24**	-0.182*	-0.175*	-0.185	-0.184
	(0.099)	(0.097)	(0.092)	(0.119)	(0.122)
Δ Log of GDP		0.3	0.276	0.311	0.318
		(0.823)	(0.738)	(0.805)	(0.802)
Δ Log of cost of capital			0.05	0.05	0.054
			(0.078)	(0.079)	(0.087)
Δ Log of Govt. investment / GDP				0.431	-0.237
				(4.183)	(4.567)
Δ Institutional Quality					0.032
					(0.388)
Dummy GFC (2007-2009)	-0.015	-0.023	-0.023	-0.024	-0.022
	(0.015)	(0.02)	(0.019)	(0.026)	(0.024)
Constant	0.097*	-0.207*	0.0403	0.051	0.116
	(0.057)	(0.106)	-0.588	(0.596)	(0.683)
Error correction term	-0.015	-0.145***	-0.145**	-0.145**	-0.129
	(0.062)	(0.053)	(0.059)	(0.072)	(0.095)
Observation	754	754	754	754	754
Countries	58	58	58	58	58
Arrelano-Bond 2nd order autocorrelation (p-value)	0.53	0.64	0.54	0.56	0.57
Hansen overidentification restriction (p-value)	0.40	0.23	0.20	0.14	0.10

Note: ***, **, * respectively denotes 1%, 5%, and 10% level of significance. The standard errors are reported in parentheses. The long-run coefficients have already adjusted by the error correction term. The GDP variable does not include private and public investments. The cost of capital included is lagged by one period with the assumption of investment decision is based on the cost reflected in the previous year. Instrumented variables: private investment and GDP. Orthogonal deviations and Windmeijer's sample correction options are applied in the estimation.

Source: Author's calculation

3. Real exchange rate misalignment in developing countries: the role of exchange rate flexibility and capital account openness

Summary

This chapter examines the association between the real exchange rate (RER) misalignment, exchange rate flexibility, and capital account openness using a panel dataset for 60 developing countries over the period 1980 – 2014. The analysis is based on an alternative measure of RER that is more consistent with the theoretical concept of RER than the commonly used index, and misalignment estimates that account for country-specific underlying factors. The results suggest that the exchange rate regime and capital account policy are significantly related to the degree of persistence and the magnitude of RER misalignment.

3.1. Introduction

The real exchange rate (RER), defined as the relative price between tradable and non-tradable goods, is one of the key variables of an open economy. Given the increasing interconnectedness of economic activity across borders in this era of financial globalization, a thorough understanding of RER behaviour is crucial for macroeconomic policy formulation (Edwards, 2018). RER undervaluation can accelerate economic growth by compensating for disadvantages in international competitiveness arising from poor institutional quality and market imperfections, which are common in developing economies (Guzman et al., 2018; Rodrik, 2008; Williamson, 2009).

Alternately, overvalued RER has important implications for the economy, especially in regard to macroeconomic stability. A survey by Frankel and Saravelos (2012) has shown that RER overvaluation is one of the most accurate leading indicators of an economic crisis. Their finding is further confirmed by the work of Gnimassoun and Mignon (2015), who show that the persistence of current account disequilibria is related to the overvaluation of the real exchange rate. Further investigations into the relationship between RER misalignment and economic growth confirm that there is a negative and significant relationship between economic growth and substantial RER misalignments from the equilibrium value regardless of whether the misalignment takes the form of overvaluation or undervaluation (Aguirre and Calderón, 2005; Schröder, 2013).

There is a vast and growing literature on RER misalignment and its economic implications.[19] The purpose of this study is to examine the implications of two important aspects of RER management that have so far received limited attention in this literature, namely exchange rate regime choice and the degree of capital account openness. The empirical analysis covers 60 developing economies for the period of 1980-2014.[20]

When compared with previous studies, this chapter introduces four methodological improvements. Firstly, the RER index is measured as the ratio of the trade-weighted wholesale price index of trading partner countries expressed in domestic currency and the domestic GDP deflator. This formulation is more consistent with the original concept of RER compared to the commonly used consumer price index (CPI)-based RER index (Edwards, 1989; Athukorala and Rajapatirana, 2003).

Second, the RER misalignment is measured using individual country regression instead of the widely used panel or cross-section approach that uses a homogenous cross-country equation. This approach is considered to be less prone to producing an inconsistent proxy of RER misalignment since the underlying determinants of the real exchange rate movement are mostly country-specific (Schröder, 2013).

[19] For comprehensive surveys of this literature see Burstein and Gopinath (2014), Chinn (2002), MacDonald and Taylor (1992).
[20] This focus on developing countries is due to the variation of institutional qualities, the stage of development of the financial markets, and their relatively limited level of integration in the international monetary system when compared to advanced economies.

Third, for estimating the RER function, the determinants considered not only real fundamental variables as mostly postulated in the particular strand of literature but also variables relating to the financial sector (Barbosa et al., 2018; Kaltenbrunner, 2015; Rey, 2015).

Finally, in generating the sustainable values of the fundamentals, a modified HP filter procedure that endogenously determines the most appropriate smoothing parameter based on individual data characteristics is applied (Hanif et al., 2017).

Exchange rate movements and capital flows play an important role in RER dynamics. In a policy regime that limits the exchange rate movement in response to market forces, the process of RER adjustment relies on changes in relative prices, which most likely to occur slowly due to rigidities in the domestic economy (Corden, 1994). It is possible for the authorities to peg the exchange rate at a certain level and apply a sterilized-intervention strategy to manage domestic macroeconomic stability. However, there is evidence that this strategy is unsustainable (Calvo, 1991; Helleiner, 1997). As for the capital account policy, the degree of openness for capital flows is likely to have an effect on the RER adjustments through movements in the nominal exchange rate or by the changes in the non-tradable prices (Calvo et al., 1993; Calvo et al. 1996). Considering the possible implications of the exchange rate and capital flows policies on the RER dynamics, it is important to evaluate both policies simultaneously, since evaluating the role of one policy without controlling the other may introduce bias to the interpretation of the association.

The existing empirical evidence on how the exchange rate regime and the capital account management interact with the RER misalignment is inconclusive. A

study by Combes et al. (2012) covering 42 emerging and developing countries during 1980-2006 concludes that capital inflows appreciate the RER and that having a flexible exchange rate regime inhibits appreciation. Another empirical observation involving 51 developing countries over the period of 1980-2010 by Nouira and Sekkat (2015) found that both fixed and floating exchange rate regimes are associated with lower real exchange rate misalignment compared to the intermediate regime. Investigation using a propensity score matching approach by Libman (2018) reach a conclusion that the pegged exchange rate regime is more likely to be associated with overvaluation of the real exchange rate. Montecino (2018) also explores this issue by focusing on the contribution of capital control on the persistence of RER misalignment using data for 77 developed and developing countries during the 1980-2011 period. His results suggest that capital controls exacerbate RER misalignment, especially under the pegged and managed floating exchange rate regimes.

There is strong evidence from the empirical analysis of this chapter that a policy configuration with a relatively more flexible exchange rate and liberal capital account contributes significantly to limiting the persistence of RER misalignment and associated with a larger magnitude of misalignments, both in the form of undervaluation and overvaluation. This interpretation is robust to alternative specification of the model, time and sample coverage. The findings also confirm that estimating RER misalignment at the individual country level by paying attention to country-specific factors, rather than employing the widely used cross-country approach yields economically more plausible and consistent results.

The chapter is structured as follows. The second section covers the RER misalignment estimation that includes discussions on the specification of the RER function, estimation method, data and comparison on the individual against the multi-country estimation results. The estimated RER misalignment is used in the third section to examine the association between RER misalignment with the exchange rate regime and capital flows management policy using alternative variables and specifications. The chapter closes in the fourth section with a summary of the key findings.

3.2. The RER misalignment estimation

The RER misalignment is defined as the deviation of the observed RER from the path of equilibrium RER (ERER). Conceptually, the ERER is described as the RER level that maintains the economy in internal and external balance under the sustainable values of exogenous and policy variables. The internal balance is achieved when markets for nontraded goods clear under full employment. The external balance is related to the current account dynamics of the economy and the balance holds when the country's net creditor position in the global financial market has reached its steady state. In other words, the external balance is defined as a condition where the current account deficit is financed by sustainable capital flows.

3.2.1. The model of RER determinants

The RER (denoted here by e) is defined as the ratio of tradable and non-tradable goods prices. It measures a country's international competitiveness: the relative cost of producing tradable goods domestically compared to its trading partners. The level of

e that maintains the economy in internal and external balance is defined as the ERER (e^*). The internal balance in the economy is achieved when the markets for nontraded goods clear as represented by the following equation:

$$y_N(e, \varepsilon) = c_N + g_N, \quad \partial y_N/\partial e < 0, \partial y_N/\partial \varepsilon < 0 \tag{3.1}$$

where y_N is the output of non-tradable goods when the economy is in full employment and c_N is the total private spending for non-tradables measured in tradable goods, while g_N is the portion of government expenditure for non-tradables. The supply of non-tradable goods is determined by the dynamics of the productivity variable (ε) for the tradable sector. A positive shock of ε increases the supply of tradable goods while decreasing the output of non-tradables at a given relative price. From equation (3.1), an increase in the demand for non-tradable goods will require the non-tradables price to increase relative to the tradables price (or RER appreciation) in order to increase the supply of non-tradables and/or increase the demand for tradables, hence maintaining the internal balance (Baffes et al. 1999).

The economy attains external balance when the current account balance matches with the country's net creditor position in the global financial markets. This equilibrium condition is given by the following equation:

$$\dot{f} = b + z + rf = y_T(e, \varepsilon) - g_T - \theta c + rf + z, \qquad \partial y_T/\partial e > 0, \partial y_T/\partial \varepsilon > 0 \tag{3.2}$$

where $\dot{f}$ represents the current account balance (defined as the changes in the net foreign assets), which consists of trade balance (b), net foreign transfer (z), and net income from the foreign asset f (the real yield on foreign asset is represented by r). g_T and θ are respectively government expenditure and the share of private expenditure

for tradable goods from total private spending (c). The trade balance is defined as the difference between the total supply of tradable goods in the economy and the domestic absorption that consists of private and government expenditure on traded goods.

Assuming that the yield and the level of foreign assets are in the steady-state and by setting the left-hand side of equation (3.2) to zero and utilizing equation (3.1), the ERER (e^*) can be expressed in the following form:

$$e^* = e^*\left(g_N, g_T, [r^* f^* + z], \varepsilon\right) \tag{3.3}$$

where "*" represents the steady-state values of the variables. Based on the partial derivatives of equation (3.3), an increase (decrease) of government expenditure for non-tradables (or tradables) goods results in RER appreciation (or depreciation). Improvement in the net creditor position or productivity in the production of tradable goods is associated with RER appreciation. Equation (3.3) also shows that the ERER is a constant provided that the fundamental variables are stationary, which corresponds to the purchasing power parity approach where the ERER refers to a certain level in a certain period.

However, if the fundamental variables are not stationary, then the ERER follows a certain path instead of a constant level. In general, as shown by Edwards (1989), Rogoff (1996), and Taylor and Taylor (2004), theoretical and empirical approaches using different methods, sample periods and various price indices are more in support of a non-stationary path of equilibrium RER. In the following section,

RER is used in place of *e* to be consistent with the standard practice in the empirical literature.

3.2.2. The RER function

For estimating RER misalignment, the equilibrium real exchange rate (ERER) is estimated using parameters derived from a representative RER function and sustainable values of its determinants. As discussed, the observed RER is the relative foreign and domestic price adjusted for changes in the nominal exchange rate, It is, therefore, important to consider the fundamental drivers that affect the nominal exchange rate and the domestic price (assuming foreign price exogeneity) in the RER function. The RER function specification in this study corresponds to the model discussed in the previous subsection that incorporates real fundamental factors represented by government expenditure, productivity, terms of trade, and trade openness (Edwards, 1989). To accommodate the potential influences coming from domestic and global monetary variables in the RER dynamics, the specification is augmented with the inclusion of net foreign assets, financial sector openness, real interest rate gap between the domestic economy and the US, and domestic real interest rate (Barbosa et al., 2018; Kaltenbrunner, 2015). The estimation equation is specified as follows (with the expected sign of the coefficients in brackets):[21]

$$RER = f(GEXP, PROD, TOT, OPEN, NFA, RIR, DRIR, FINOP), \qquad (3.4)$$

(+/-) (-) (+/-) (+) (+/-) (+/-) (+/-) (+/-)

[21] A positive (+) direction of association indicates that an increase of a variable is expected to be followed by RER depreciation while a negative (-) direction indicates that an increase of a variable is expected to be followed by RER appreciation.

where *RER* = the real exchange rate,

GEXP = government expenditure,

PROD = productivity,

TOT = terms of trade,

OPEN = trade openness,

NFA = net foreign asset,

RIR = real interest rate gap between the home country and the US,

DRIR = domestic real interest rate, and

FINOP = financial sector openness.

Government expenditure (GEXP) generally contains a larger non-tradable component compared to total domestic expenditure. Therefore, an increase in government expenditure in the economy is hypothesised to exert demand pressure for the non-tradables causing their price to increase relative to the tradables (RER appreciation) (Edwards, 1989). In cases where expenditure is skewed towards imported or tradable goods, the RER will need to depreciate to maintain the sustainability of the external balance (Montiel, 1999).

Productivity (PROD) is included to capture the Balassa-Samuelson effect (Balassa, 1964; Samuelson, 1964). Based on the Balassa-Samuelson theorem, productivity growth is assumed to be higher in the tradable sector compared to the non-tradable sector. Under the assumption that the law of one price holds for tradables, the productivity improvements that occur under conditions of full employment and perfect labour mobility increase the absorption of workers from the non-tradables to the tradables sector (supply effect) and therefore drive-up real wages

for all sectors of the economy. Hence, an improvement in productivity is hypothesised to be associated with RER appreciation (Obstfeld et al., 1996).

The terms of trade (TOT) (the relative price of exports to imports) is included to account for the effect of exogenous adjustments in world prices that will influence the RER. Income growth generated by improvements in TOT leads to higher demand for non-tradables. To maintain the equilibrium, the price of non-tradables needs to increase thereby causing the RER to appreciate. However, it is possible to observe RER depreciation under this condition where the substitution effect is larger than the income effect (Edwards, 1989).

A higher degree of trade openness (OPEN) leads to greater demand for tradable goods. To restore equilibrium, the RER is required to depreciate in order to increase the supply for tradable goods or switch the demand from tradable goods towards non-tradables. Therefore, under the assumptions that tradables and non-tradables are substitutes and the substitution effect is greater than the income effect, OPEN is hypothesized to have a positive impact on RER and expected to have a positive sign. (Edwards, 1989).

The net foreign assets (NFA) variable is included in the model to account for the external balance position of the economy. If a country is becoming increasingly reliant on international financing to cover its balance of payments deficit, it needs to generate a larger trade surplus to cover debt servicing for the financing at some point in the future. Therefore, a worsening net foreign assets position is associated with real depreciation (Aguirre and Calderón, 2005; Christopoulos et al., 2012 and Montiel, 2007). However, it is possible to find an opposite relationship in an economy that is in

the process of achieving the desired stock of foreign assets to supplement the financing needed for the domestic economy. In this case, the country may experience RER appreciation alongside the growth of its foreign liabilities (Égert et al., 2004).

The real interest rate gap (RIR) and the domestic real interest rate (DRIR) is included to capture the effect of the foreign and domestic monetary policy stance. A larger gap between the domestic real interest rate and the foreign real interest rate is expected to be associated with an appreciated RER due to inflows of capital. Higher domestic real interest rate is also expected to be associated with the appreciation of the RER. Aside from the nominal appreciation of the exchange rate from the increase of capital inflows, the higher real interest rate could also suppress the inflation of the non-tradables. However, for the two variables, especially in the case of developing countries, it is possible to observe that higher real interest rate is associated with a more depreciated RER if the adjustment in the domestic interest rate is perceived to lead to a higher uncertainty that leads to negative market sentiment (Barbosa et al., 2018 and Kaltenbrunner, 2015).

The openness of the financial sector (FINOP) could affect the domestic intertemporal consumption decisions that affect the equilibrium relative prices with different directions. In other words, the sign of the coefficient of FINOP can go either way. A more open financial sector that provides easy access to external sources of financing could result in an appreciation of the RER and hence the expected sign is negative (Lartey, 2011). By contrast, if the openness of the financial sector tends to take the form of making investment abroad easier (i.e. encouraging capital outflows)

compared to accessing international financing for domestic investment then the expected sign is positive (Edwards, 2000).

3.2.3. Estimation of the RER function

Based on equation (3.4), the equivalent empirical specification for the RER function is expressed as follows:

$$\ln RER_{it} = \beta_i' F_{it} + u_{it} \tag{3.5}$$

where F_{it} is a vector of relevant fundamental variables for country i at time t, and u_{it} is assumed to be stationary and to have zero mean.

Most of the previous multi-country studies of RER misalignment have estimated RER function using data pooled for all countries. This approach assumes homogeneity of the coefficient across countries for the variables used in the equation. The adoption of the homogeneity assumption is prone to produce inconsistent fitted values due to the possibility of some fundamental variable to have a different direction of relationship with the RER, depending on the structure of individual economies (Schröder, 2013). Therefore, in this study RER misalignment is calculated using RER equations estimated for each country.

The estimation method used is the dynamic ordinary least squares (DOLS) approach (Saikkonen, 1991; Stock and Watson, 1993). This method enables the use of variables with different unit root properties in estimating the cointegrating relationship[22] and is suitable for small- sample estimation. By including the leads and

[22] The cointegration approach is supported by the work of De Grauwe and Grimaldi (2006) based on a behavioural exchange rate model. One of the conclusions derived from their study is the changes in exchange rate is cointegrated with its fundamental value although the exchange rate changes are generally detached from the changes in the fundamentals.

lags of the differenced cointegrated variables in the estimation equation,[23] the method addresses the spurious regression problem and reduces endogeneity bias. The cointegrating relationship can be estimated efficiently and consistently by ordinary least squares (OLS) using Newey-West heteroscedasticity standard errors. With leads and lags, the estimation equation takes the following form:

$$\ln RER_{it} = \beta'_{i1} Z_{it} + \beta'_{i2} X_{it} + \sum_{l=-n_2}^{l=n_1} \tau'_{il} \Delta Z_{it+l} + u_{it} \tag{3.6}$$

where n_1 and n_2 are the leads and lags added to the equation and vectors Z_{it} and X_{it} are fundamental variables with I(1) and I(0) unit root characteristic respectively.

Given differences among countries in terms of data availability, estimation is done in two steps. The first step involved testing for unit root property of each variable in each country. Stationary (*I(0)*) variables are categorized as deterministic variables, while *I(1)* variables are categorized as cointegrating variables and their level and differenced leads and lags are added to the estimation. This was followed by estimating the equation using all possible unique combinations of variables[24] and selecting a representative equation that fulfils the following criteria (i) All the cointegrating and deterministic variables must be significant and have the correct signs consistent with the theoretical framework; (ii) The cointegration test (Engle-Granger ADF test and Hansen stability test) confirms a cointegration relationship;

[23] The selection for the length of the leads and lags is based on the minimum information criteria value.
[24] Due to the limitation of the data, the group of cointegrating variables being assessed consists of a combination of at least two variables and up to a maximum of five variables. As for the deterministic variable the maximum combination is limited to two variables at most. Constant and trend are included in the regression if the inclusion improves the information criterion. Maximum leads and lags of 3 are applied.

(iii) If multiple potential equations meet the above criteria, the equation with the minimum value of the info criterion is chosen (Montiel, 2007).

3.2.4. Estimation of the ERER

After estimating the RER equation for individual economies, ERER is computed by using the estimated coefficients (β_i') on the sustainable (trend) component of each cointegrated variables (F_{it}^s), which is extracted using the Hodrick and Prescott (1997) filter (HP filter).

$$\ln ERER_{it} = \beta_i' F_{it}^s \tag{3.7}$$

In the HP filter procedure, the trend and cycle components from a time series are separated by applying a smoothing parameter (λ) to minimize the trade-off between goodness of fit and the degree of smoothness. The standard approach of applying the filter in empirical economic research is to assign a uniform λ across all series for all countries. However, assuming every series in each country has the same cyclical characteristics is very restrictive considering the significance of idiosyncratic shocks in individual countries (Aguiar and Gopinath, 2007; Benhamou, 2018). Another issue with the HP filter approach is the endpoint bias that relates to the specification of the HP filter. By construction, the trend and cycle component computation using the HP filter is sensitive to the start and the end of the series. Therefore, the filtering procedure in this study applies the fully modified HP filter approach developed by Hanif et al. (2017) that addresses these issues. The procedure enables the determination of the lambda parameter endogenously, driven by the character of each series while also minimizing the endpoint bias.

Using the ERER path and the observed RER, the misalignment of the RER for country *i* at time *t* (mis_{it}) is calculated as follows:

$$mis_{it} = \frac{EREER_{it} - RER_{it}}{RER_{it}} \tag{3.8}$$

where negative (or positive) value of mis_{it} implies undervaluation (or overvaluation).

3.2.5. Data

The RER index is constructed as the weighted average of main trading partners' wholesale or producer price indexes expressed in domestic currency relative to domestic price measured by the GDP deflator, using export shares as weights. The calculation for the RER index is expressed as follows:[25]

$$RER_{it} = \prod_{j=1}^{30} \left(\frac{NER_{ijt} \cdot WPI_{jt}}{GDP\ def_{it}} \right)^{w_j} \tag{3.9}$$

where RER_{it} is the RER index for country *i* at time *t* ; NER_{ijt} is the nominal exchange rate of country *j* in the currency of country *i* at time *t*; WPI_{jt} is the wholesale or producer price index of country *j* at time *t*; $GDP\ def_{it}$ is the GDP deflator of country *i* at time *t*; and w_j is the ratio of the export value of country *i* to *j* and the total export value of country *i* to its top 30 export partners using 5-years average. The base year chosen for the index calculation is 2010.

Given the nature of data availability, constructing a RER index consistent with its heretical definition (relative price of non-traded to trade goods) is a challenging

[25] The term real exchange rate (RER) used in this study refers to the real effective exchange rate that is expressed in equation (3.9).

task.[26] Previous studies have commonly used the standard IMF index that uses consumer price index to measure both world (trading partner) price and domestic price in constructing the RER index. The construction of the RER index based on this method is not consistent with the standard definition of the real exchange (Edwards, 1989). The use of CPI to measure foreign (trading partner) price is not theoretically consistent because it covers both tradable and non-tradable goods. Furthermore, in some developing countries, the CPI understates the rate of inflation because of political intervention in the construction of the index and price controls on some essential consumer goods. The GDP deflator is a better indicator of domestic prices for two reasons: presumably, it is less susceptible to political manipulations, and it provides broader coverage of price movement in the economy (Athukorala and Rajapatirana, 2003). The choice of using the export share as the weight for the RER calculation is based on its superiority in representing the country's competitiveness compared to other alternatives such as import shares or total trade share (Warr, 1986).

The data are compiled from IMF's Direction of Trade Statistics (DOTS) and International Financial Statistics (IFS), World Bank's World Development Indicator (WDI), Penn World Table (PWT version 9) (Feenstra et al., 2015), and other sources covering 60 developing countries at yearly basis over the period 1980 - 2014. The list of variable description and sources are available in Table 3.1. A summary of

[26] Engel (1999) and Betts and Kehoe (2008) have shown that even for the US and the EU countries, which have relatively rich databases, it is difficult to precisely delineate tradable and non-tradable price.

descriptive statistics for the variables and the list of countries included in the sample is presented in Appendix (Table 3A.1 and Table 3A.2).

Table 3.1 RER function variables

Variable	Description	Sources
Real exchange rate index (RER)	The index is constructed using the cross-rate between the home country and trade partner, multiplied with the ratio of the trade partner's wholesale/producer price index and home country's GDP deflator. The index is then weighted geometrically using export weights of top 30 exports destinations. By this definition, an (a) increase (decrease) in the REER index indicates depreciation (appreciation).	DOTS (IMF) IFS (IMF) WDI (World Bank)
Government expenditure (GEXP)	There are 4 different definitions used to represent this variable: (1) Govt. consumption/GDP (current price) (2) Govt. consumption/GDP (constant price) (3) (2) + Govt. investment/GDP (constant price) (4) (1) + Govt. investment/GDP (current price)	WDI (World Bank) PWT (Feenstra et al., 2015) Investment and Capital Stock Dataset – (IMF)
Productivity (PROD)	The ratio of the country's GDP per capita with OECD's average GDP per capita. Calculated both in (1) the constant price, and (2) the current price.	WDI (World Bank)
Terms of trade (TOT)	The ratio between the price level of exports and price level of imports.	PWT (Feenstra et al., 2015)
Trade Openness (OPEN)	There are 3 different definitions used to represent this variable: (1) Imports/GDP (WDI – current price) (2) Exports + Imports / GDP (PWT constant price) (3) Exports + Imports / GDP (WDI – current price)	WDI (World Bank) PWT (Feenstra et al., 2015)
Net foreign assets (NFA)	Calculated as (1) net foreign assets / GDP, and (2) net foreign assets / imports.	Lane and Milesi-Ferretti (2018) WDI (World Bank)
Real interest rate gap (RIR)	The difference between domestic and US real interest gap.	WDI (World Bank)
Domestic real interest rate (DRIR)	The difference between the loan interest rate and inflation (GDP deflator).	WDI (World Bank)
Financial sector openness (FINOP)	Calculated using the NFA data based on the following formula (Saadma and Steiner, 2016): (Foreign asset – Reserves) + (Foreign liabilities – public loan) / GDP	Lane and Milesi-Ferretti (2018) WDI (World Bank)

Note: NFA and FINOP variables are included in the RER function with a 1-year lag to prevent bias from reverse causality.

3.2.6. RER misalignment

The estimated RER functions for individual countries are reported in Appendix (Table 3A.2). For the purpose of comparison, a panel DOLS regression estimation result is also provided. The signs of the estimated coefficients are all consistent with the theoretical expectation. Three variables that emerge statistically significant in the RER function for more than 40 countries in the sample are government expenditure, productivity, and trade openness. Net foreign asset, terms of trade, and financial openness also appear significant in more than half of the sample. Real interest rate gap and domestic real interest rate variables are only statistically significant for 12 and 8 countries. Note that there are notable differences among individual-countries in terms of the magnitude and the degree of statistical significance of regression coefficients. There are also some theoretically-consistent sign reversals of the coefficients of some variables. This notable structural heterogeneity of regression estimates supports the *a priori* reasoning for estimating RER misalignment by time-series regression at the country level rather than based on multi-country panel data regression.[27]

There are significant variances in the smoothing parameters, presumably reflecting country-specific characteristics. This justifies the use of fully modified HP filter that enables the determination of the lambda parameter endogenously, driven by the character of each series while also minimizing the endpoint bias.

[27] A referee has correctly noted that regression coefficients of some variables (in particular for terms of trade and productivity) are seemingly abnormally large in a few cases, presumably driven by missing variables. We think that poor data quality and differences in variable measurement in original sources could have been other possible drivers. These are problems commonly encountered in a multi-country econometric analysis of developing countries of this nature.

Figure 3.1 compares estimates of RER misalignment based on the panel DOLS regression and individual country regressions for three selected countries, China, Indonesia, and Malaysia. Based on the results, it can be concluded that the homogeneity assumption inherent in the panel regression can provide misleading misalignment estimates. In the case of China, the panel estimation indicates that the RER is more often experiencing significant overvaluation compared to undervaluation during the 1980-2014 period. For Indonesia and Malaysia, the panel regression results show that in the few years leading up to the 1998 Asian financial crisis, the two countries' RERs are not experiencing overvaluation but undervaluation. The highlighted cases are in sharp contrast with the results of RER estimates for individual countries, which are more consistent with the consensus based on available country-specific evidence (Chinn, 2000; Funke and Rahn, 2005; Athukorala, 2012). Therefore, the RER misalignment estimates based on individual regressions are used for analysis in the following section.

Figure 3.1 RER misalignment for China, Indonesia, and Malaysia

Note: Positive (negative) observations indicate overvaluation (undervaluation) of the RER.

Source: Author's calculation.

3.3. RER misalignment, exchange rate regime and capital account openness

3.3.1. Model

To examine the relationship between the RER misalignment with the exchange rate regime and capital account openness, an empirical strategy combining approaches implemented by Nouira and Sekkat (2015) and Montecino (2018) is applied under a dynamic panel fixed effect regression setting. The use of the panel approach in this stage is driven by the low temporal variety characteristic of the exchange rate regime and capital account openness variables. The model is expressed as follows:

$$mis_{it} = \rho mis_{it-1} + \alpha ER_{it} + \beta KA_{it} + \gamma_1 RENT_{it} + \gamma_2 SOE_{it} + \gamma_3 BMO_{it} + \gamma_4 CRI_{it} + \theta_i + \vartheta_t + \tau_i \cdot trend + e_{it} \quad (3.10)$$

where mis_{it} = RER misalignment,

ER_{it} = exchange rate flexibility,

KA_{it} = capital account openness,

$RENT_{it}$ = ratio of resource rent over GDP,

SOE_{it} = social economic condition index,

BMO_{it} = ratio of broad money over GDP ,

CRI_{it} = economic crisis event dummy,

θ = country fixed effect,

ϑ = year fixed effect,

$\tau_i \cdot trend$= country-specific trend, and *i, t* denote country and time.

In equation (3.10), the coefficient ρ measures the degree of persistence of the RER misalignment. Coefficients α and β represents the association of the exchange rate flexibility and capital account openness with the level of misalignment. Control variables included in the estimation that accounts for country's reliance on natural resources (RENT), social-economic condition (SOE) representing institutional quality, financial market development (BMO), and economic crisis events (CRI) are based on the work of Nouira and Sekkat (2015). Economies that rely on natural resources are expected to be associated with larger RER misalignment driven by changes in the commodity prices or new discovery of resources. Economies with better institutional quality and a more developed financial market are predicted to be better in managing surges and reversals of capital flows and therefore tend to be more tolerable to RER misalignments (Aizenman and Riera-Crichton, 2008; Aghion et al., 2009; and Elbadawi et al., 2012). The economic crisis dummy (which takes a value of 1 for crisis years and 0 otherwise) controls for extreme changes in the nominal exchange rate due to economic crisis events.

The misalignment persistence term (ρ) is elaborated further in equation (3.11). The model includes a constant ρ_0 to capture unobserved country and time-invariant components that affect the misalignment persistence. ρ_1 and ρ_2 denote the contribution of the exchange rate regime (ER) and capital account openness (KA) to the persistence of the misalignment.

$$\rho = (\rho_0 + \rho_1 ER_{it} + \rho_2 KA_{it}) \tag{3.11}$$

3.3.2. Data

Data on exchange rate regimes and capital account openness is from the database of Aizenman et al. (2013). Alternative exchange rate regime indicator and capital account openness indicator respectively compiled by Ilzetzski et al. (2017) and Fernández et al. (2016) are used as alternative indices for assessing the consistency of estimation results. A list for variable description and sources is available in Table 3.2.[28]

[28] A summary of descriptive statistics and the correlation table and the correlation table for the variables is in the Appendix (Table 3A.1 and Table 3A.3) of this chapter.

Table 3.2 RER misalignment regression variables

Variable	Description	Sources
RER misalignment (*mis*)	The gap between the estimated ERER and the observed RER index, as calculated in equation (8).	Own calculation
Exchange rate flexibility index (ER)	Measures the flexibility of the exchange rate based on the annual standard deviations of the monthly exchange rate between the home country and the base country. In this study, the original index has been converted where a higher value indicates a more flexible exchange rate.	Aizenman et al. (2013)
Exchange rate regime category (ER_{fix}, ER_{int}, ER_{flex})	Ilzetzski et al. (2017) rank the de facto exchange rate flexibility of countries using 15 different categories. This study applies the classification by Martin (2016) to group the categories into 3, namely fixed, intermediate and flexible exchange rate regime. Observations with parallel market data are not available (code 15), are excluded from the analysis.	Ilzetzski et al. (2017)
Capital account openness index (KA)	Standardized index based on the principal component of variables that indicate the presence of multiple exchange rates, restrictions on current account transactions, on capital account transactions, and the requirement of the surrender of export proceeds. The index is normalized between zero and one. A higher value indicates a more liberalized capital account.	Aizenman et al. (2013)
Capital account openness index - Schindler (KA_{Sch})	Originally constructed by Schindler (2009) based on the information on the IMF's AREAR on capital flows management measures implemented by countries for a range of instruments in both directions of inflows and outflows. The country coverage has been expanded and updated in Fernandez et al. (2016). The index is normalized between zero and one. A higher value indicates a more liberalized capital account.	Fernandez et al. (2016)
Resource rent (RES)	The sum of oil rents, natural gas rents, coal rents (hard and soft), mineral rents, and forest rents as a percentage of GDP.	WDI (World Bank)
Socioeconomic condition score (SOE)	A proxy for the institutional factor of an economy that describes the socioeconomic pressures in society. The score is the sum of three subcomponents, each with a maximum score of 4 points and a minimum score of 0 points. A score of 4 points equates to very low risk and a score of 0 points to very high risk. The subcomponents are unemployment, consumer confidence, and poverty.	International Country Risk Guide (PRS Group)
Broad money/GDP (BMO)	A proxy for financial market development represented by the ratio of broad money to GDP.	WDI (World Bank)
Crisis dummy (CRI)	Economic crisis events (including systemic banking, currency and sovereign crisis).	Laeven and Valencia (2018)

3.3.3. Result

3.3.3.1. Trend and patterns of exchange rate flexibility and capital account openness

Figure 3.2 and Figure 3.3 plot the general profile of the sample countries' exchange rate flexibility and capital account openness based on different indices. The plot in Figure 3.2 suggests that there is a mild increasing trend in exchange rate flexibility in the early sample period. However, the trend has stagnated since the early 1990s as more countries have tended to manage the movement of their exchange rate, as confirmed by the increased number of countries classified under the intermediate exchange rate regime.

Figure 3.3 indicates an overall policy shift towards a more liberalized capital account regimes among the countries during the period under study. This is consistent with one of the policy reforms themes advocated for developing economies during the period in the form of financial market liberalization (Ghosh et al., 2018). However, in the more recent period after the global financial crisis in 2008, there is a slight decrease in the capital account openness among the sample countries.

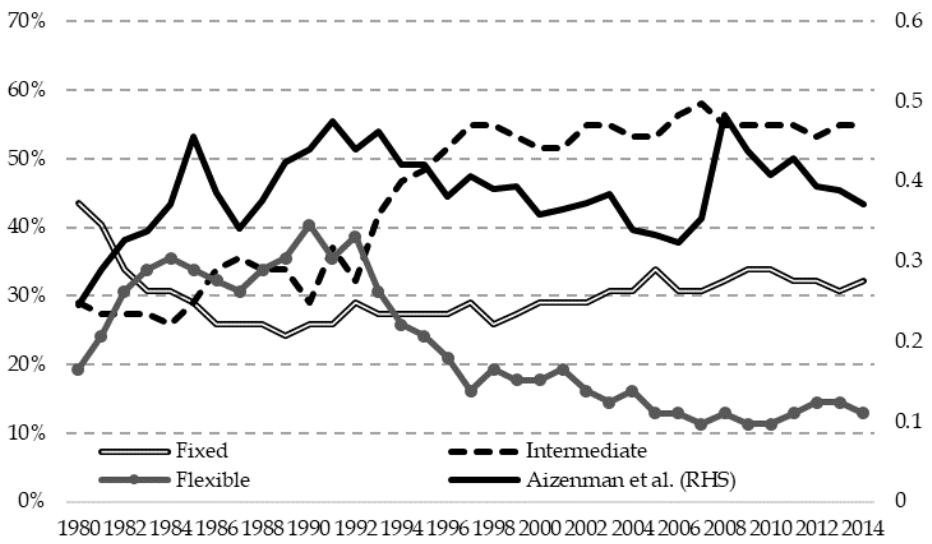


Figure 3.2 Exchange rate flexibility indicators

Note: The solid line refers to the right-hand scale of the graph that indicates the average exchange rate flexibility index based on the data from Aizenman et al. (2013) for the sample where higher observations indicate higher exchange rate flexibility. The rest of the line refers to the left-hand scale of the graph that represents the proportion of sample countries that are included in the reclassified exchange rate regime of Ilzetzski et al. (2017).

Source: Aizenman et al. (2013) and Ilzetzski et al. (2017).

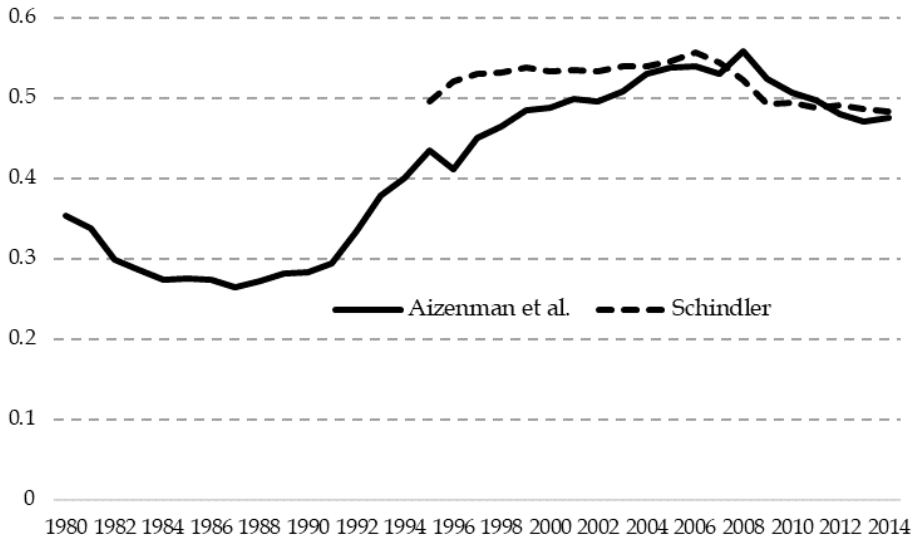


Figure 3.3 Capital account openness indicators

Note: The solid line refers to the average capital account openness index based on the data from Aizenman et al. (2013). The dashed line represents the average capital account openness index based on the data from Fernandez et al. (2016) for countries in the sample. A higher value indicates a more open capital account.

Source: Aizenman et al. (2013) and Fernandes et al. (2016).

Figure 3.4 depicts the distribution of policy configuration of the sample countries. The graph suggests that on average, there is a tendency that countries with a fixed exchange rate regime have a more open capital account and those with flexible exchange rate regime have a less liberalized capital account policy. One possible explanation for this pattern is that, as an economy opens up for foreign capital flows, it attempts to preserve its international competitiveness by intervening on the domestic foreign exchange market using the country's international reserves (Aizenman and Lee, 2007; Obstfeld et al., 2010; Aizenman et al., 2015). The graph also shows that most of the observation (48% of observations) are classified as having an intermediate exchange rate regime with a moderate degree of capital account openness.

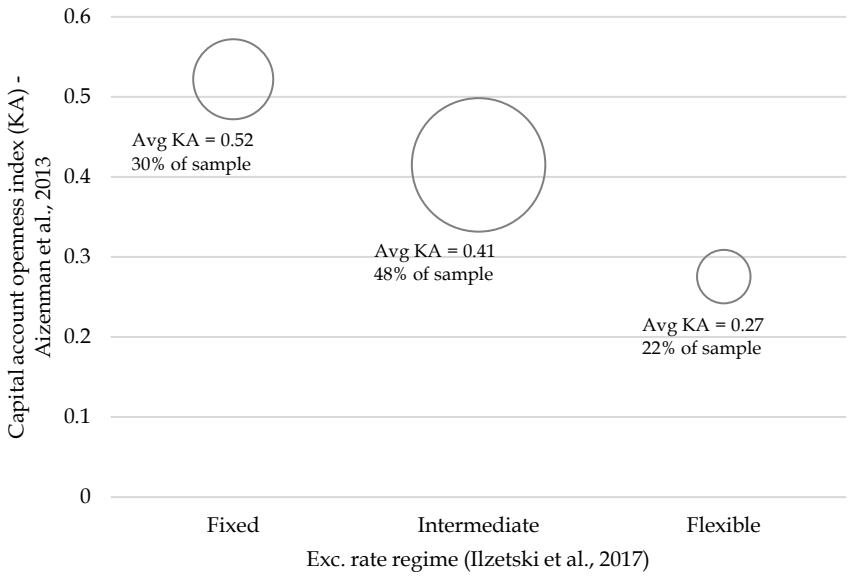


Figure 3.4 Exchange rate regime and capital account openness

Note: The size of the circle represents the proportion of each category in the sample. A higher value of capital openness index (KA) represents a more open capital account.

Source: Aizenman et al. (2013) and Ilzetzski et al. (2017).

3.3.3.2. Benchmark results

The dynamic panel fixed-effect specification based on equations (3.10) and (3.11) are regressed using the generalized method of moments (GMM) estimator. The GMM estimation is chosen to treat the dynamic panel bias (Nickell, 1981) introduced by the use of lagged RER misalignment in the fixed-effect setting.[29] The test results of overidentifying restriction confirmed the validity of the estimated results of all equations.[30]

The first row of Table 3.3 shows that the estimated coefficients of lagged misalignment (mis_{it-1}), which corresponds to the constant persistence factor (ρ_0- equation (3.11)) are statistically significant with the expected (positive) sign. This implies that holding other variables constant and under the regime of the fixed exchange rate (ER=0) and closed capital account (KA=0), around 74% to 88% of the previous year's RER misalignment (mis_{it-1}) contributes to the current misalignment (mis_{it}).

The regression in column 3.1 includes the exchange rate regime and capital account openness indicator. The contribution of the exchange rate regime on the persistence factor (ρ_1- equation (3.11)) corresponds to the coefficient of mis_{it-1}·ER. The negative and statistically significant coefficient indicates that a more flexible nominal exchange rate regime is associated with a significantly less persistent RER

[29] The two-step efficient GMM estimator is applied (Hayashi, 2000)). The lagged RER misalignment is instrumented using a combination of further lags (2 and 3 years) of the misalignment with a 2-year lag of the US real interest rate and the same lag of a global liquidity indicator represented by the ratio of the sum of foreign asset and liabilities to the GDP of OECD countries.

[30] Estimation results using OLS method is provided in Appendix – Table 3A.4 for comparison.

misalignment. Under the free-floating exchange rate regime (ER=1), the persistence of the misalignment is reduced significantly by around 40%.[31] As for the contribution of capital account openness on the persistence factor (ρ_2-equation (3.11)) that is represented by the coefficient of mis_{it-1}·KA, the result indicates that capital account openness does not contribute significantly to the persistence of the RER misalignment. In terms of the level of misalignment, free-floating exchange rate regime (ER=1) is significantly associated with RER undervaluation of around 9% while there is no significant contribution to the level of misalignment from the capital account openness. The result also confirms the significant association of other control variables with the level of the RER misalignment. Reliance on the natural resources sector, social-economic condition, and the ratio of broad money to GDP are all significantly related to the level of misalignment, in-line with the previous finding of Nouira and Sekkat (2015).[32]

The model estimated by replacing the exchange rate regime indicator with the reclassified exchange regime of Ilzetzski et al. (2017) is reported in column 3.2. The results are consistent with those in column 3.1 where under flexible exchange rate regime ($ER_{flexible}$=1), the RER misalignment is lower in terms of persistence and tend to experience undervaluation compared to the fixed regime (used as the reference case) and the intermediate regime (ER_{inter}=1). As for the capital account policy, the result in the persistence term indicates that a liberalized policy is associated with a

[31] Calculated based on equation (3.11).
[32] The result of the additional control variables (resource rent, social-economic condition, broad money to GDP ratio, and economic crisis) is consistent across estimations. Therefore, further discussions will be focused on exchange rate flexibility (ER) and capital account openness (KA).

shorter period of RER misalignment. However, the result does not indicate that capital account openness has a significant association with the level of misalignment.

For estimations in columns 3.3 and 3.4, the empirical model is modified by replacing both ER and KA variables with the interaction of both variables (KA·ER). The regression in column 3.3 uses the exchange rate flexibility and capital account openness index by Aizenman et al. (2013) as was done in column 3.1. The result indicates that the interaction of both policies has a significant relationship both in terms of persistence and level of the misalignment. Under the maximum exchange rate flexibility and capital account openness (where ER = 1 and KA = 1), the adjustment period needed for the RER to converge to the equilibrium level is significantly faster and on average is associated with undervaluation of 6%.

The alternative estimate results of the model with categorical exchange rate regime variable (column 3.4) is broadly consistent with the results from previous regressions. Comparison of the coefficients of the interaction term between the capital account policy and fixed exchange rate (mis_{it-1}·KA·ER_{fix}=1) and the one with the flexible exchange rate (mis_{it-1}·KA·ER_{flex}=1) confirms that under the same degree of capital account openness, the misalignment persistence is lower under the flexible exchange rate regime. The results also indicate that the fixed exchange rate regime is associated with overvalued RER, while the flexible regime is associated with RER undervaluation.

Table 3.3 Benchmark estimation result (GMM estimates)

Dependent variable: RER misalignment (mis_{it})

	Singular specification		Interaction	
	3.1	3.2	3.3	3.4
mis_{it-1}	0.878***	0.828***	0.745***	0.764***
	(0.0477)	(0.0582)	(0.0259)	(0.0325)
Exchange rate regime (ER) & capital account openness (KA) in the persistence term				
mis_{it-1}·ER	-0.350***			
	(0.0648)			
mis_{it-1}·ER_{inter}=1		-0.0137		
		(0.0496)		
mis_{it-1}·$ER_{flexible}$=1		-0.303***		
		(0.0666)		
mis_{it-1}·KA	-0.0774	-0.141**		
	(0.0571)	(0.0584)		
mis_{it-1}·KA·ER			-0.179**	
			(0.0896)	
mis_{it-1}·KA·ER_{fix}=1				-0.159**
				(0.0738)
mis_{it-1}·KA·ER_{inter}=1				-0.0527
				(0.0587)
mis_{it-1}·KA·ER_{flex}=1				-0.372***
				(0.1432)
Exchange rate regime (ER) & capital account openness (KA) in the misalignment level				
ER	-0.0868***			
	(0.01)			
ER_{inter}=1		-0.0244***		
		(0.0083)		
$ER_{flexible}$=1		-0.0999***		
		(0.0132)		
KA	0.0193	0.00769		
	(0.0133)	(0.013)		
KA·ER			-0.0603***	
			(0.0169)	
KA·ER_{fix}=1				0.0516***
				(0.0191)
KA·ER_{inter}=1				0.0114
				(0.0145)
KA·ER_{flex}=1				-0.0493**
				(0.0223)
Other controls				
Resource rent	0.00225***	0.00203**	0.00180**	0.00173**
	(0.0007)	(0.0008)	(0.0008)	(0.0008)
Social- economic	0.00672***	0.00506**	0.00442*	0.00514**
condition	(0.0021)	(0.002)	(0.0023)	(0.0021)
Broad money / GDP	-0.000847***	-0.000854***	-0.000956***	-0.00102***
	(0.0003)	(0.0003)	(0.0003)	(0.0003)
Economic crisis	-0.0867***	-0.0886***	-0.0991***	-0.0973***
	(0.0099)	(0.0098)	(0.0109)	(0.0106)
Observations	1713	1713	1713	1713
Adjusted R-square	0.578	0.587	0.561	0.563
Test of overidentifying restriction; *p* - value	0.678	0.635	0.687	0.686

Note: The RER misalignment variable used in the regression is based on the estimation discussed in Section 3.2 of this chapter. All regressions use the capital account openness index (KA) based on Aizenman et al. (2013). Regressions in columns 3.1 and 3.3 use the exchange rate flexibility index (ER) based on Aizenman et al. (2013). Regressions in columns 3.2 and 3.4 use the reclassified exchange rate regime of Ilzetzski et al. (2017). The country and year fixed effect, and country-specific trends are applied. ***,**, and * represents the level of significance of 1%, 5%, and 10% respectively. Robust standard errors to heteroscedasticity and autocorrelation are reported in the parentheses. Source: Author's calculation

3.3.3.3. Asymmetries of the RER misalignment

The discussion so far has been based on the assumption that the relationship between RER misalignment, and exchange rate flexibility and capital account openness is symmetrical between RER undervaluation and overvaluation. The purpose of this section is to test the validity of this assumption.

The alternative estimates undertaken for this purpose are reported in Tables 3.4 and 3.5. The estimates reported in Table 3.4 correspond to those in columns 3.1 and 3.2 of Table 3, while the results in Table 3.5 correspond to columns 3.3 and 3.4. In these estimates, a binary dummy that distinguishes between RER undervaluation and overvaluation (1 for undervaluation and 0 for overvaluation) is interacted with exchange rate flexibility and capital account openness variables, in the persistence and the level components.

As the result reported in column 4.1 suggest, there is no significant difference in the constant persistence factor when the RER is undervalued as shown by the insignificant coefficient of $mis_{it-1} \cdot 1\{mis_{it-1}<0\}$ in the second row. In the persistence term, the result still confirms that the flexible exchange rate regime contributes to a faster adjustment of RER to its equilibrium value. However, when the RER is undervalued in the previous year, the speed of adjustment is not as fast as when the RER is overvalued. The asymmetry is indicated by the coefficient of $mis_{it-1} \cdot ER \cdot 1\{mis_{it-1}<0\}$, which is positive and significant at the 10% significance level, but smaller than the coefficient of $mis_{it-1} \cdot ER$ in absolute term. The result also indicates that capital account openness has a significant negative association with the misalignment persistence term, and there is no asymmetry detected. In terms of misalignment level, a higher

degree of exchange rate flexibility and capital account openness is associated with a larger RER misalignment both in the form of overvaluation and undervaluation.

The results in column 4.2 with categorical exchange rate variable is generally consistent with the results in column 4.1. Unlike the equation in column 4.1, the one in column 4.2 does not find evidence of exchange rate regime asymmetric contribution in the persistence term. The result also suggests that capital account openness only has a significant association with the RER misalignment through the persistence term. As for the magnitude of misalignment, greater exchange rate flexibility is associated with deeper RER undervaluation.

Results using interaction specification reported in Table 3.5 also suggest there is no significant difference in the constant persistence factor during RER undervaluation episodes. The results in columns 5.1 and 5.2 suggest that countries with a liberalized policy configuration tend to have a shorter period of RER misalignment with no indication of asymmetric relationship. Related to the magnitude of misalignment, the results also suggest that a less restrictive policy setting in terms of exchange rate flexibility and the capital account is associated with larger overvaluation and undervaluation episodes.

Table 3.4 Asymmetric estimation results- singular specification (GMM estimates)

Dependent variable: RER misalignment (mis_{it})

	4.1	4.2
mis_{it-1}	0.908***	0.627***
	(0.087)	(0.1194)
mis_{it-1}·1{mis_{it-1}<0}	-0.209	0.0177
	(0.1533)	(0.1786)
Exchange rate regime (ER) & capital account openness (KA) in the persistence term		
mis_{it-1}·ER	-0.641***	
	(0.1157)	
mis_{it-1}·ER_{inter}= 1		0.0667
		(0.1015)
mis_{it-1}·$ER_{flexible}$= 1		-0.501***
		(0.1256)
mis_{it-1}·KA	-0.241**	-0.216**
	(0.0984)	(0.0993)
mis_{it-1}·ER·1{mis_{it-1}<0}	0.338*	
	(0.1826)	
mis_{it-1}·ER_{inter}=1·1{mis_{it-1}<0}		-0.233
		(0.15)
mis_{it-1}·$ER_{flexible}$= 1·1{mis_{it-1}<0}		0.222
		(0.181)
mis_{it-1}·KA·1{mis_{it-1}<0}	-0.0195	0.0092
	(0.1723)	(0.1626)
Exchange rate regime (ER) & capital account openness (KA) in the misalignment level		
ER	0.0437***	
	(0.0154)	
ER_{inter}= 1		-0.0345***
		(0.0126)
$ER_{flexible}$= 1		-0.0146
		(0.0164)
KA	0.0540***	0.00613
	(0.0143)	(0.0152)
ER·1{mis_{it}<0}	-0.160***	
	(0.0115)	
ER_{fix}=1·1{mis_{it}<0}		-0.112***
		(0.0135)
ER_{inter}=1·1{mis_{it}<0}		-0.114***
		(0.0097)
$ER_{flexible}$= 1·1{mis_{it}<0}		-0.176***
		(0.0115)
KA·1{mis_{it}<0}	-0.0762***	0.00245
	(0.0102)	(0.0142)
Observations	1713	1713
Adjusted R-square	0.682	0.725
Test of overidentifying restriction; *p* - value	0.657	0.788

Table 3.5 Asymmetric estimation results - interaction specification (GMM estimates)

Dependent variable: RER misalignment (mis_{it})

	5.1	5.2
mis_{it-1}	0.769***	0.765***
	(0.0455)	(0.0539)
mis_{it-1}·1{mis_{it-1}<0}	-0.0877	0.0299
	(0.0852)	(0.1096)
Exchange rate regime (ER) & capital account openness (KA) in the persistence term		
mis_{it-1}·KA·ER	-0.640***	
	(0.1428)	
mis_{it-1}·KA·ER_{fix}=1		-0.584***
		(0.1402)
mis_{it-1}·KA·ER_{inter}=1		-0.306***
		(0.0974)
mis_{it-1}·KA·ER_{flex}=1		-1.136***
		(0.2833)
mis_{it-1}·KA·ER·1{mis_{it-1}<0}	-0.0629	
	(0.2725)	
mis_{it-1}·KA·ER_{fix}=1·1{mis_{it-1}<0}		0.159
		(0.2308)
mis_{it-1}·KA·ER_{inter}=1·1{mis_{it-1}<0}		-0.209
		(0.1959)
mis_{it-1}·KA·ER_{flex}=1·1{mis_{it-1}<0}		0.233
		(0.3986)
Exchange rate regime (ER) & capital account openness (KA) in the misalignment level		
KA·ER	0.103***	
	(0.0231)	
KA·ER_{fix}= 1		0.131***
		(0.0242)
KA·ER_{inter}= 1		0.0759***
		(0.0169)
KA·ER_{flex}= 1		0.102***
		(0.0347)
KA·ER·1{mis_{it}<0}	-0.294***	
	(0.0193)	
KA·ER_{fix}= 1·1{mis_{it}<0}		-0.149***
		(0.0146)
KA·ER_{inter}= 1·1{mis_{it}<0}		-0.152***
		(0.0102)
KA·ER_{flex}= 1·1{mis_{it}<0}		-0.265***
		(0.0361)
Observations	1713	1713
Adjusted R-square	0.608	0.627
Test of overidentifying restriction; *p* – value	0.741	0.776

Note: The RER misalignment variable used in the regression is based on the estimation discussed in Section 3.2 of this chapter. All regressions control for resource rent, social-economic condition, the ratio of broad money to GDP, and economic crisis events. The capital account openness index (KA) based on Aizenman et al. (2013) is used for all regressions. Regressions in columns 4.1 and 5.1 use the exchange rate flexibility index (ER) based on Aizenman et al. (2013). Regressions in columns 4.2 and 5.2 use the reclassified exchange rate regime of Ilzetzski et al. (2017). The country and year fixed effect, and country-specific trends are applied. ***,**, and * represents the level of significance of 1%, 5%, and 10% respectively. Robust standard errors to heteroscedasticity and autocorrelation are reported in the parentheses. Source: Author's calculation

3.3.3.4. Capital inflow and outflow liberalization

Table 3.6 reports the equation in column 5.1 of Table 3.5 reestimated using a combination of Aizenman's exchange rate flexibility indicator with alternative measures of capital account openness. The capital account openness indicator (KA) compiled by Aizenman et al. (2013) is used in column 6.1, which act as the benchmark for other estimations in the rest of other columns using the Schindler (2009) index. In column 6.2 the capital account openness indicator is the overall index, followed by the index for capital inflows (column 6.3), and column 6.4 uses the indicator for capital outflows. The sample used for estimations in this table is adjusted to the coverage of Schindler index that consists of 50 countries covering a shorter period of 1995 to 2014.[33]

There is no significant difference in terms of the direction of the estimated coefficients even when the capital account openness variable is replaced with the inflow and outflow indicator (columns 6.3 and 6.4). Results reported in Table 6 for different sub-sample and alternative indicators of capital account policy, reaffirm previous interpretations on the association of the exchange rate flexibility and the capital account openness with the RER misalignment. Relating to the persistence of RER misalignment, countries that allow more flexibility in the exchange rate movement and more open capital account tend to have lower persistence RER misalignment. As for the misalignment level, the result implies that liberalized policy

[33] Countries not covered due to the use of the Schindler index are Albania, Cameroon, Congo, Gabon, Honduras, Jordan, Madagascar, Mongolia, Nepal, Sudan, Senegal, and Trinidad and Tobago.

setting in terms of exchange rate flexibility and the capital account is associated with larger misalignments both in form of overvaluation and undervaluation.

Table 3.6 Asymmetric estimation results – alternative capital account policy indices

Dependent variable: Dependent variable: RER misalignment (mis_{it})

	6.1	6.2	6.3	6.4
mis_{it-1}	0.757***	0.763***	0.759***	0.771***
	(0.0655)	(0.0644)	(0.0677)	(0.0609)
mis_{it-1}·1{mis_{it-1}<0}	0.0942	0.07	0.0969	0.0289
	(0.1114)	(0.1137)	(0.1178)	(0.1101)
Exchange rate regime (ER) & capital account openness (KA) in the persistence term				
mis_{it-1}·ER·KA_{Aiz}	-0.686***			
	(0.1515)			
mis_{it-1}·ER·KA_{Sch}		-0.822***		
		(0.182)		
mis_{it-1}·ER·$KA_{Sch\text{-}inflow}$			-0.855***	
			(0.1945)	
mis_{it-1}·ER·$KA_{Sch\text{-}outflow}$				-0.768***
				(0.1571)
mis_{it-1}·ER·KA_{Aiz}·1{mis_{it-1}<0}	-0.355			
	(0.2494)			
mis_{it-1}·ER·KA_{Sch}·1{mis_{it-1}<0}		-0.169		
		(0.2858)		
mis_{it-1}·ER·$KA_{Sch\text{-}inflow}$·1{mis_{it-1}<0}			-0.141	
			(0.2991)	
mis_{it-1}· ER·$KA_{Sch\text{-}outflow}$·1{mis_{it-1}<0}				-0.154
				(0.2619)
Exchange rate regime (ER) & capital account openness (KA) in the misalignment level				
ER·KA_{Aiz}	0.0390**			
	(0.0184)			
ER·KA_{Sch}		0.0587**		
		(0.0232)		
ER·$KA_{Sch\text{-}inflow}$			0.0469**	
			(0.0233)	
ER·$KA_{Sch\text{-}outflow}$				0.0708***
				(0.0221)
ER·KA_{Aiz}·1{mis_{it}<0}	-0.230***			
	(0.0158)			
ER·KA_{Sch}·1{mis_{it}<0}		-0.255***		
		(0.0183)		
ER·$KA_{Sch\text{-}inflow}$·1{mis_{it}<0}			-0.251***	
			(0.0173)	
ER·$KA_{Sch\text{-}outflow}$·1{mis_{it}<0}				-0.246***
				(0.0178)
Observations	940	940	940	940
Adjusted R-square	0.724	0.740	0.740	0.734
Test of overidentifying restriction; p – value	0.694	0.735	0.751	0.711

Note: The RER misalignment variable used in the regression is based on the estimation discussed in Section 3.2 of this chapter. All regressions control for resource rent, social-economic condition, the ratio of broad money to GDP, and economic crisis events. The exchange rate flexibility index (ER) based on Aizenman et al. (2013) is used. KA_{Aiz} corresponds to the capital account openness indicator by Aizenman et al. (2013). KA_{Sch} refers to the overall capital account indicator by Schindler (2009) with the inflow/outflow subscript indicating the indicator for the degree of capital openness for capital inflows/outflows. The country and year fixed effect, and country-specific trends are applied. ***,**, and * represents the level of significance of 1%, 5%, and 10% respectively. Robust standard errors to heteroscedasticity and autocorrelation are reported in the parentheses. Source: Author's calculation

3.4. Conclusion

This chapter has examined the association of RER misalignment with the exchange rate flexibility and the capital account openness using a panel dataset covering 60 developing countries over the period 1980-2014. The analysis is based on an RER index which is more consistent with the theoretical concept of RER compared to the commonly used CPI-based index. The RER misalignment is estimated by taking into account the heterogeneity of underlying drivers of RER behaviour among countries. In calculating the equilibrium path of the RER, individual RER function has been estimated by applying the endogenous HP filter procedure on each variable in the function. The analysis paid proper attention to the sensitivity of results due to the use of alternative measures of the exchange rate and capital account regimes and alternative specifications.

The results indicate that in general, exchange rate flexibility and capital account openness is associated with the degree of persistence and the magnitude of RER misalignment. A higher degree of exchange rate flexibility and openness to capital flows is associated with faster adjustment of the RER to its equilibrium value. This is consistent with the argument of Corden (1994) where the RER adjustment will most likely to be slow under the fixed exchange rate regime. The result is also in line with the conclusion of Montecino (2018) who asserts that countries with capital controls tend to have a longer duration of RER misalignments. The asymmetric estimation results found limited evidence of asymmetry in the contribution of the exchange rate flexibility on the persistence term when the RER is undervalued. In terms of the

magnitude of the RER misalignment, the result implies that liberalized policy configuration is associated with larger misalignments both in the form of overvaluation and undervaluation.

Appendix

Table 3A. 1 Descriptive statistics

Variables	Remarks/units	Observations	Average	Standard Deviation	Minimum	Maximum
Real exchange rate index	Index (2010 = 100)	2,081	128.87	45.98	29.28	546.44
Misalignment	Decimal x 100 = Percent (%)	2,008	-0.47	15.72	-53.57	107.65
Financial sector openness (Saadma and Steiner 2016)	Ratio	2,035	1.06	2.77	-0.34	33.53
Govt. Expenditure 1 - Govt. consumption / GDP	Current price - Percent (%)	1,923	13.41	5.58	0.91	76.22
Govt. Expenditure 2 - Govt. consumption / GDP	Constant price - Percent (%)	2,100	18.22	10.00	1.66	177.64
Govt. Expenditure 3 - Govt. consumption & investment / GDP	Constant price - Percent (%)	2,100	23.39	11.35	2.37	181.75
Govt. Expenditure 4 - Govt. consumption & investment / GDP	Current price - Percent (%)	2,098	18.95	9.31	0.88	83.54
Net foreign asset 1 - Net foreign asset / Imports	Percent (%)	2,047	-48.71	144.15	-4573.60	550.62
Net foreign asset 2 - Net foreign asset / GDP	Percent (%)	1,967	-5.25	49.98	-1121.74	14.57
Openness 1 - Export + Import / GDP	Current price - Percent (%)	1,982	34.46	18.68	0.06	125.71
Openness 2 - Import / GDP	Current price - Percent (%)	2,100	36.12	26.81	0.27	161.21
Openness 3 - Export + Import / GDP	Constant price - Percent (%)	1,982	66.10	36.30	0.17	251.14
Productivity 1 - GDP per capita / Avg. GDP per capita of OECD	Constant price - Percent (%)	2,069	14.30	17.89	0.55	147.65
Productivity 2 - GDP per capita / Avg. GDP per capita of OECD	Current price - Percent (%)	2,058	14.11	19.48	0.00	211.23
Domestic real interest rate	Percent (%)	1,323	6.61	26.46	789.80	8749.50
Real interest rate gap	Percent (%)	1,303	2.51	26.20	-103.70	784.18
Terms of trades	Ratio	2,100	0.99	0.12	0.32	2.55
Exchange rate flexibility (Aizenman et al.,2013)	Index (0 to 1)	2,067	0.39	0.33	0	1
Exchange rate regime category (Ilzetzski et al., 2017)	Categorical (1 to 3)	2,057	1.93	0.72	1	3
Capital account openness (Aizenman et al., 2013)	Index (0 to 1)	2,051	0.41	0.34	0	1
Capital account openness (Fernandez et al., 2016)	Index (0 to 1)	960	0.52	0.35	0	1
Resource Rent	Percent (%)	2,059	9.30	11.51	0.00	72.17
Socioeconomic condition	Index (1 to 11)	1,822	5.08	1.75	1	11
Broad money/GDP	Percent (%)	2,023	43.59	28.03	7.29	192.24
Economic crisis	Dummy (0 & 1)	2,100	0.09	0.28	0	1

Source: Author's calculation

Table 3A. 2 Individual country RER function

No	Country	Govt. expenditure	Productivity	Terms of trade	Trade openness	Net foreign asset	Real interest rate gap	Domestic real interest rate	Financial openness	[leads,lags]
1	Albania	-0.035 (1.85)* (2)	-0.144 (9.88)*** (2)	5.986 (16.16)***						[0,0]
2	Algeria	-0.034 (4.08)*** (4)	-0.012 (5.81)*** (2)		0.035 (4.87)***	-0.002 (5.32)***			1.367 (2.64)**	[1,1]
3	Argentina			2.596 (4.4)***	0.083 (2.9)*** (2)	-0.011 (3.04)***				[0,1]
4	Bahrain	-0.035 (18.29)*** (3)	-0.017 (15.12)*** (2)		0.001 (3.56)*** (2)	0.356 (26.15)*** (2)	0.003 (5.27)***		-0.026 (16.09)***	[1,0]
5	Bangladesh	0.417 (36.29)***		0.827 (12.99)***		-0.045 (62.09)***			5.119 (26.51)***	[3,3]
6	Bolivia	0.066 (7.09)*** (3)		0.791 (2.59)**	0.03 (16.44)*** (3)	-0.093 (15.49)*** (2)				[2,1]
7	Brazil	-0.021 (2.13)	-0.038 (5.94)*** (2)		0.007 (2.91)** (2)	-0.061 (7.84)*** (2)				[2,2]
8	Bulgaria		-0.049 (9.59)*** (2)	2.757 (2.21)**	0.004 (1.96)* (3)					[0,0]
9	Cameroon		-0.014 (1.95)* (2)		0.004 (8.94)*** (3)				0.378 (3.1)***	[2,0]
10	Chile	-0.031 (4.01)*** (3)	-0.054 (7.36)***	-0.714 (1.8)*			0.009 (1.9)*		0.156 (3.64)***	[1,2]
11	China	0.026 (3.33)*** (2)				-0.343 (5.57)*** (2)		-0.021 (2.28)**	-1.479 (1.78)*	[0,0]
12	Colombia	0.023 (3.1)** (4)				-0.022 (4.29)***	0.033 (4.11)***	-0.036 (4.26)***	1.419 (2.88)**	[1,2]
13	Congo, Dem. Rep	-0.021 (4.96)*** (2)	-0.067 (8.88)*** (2)	-1.947 (3.46)***	0.001 (3.32)** (3)	-0.001 (2.45)**				[1,1]
14	Costa Rica		-0.026 (13.74)*** (2)		0.003 (2.1)**	-0.003 (14.06)***	0.001 (2.42)**			[0,0]
15	Côte d'Ivoire	0.225 (33.14)***		-4.174 (15.7)***	0.014 (15.09)*** (3)	-0.015 (26.37)***			-0.314 (9.09)**	[2,2]
16	Dominican Republic	0.143 (7.15)*** (4)	-0.119 (13.89)*** (2)	4.861 (61.59)***					-1.927 (9.22)***	[2,2]
17	Ecuador	0.007 (6.58)*** (3)	-0.036 (23.48)*** (2)	0.338 (2.23)**					0.566 (5.05)***	[2,1]
18	Egypt	0.145 (12.74)***	-0.176 (10.85)*** (2)		0.016 (2.69)** (2)	-0.013 (5.41)***				[2,0]
19	El Salvador	0.076 (14.1)***	-0.109 (12.01)*** (2)			-0.065 (1.85)* (2)			-1.007 (17.16)***	[2,0]
20	Ethiopia	-0.027 (30.54)*** (3)	-0.124 (9.95)*** (2)	4.812 (576.35)***						[3,3]
21	Gabon	0.024 (8.65)***		0.161 (2.37)**	0.014 (8.75)***	-0.012 (32.66)***			-1.272 (24.63)***	[2,0]
22	Ghana		-0.377 (9.54)*** (2)	-1.52 (3.93)***	0.003 (3.09)** (3)				-0.914 (5.88)***	[2,2]
23	Guatemala	-0.05 (4.09)***	-0.102 (2.16)**	2.52 (5)***	0.015 (3.82)*** (3)					[1,0]
24	Honduras	-0.069 (7.01)*** (2)		0.658 (1.92)*	0.004 (5.09)*** (3)					[2,2]
25	India	-0.062 (6.23)*** (2)		-0.635 (3.52)***	0.035 (2.99)** (3)		0.005 (2.33)**		-3.745 (4.41)***	[2,2]
26	Indonesia	0.028 (25.71)** (3)	-0.055 (25.54)** (2)	0.878 (27)**		-0.03 (29.77)**			-3.362 (24.21)**	[2,2]
27	Iran	0.098 (25.55)** (2)	-0.495 (49.42)**	-0.839 (23.32)**	0.024 (8.89)*	0.018 (14.05)**				[2,2]
28	Jamaica	-0.029 (17.41)*** (3)	-0.017 (4.06)*** (2)		0.002 (1.94)* (3)		-0.012 (4.25)***	0.01 (3.14)***	-0.078 (4.01)***	[0,1]
29	Jordan	0.03 (9.95)***	-0.032 (4.97)*** (2)	2.788 (24.35)***	0.012 (4.78)***				0.146 (3.64)*** (2)	[0,2]
30	Kenya		-0.218 (29.91)*** (2)	-0.375 (2.45)**	0.008 (2.85)** (3)	-0.006 (8.3)***		0.002 (1.94)*		[1,0]
31	Kuwait	0.041 (55.99)*** (4)		-2.32 (14.14)***		0.091 (17)*** (2)			-0.254 (14.44)***	[2,2]
32	Madagascar		-0.247 (9.03)*** (2)	-1.018 (2.15)**		-0.027 (1.92)* (2)			-0.274 (3.79)***	[2,0]
33	Malaysia	-0.011 (3.09)*** (3)	-0.05 (7.93)***		0.005 (11.13)***		0.003 (2.91)***			[1,0]
34	Mexico	0.026 (4.99)*** (4)	-0.025 (6.15)*** (2)			-0.063 (6.35)*** (2)			-0.27 (3.33)***	[0,0]
35	Mongolia	0.006 (2.95)** (4)	-0.188 (2.51)**		0.013 (2.17)*					[3,2]
36	Morocco	-0.111 (4.01)** (3)		4.748 (6.99)***	0.077 (3.93)** (2)	-0.03 (2.22)*			-3.81 (4.22)**	[2,2]
37	Myanmar			4.329 (51.32)***		0.002 (3.64)***			0.545 (4.33)***	[0,0]
38	Nepal	-0.009 (2.25)** (3)	-0.236 (7.26)*** (2)	-0.448 (3.18)***	0.005 (2.08)**					[0,0]
39	Nicaragua	0.025 (14.87)***	-0.033 (3.2)*** (2)	-0.553 (2.05)*		0.00001 (2.4)**				[2,1]
40	Nigeria	-0.032 (3.89)*** (2)	-0.093 (4.08)*** (2)	2.946 (3.76)***	0.029 (1.97)*	0.033 (2.32)** (2)	-0.005 (8.95)***			[1,1]
41	Oman	0.155 (5.79)*** (2)		4.932 (5.67)***			0.13 (3.59)**	-0.135 (3.73)**	-1.984 (2.8)**	[2,3]
42	Pakistan		-0.113 (6.58)*** (2)	-0.419 (1.85)*	0.02 (5.87)*** (3)	-0.079 (4.04)*** (2)				[0,0]
43	Panama	-0.042 (4.08)***	-0.019 (6.09)*** (2)		0.002 (4.25)*** (2)	-0.004 (5.92)***			0.027 (2.69)**	[0,0]

Table 3A. 2 Individual country RER function (continued)

No	Country	Govt. expenditure	Productivity	Terms of trade	Trade openness	Net foreign asset	Real interest rate gap	Domestic real interest rate	Financial openness	[leads,lags]
44	Paraguay	-0.027 (1.9)* (4)			0.008 (22.39)*** (3)	-0.004 (2.27)**			-0.346 (1.72)*	[0,0]
45	Peru	0.131 (8.7)*** (4)	-0.037 (3.24)*** (2)	2.452 (26.11)***	0.011 (1.96)*	-0.071 (9.57)*** (2)				[1,1]
46	Philippines			-1.509 (2.47)**	0.025 (4.52)*** (2)	-0.339 (3.94)*** (2)	0.021 (3.32)***	-0.025 (3.47)***	-1.933 (3.72)***	[1,1]
47	Saudi Arabia		-0.008 (2.42)*		0.06 (26.44)*** (3)	-0.052 (22.51)***			4.87 (35.73)***	[2,2]
48	Senegal	0.006 (2.17)** (2)			0.008 (6.63)*** (3)	-0.002 (3.18)***				[0,0]
49	Sri Lanka	-0.002 (2.39)** (2)	-0.079 (21.66)*** (2)		0.006 (4.4)***	-0.003 (1.93)*			1.281 (3.46)***	[1,1]
50	Sudan	0.071 (3.74)***	-0.256 (5.96)*** (2)	5.303 (19.95)***	0.007 (1.86)* (2)					[1,0]
51	Tanzania			4.026 (39.56)***	0.016 (2.29)** (2)	-0.011 (11.49)***			-1.498 (6.98)***	[0,1]
52	Thailand		-0.037 (15.42)*** (2)			-0.003 (8.47)***			-0.207 (5.55)***	[0,0]
53	Trinidad & Tobago	0.03 (5.05)** (3)	-0.028 (22.59)***		0.01 (14.62)*** (2)				0.609 (16.39)***	[2,2]
54	Tunisia	0.003 (2.32)** (2)	-0.061 (4.21)*** (2)		0.003 (3.23)*** (2)					[1,0]
55	Turkey	-0.039 (3.45)***		2.452 (3.79)***	0.014 (2.02)*	-0.262 (3.15)*** (2)			-1.267 (5.82)***	[0,0]
56	Uganda	0.118 (9.83)*** (2)		2.382 (23.07)***		-0.014 (16.6)***				[1,1]
57	Uruguay	0.07 (3.24)***	-0.04 (8.57)***		0.011 (3.54)*** (3)		0.016 (2.22)**	-0.018 (2.25)**		[0,0]
58	Venezuela	0.01 (2.93)**	-0.027 (21.59)***		0.008 (2.31)**	0.052 (3.33)***		-0.001 (3.99)***		[0,1]
59	Vietnam	-0.118 (4.49)*** (4)	-0.153 (4.01)*** (2)							[1,3]
60	Zambia	0.016 (7.25)*** (2)	-0.205 (7.69)*** (2)	-1.212 (6.92)***			0.001 (2.04)*		0.458 (5.9)***	[1,0]
	PANEL - DOLS	-0.009(5.89)*** (2)	-0.034 (5.68)***			-0.001 (8.99)***				[1,1]

Note: *,**, and *** represents the level of significance of 1%, 5%, and 10% respectively. Numbers in parentheses are t-statistics. Numbers in the superscript format indicate the n-th alternative variables used in the function. For example, the coefficient for Albania for government expenditure is estimated using the 3rd alternative variable used to represent the government expenditure, which is the ratio of government consumption and investment to GDP in current price. The definition of each variable used in the model is available in Table 1. The panel DOLS regression is estimated using data from 53 countries due to data availability.

Source: Author's calculation

Table 3A. 3 Correlation of variables for the RER misalignment regressions

	RER misalign-ment	Exchange rate regime (Aizenman)	Exchange rate regime (Ilzetzski)	Capital account openness (Aizenman)	Capital account openness (Schindler)	Capital inflows openness (Schindler)	Capital outflows openness (Schindler)	Resource rent	Socio-economic condition	Broad money / GDP	Economic crisis event
RER misalignment	1										
Exchange rate regime (Aizenman)	-0.1093	1									
Exchange rate regime (Ilzetzski)	-0.0988	0.6538	1								
Capital account openness (Aizenman)	0.0389	-0.1501	-0.2588	1							
Capital account openness (Schindler)	0.0496	-0.1542	-0.1032	0.7294	1						
Capital inflows openness (Schindler)	0.0261	-0.1711	-0.1362	0.71	0.9564	1					
Capital outflows openness (Schindler)	0.0589	-0.1423	-0.0785	0.7024	0.9672	0.8542	1				
Resource rent	-0.0404	-0.1598	-0.2081	0.1503	-0.0071	-0.0244	0.0424	1			
Socioeconomic condition	-0.0346	-0.059	-0.1256	0.207	-0.0312	-0.0188	-0.0202	0.1465	1		
Broad money/GDP	0.0054	-0.0263	-0.126	0.1718	-0.2786	-0.2432	-0.2962	-0.0542	0.3519	1	
Economic crisis event	-0.0726	0.1268	0.1539	-0.1369	-0.0007	-0.0156	0.0094	-0.0406	-0.0465	-0.0939	1

Source: Author's calculation

Table 3A. 4 Benchmark estimation result (OLS estimates)

Dependent variable: RER misalignment (mis_{it})

	Singular specification		Interaction	
	1	2	3	4
mis_{it-1}	0.718***	0.658***	0.651***	0.644***
	(0.0644)	(0.0629)	(0.0476)	(0.0609)
Exchange rate regime (ER) & capital account openness (KA) in the persistence term				
mis_{it-1}·ER	-0.221*			
	(0.1201)			
mis_{it-1}·ER_{inter}=1		0.08		
		(0.0613)		
mis_{it-1}·$ER_{flexible}$=1		-0.206**		
		(0.0894)		
mis_{it-1}·KA	0.0517	-0.0136		
	(0.0841)	(0.0765)		
mis_{it-1}·KA·ER			-0.0204	
			(0.1348)	
mis_{it-1}·KA·ER_{fix}=1				-0.0508
				(0.1168)
mis_{it-1}·KA·ER_{inter}=1				0.104
				(0.0996)
mis_{it-1}·KA·ER_{flex}=1				-0.303*
				(0.1827)
Exchange rate regime (ER) & capital account openness (KA) in the misalignment level				
ER	-0.0980***			
	(0.0148)			
ER_{inter}=1		-0.0205*		
		(0.012)		
$ER_{flexible}$=1		-0.105***		
		(0.0175)		
KA	0.0099	0.00369		
	(0.0173)	(0.0167)		
KA·ER			-0.0766***	
			(0.0212)	
KA·ER_{fix}=1				0.0526**
				(0.0253)
KA·ER_{inter}=1				0.011
				(0.019)
KA·ER_{flex}=1				-0.0801***
				(0.0269)
Other controls				
Resource rent	0.00195**	0.00176*	0.00151	0.00153
	(0.001)	(0.0009)	(0.001)	(0.001)
Socioeconomic	0.00673**	0.00630**	0.00704**	0.00696**
	(0.0027)	(0.0026)	(0.0028)	(0.0027)
Broad money	-0.00101**	-0.000930**	-0.00105***	-0.00108***
	(0.0004)	(0.0004)	(0.0004)	(0.0004)
Economic crisis	-0.0818***	-0.0803***	-0.0987***	-0.0947***
	(0.0126)	(0.0122)	(0.0143)	(0.0138)
Observations	1726	1726	1726	1726
Adjusted R-square	0.592	0.599	0.575	0.578

Note: The RER misalignment variable used in the regression is based on the estimation discussed in Section 3.2 of this chapter. All regressions use the capital account openness index (KA) based on Aizenman et al. (2013). Regressions in columns 1 and 3 use the exchange rate flexibility index (ER) based on Aizenman et al. (2013). Regressions in columns 2 and 4 use the reclassified exchange rate regime of Ilzetzski et al. (2017). The country and year fixed effect, and country-specific trends are applied. ***,**, and * represents the level of significance of 1%, 5%, and 10% respectively. Robust standard errors to heteroscedasticity and autocorrelation are reported in the parentheses. Source: Author's calculation

Table 3A. 5 Asymmetric estimation results - singular specification (OLS estimates)

Dependent variable: RER misalignment (mis_{it})	1	2
mis_{it-1}	0.633***	0.343***
	(0.1124)	(0.104)
mis_{it-1}·1{mis_{it-1}<0}	0.13	0.0984
	(0.1664)	(0.1403)
Exchange rate regime (ER) & capital account openness (KA) in the persistence term		
mis_{it-1}·ER	-0.411**	
	(0.184)	
mis_{it-1}·ER_{inter}= 1		0.238**
		(0.1105)
mis_{it-1}·$ER_{flexible}$= 1		-0.262**
		(0.1303)
mis_{it-1}·KA	0.0189	0.0226
	(0.1323)	(0.1232)
mis_{it-1}·ER·1{mis_{it-1}<0}	0.0615	
	(0.2485)	
mis_{it-1}·ER_{inter}=1·1{mis_{it-1}<0}		-0.25
		(0.1583)
mis_{it-1}·$ER_{flexible}$= 1·1{mis_{it-1}<0}		0.222
		(0.1803)
mis_{it-1}·KA·1{mis_{it-1}<0}	-0.398**	-0.128
	(0.1975)	(0.1839)
Exchange rate regime (ER) & capital account openness (KA) in the misalignment level		
ER	0.0315	
	(0.0203)	
ER_{inter}= 1		-0.0433**
		(0.0185)
$ER_{flexible}$= 1		-0.0303
		(0.0194)
KA	0.0291	-0.0184
	(0.0209)	(0.0206)
ER·1{mis_{it}<0}	-0.182***	
	(0.0142)	
ER_{fix}=1·1{mis_{it}<0}		-0.158***
		(0.013)
ER_{inter}=1·1{mis_{it}<0}		-0.139***
		(0.0115)
$ER_{flexible}$= 1·1{mis_{it}<0}		-0.202***
		(0.0119)
KA·1{mis_{it}<0}	-0.0708***	0.0455***
	(0.0132)	(0.015)
Observations	1726	1726
Adjusted R-square	0.695	0.737

Table 3A. 6 Asymmetric estimation results - interaction specification (OLS estimates)

Dependent variable: RER misalignment (mis_{it})	1	2
mis_{it-1}	0.560***	0.553***
	(0.0916)	(0.115)
mis_{it-1}·1{mis_{it-1}<0}	0.188	0.23
	(0.1312)	(0.1609)
Exchange rate regime (ER) & capital account openness (KA) in the persistence term		
mis_{it-1}·KA·ER	-0.204	
	(0.2365)	
mis_{it-1}·KA·ER_{fix}=1		-0.266
		(0.2224)
mis_{it-1}·KA·ER_{inter}=1		0.0117
		(0.1784)
mis_{it-1}·KA·ER_{flex}=1		-0.792**
		(0.3923)
mis_{it-1}·KA·ER·1{mis_{it-1}<0}	-0.713**	
	(0.3514)	
mis_{it-1}·KA·ER_{fix}=1·1{mis_{it-1}<0}		-0.336
		(0.3176)
mis_{it-1}·KA·ER_{inter}=1·1{mis_{it-1}<0}		-0.568**
		(0.2755)
mis_{it-1}·KA·ER_{flex}=1·1{mis_{it-1}<0}		-0.157
		(0.5023)
Exchange rate regime (ER) & capital account openness (KA) in the misalignment level		
KA·ER	0.0615**	
	(0.0299)	
KA·ER_{fix}= 1		0.0931***
		(0.0356)
KA·ER_{inter}= 1		0.0561**
		(0.0262)
KA·ER_{flex}= 1		0.0738*
		(0.0409)
KA·ER·1{mis_{it}<0}	-0.314***	
	(0.0198)	
KA·ER_{fix}= 1·1{mis_{it}<0}		-0.157***
		(0.0146)
KA·ER_{inter}= 1·1{mis_{it}<0}		-0.159***
		(0.0115)
KA·ER_{flex}= 1·1{mis_{it}<0}		-0.285***
		(0.0315)
Observations	1726	1726
Adjusted R-square	0.624	0.643

Note: The RER misalignment variable used in the regression is based on the estimation discussed in Section 3.2 of this chapter. All regressions control for resource rent, social-economic condition, the ratio of broad money to GDP, and economic crisis events. The capital account openness index (KA) based on Aizenman et al. (2013) is used for all regressions. Regressions in the first column of tables A.5 and A.6 use the exchange rate flexibility index (ER) based on Aizenman et al. (2013). Regressions in the second column of tables A.5 and A.6 use the reclassified exchange rate regime of Ilzetzski et al. (2017). The country and year fixed effect, and country-specific trends are applied. ***,**, and * represents the level of significance of 1%, 5%, and 10% respectively. Robust standard errors to heteroscedasticity and autocorrelation are reported in the parentheses. Source: Author's calculation

Table 3A. 7 Asymmetric estimation results – alternative capital account policy indices

Dependent variable: RER misalignment (mis_{it})

	1	2	3	4
mis_{it-1}	0.652***	0.709***	0.704***	0.696***
	(0.0885)	(0.0859)	(0.0886)	(0.0811)
mis_{it-1}·1{mis_{it-1}<0}	0.156	0.0756	0.0628	0.0992
	(0.1296)	(0.1263)	(0.1296)	(0.119)
Exchange rate regime (ER) & capital account openness (KA) in the persistence term				
mis_{it-1}·ER·KA_{Aiz}	-0.514***			
	(0.1906)			
mis_{it-1}·ER·KA_{Sch}		-0.787***		
		(0.288)		
mis_{it-1}·ER·$KA_{Sch\text{-}inflow}$			-0.769***	
			(0.2831)	
mis_{it-1}·ER·$KA_{Sch\text{-}outflow}$				-0.719***
				(0.2463)
mis_{it-1}·ER·KA_{Aiz}·1{mis_{it-1}<0}	-0.435			
	(0.2983)			
mis_{it-1}·ER·KA_{Sch}·1{mis_{it-1}<0}		-0.0529		
		(0.3905)		
mis_{it-1}·ER·$KA_{Sch\text{-}inflow}$·1{mis_{it-1}<0}			-0.00535	
			(0.3749)	
mis_{it-1}· ER·$KA_{Sch\text{-}outflow}$·1{mis_{it-1}<0}				-0.138
				(0.3551)
Exchange rate regime (ER) & capital account openness (KA) in the misalignment level				
ER·KA_{Aiz}	0.0363			
	(0.0287)			
ER·KA_{Sch}		0.0683**		
		(0.0334)		
ER·$KA_{Sch\text{-}inflow}$			0.0636*	
			(0.0327)	
ER·$KA_{Sch\text{-}outflow}$				0.0747**
				(0.0313)
ER·KA_{Aiz}·1{mis_{it}<0}	-0.240***			
	(0.0198)			
ER·KA_{Sch}·1{mis_{it}<0}		-0.266***		
		(0.025)		
ER·$KA_{Sch\text{-}inflow}$·1{mis_{it}<0}			-0.260***	
			(0.0234)	
ER·$KA_{Sch\text{-}outflow}$·1{mis_{it}<0}				-0.259***
				(0.0238)
Observations	940	940	940	940
Adjusted R-square	0.732	0.745	0.747	0.740

Note: The RER misalignment variable used in the regression is based on the estimation discussed in Section 3.2 of this chapter. All regressions control for resource rent, social-economic condition, the ratio of broad money to GDP, and economic crisis events. The exchange rate flexibility index (ER) based on Aizenman et al. (2013) is used. KA_{Aiz} corresponds to the capital account openness indicator by Aizenman et al. (2013). KA_{Sch} refers to the overall capital account indicator by Schindler (2009) with the inflow/outflow subscript indicating the indicator for the degree of capital openness for capital inflows/outflows. The country and year fixed effect, and country-specific trends are applied. ***,**, and * represents the level of significance of 1%, 5%, and 10% respectively. Robust standard errors to heteroscedasticity and autocorrelation are reported in the parentheses. Source: Author's calculation

4. How effective is capital flow management?

The Indonesian experience

Summary

This chapter reviews capital flow management (CFM) policy in Indonesia and examines its effectiveness from 2000 to 2019. The methodology involves constructing a new capital flow management policy restrictiveness index (CFMIX) separately for capital inflows and outflows and examining impulse responses of these flows to CFMIX adjustments through structural vector auto-regression (SVAR) estimation. The index shows that the Indonesian CFM policy stance has been more accommodative of capital inflows and restrictive on outflows over time. The results of the SVAR analysis indicate that capital inflows in the form of portfolio investment are significantly responsive to CFM measures. However, there is no evidence of significant impact of CFM policy on capital outflows.

4.1. Introduction

The Mundell-Fleming trilemma postulates that an economy cannot maintain a sustainably independent monetary policy, fixed exchange rate, and free capital mobility at the same time. The mainstream macroeconomic policy advocacy during the post-Bretton Woods era until the late 1990s therefore favoured exchange rate flexibility and monetary autonomy while opening the capital account. The appropriateness of this policy configuration has, however, come under reconsideration following the Asian financial crisis (AFC) 1997 – 1998 and the subsequent financial turmoil in other emerging and developing economies, which demonstrated that exposure to volatile capital flows makes countries with underdeveloped domestic financial markets vulnerable to a financial crisis. Consequently, over the past two decades, there has been a tendency in these countries to adopt a 'middle ground' of the trilemma: maintaining a feasible level of monetary independence, fine-tuning the flexibility of the exchange rate, and managing capital mobility through prudential capital flows management (Aizenman, 2019; Frankel, 1999). In the context of the ongoing process of financial globalization, the effectiveness of capital flow management measures is a key determinant of the viability of this policy configuration. The purpose of this chapter is to examine this issue through a case study of Indonesia.

Indonesia figures prominently in the policy debate on the sequencing of liberalization reforms as a unique case of liberalizing the capital account well before trade liberalization and domestic financial sector reforms. During the 1970s and the first half of 1980s, capital account opening did not have a discernible impact on the

macroeconomic performance because the Indonesian economy remained virtually detached from world capital markets at the time. However, the circumstances changed from about the late 1980s, when broad-based liberalization reforms began to expose the economy to financial globalization. In the lead-up to the AFC, 'the Indonesian private sector engaged in a short-term international borrowing binge' and capital exoduses contributed to huge depreciation of the rupiah and banking collapsed during the crisis (Corden, 2004, p. 204). This experience resulted in a focus on prudential management of capital flows in the post-AFC macroeconomic policy debate in Indonesia (Warjiyo and Juhro, 2019, Chapter 15). With a relatively shallow domestic financial market, volatile capital inflows transmit shocks to the Indonesia economy from global financial markets through the exchange rate channel. Therefore, managing capital flows to maintain domestic macroeconomic stability has become an important policy focus.

This chapter examines the impact of capital flows management (CFM) policy on the magnitude and the composition of capital flows in Indonesia. The empirical analysis involves constructing a quarterly CFM policy index (CFMIX) that capture the restrictiveness of policies on capital inflows and outflows implemented by the Indonesian authorities. The impact of the CFMIX adjustments on the dynamics of capital flows is examined based on the impulse response function generated by structural vector auto-regression (SVAR) estimations that are applied to quarterly data covering the 2000 – 2019 period.

The movements of CFMIX for capital inflows indicate that the Indonesian policy stance was becoming more restrictive until about 2007 and then gradually becoming more open continuously since 2012. As for capital outflows, the index indicates that the policy was continually becoming less accommodative. Meanwhile, the results of SVAR analysis suggest that portfolio investment inflows significantly respond to adjustments of the CFM measures targeted for inflows. The analysis also suggests that increasing CFM restrictiveness for inflows decrease the share of short-term flows in the aggregate inflows, although the impact is not statistically significant. As for capital outflows, the analysis does not find any evidence on the effectiveness of the CFM measures.

The remainder of the chapter is organised as follows: The following section reviews the literature on the capital account liberalization debate and provides an overview of recent policy responses of emerging economies related to capital mobility. The third section provides a chronological account of Indonesia's capital account policy evolution. The construction of the CFMIX, methodology, and data are discussed in the fourth section. The fifth section examines the association between adjustments of CFMIX with capital flows. The key findings are summarised in the final section.

4.2. Literature review

4.2.1. Capital account liberalization

As postulated by the Mundell-Fleming model (Mundell, 1963; Fleming, 1962), in the context of financial globalization, a small open economy is faced with the 'trilemma' of choosing two out of the three policy objectives: exchange rate stability, monetary policy autonomy, and full capital mobility. The theory implies that an economy that prioritizes a fixed exchange rate regime and a liberalized capital account cannot have monetary policy autonomy. This configuration is the present arrangement within the Euro area. If monetary policy autonomy and free capital mobility become the priority, the economy cannot maintain a fixed exchange rate regime, which is the current arrangement in advanced economies, excluding Euro countries. Finally, the economy cannot have full capital mobility by prioritizing monetary policy autonomy and exchange rate stability as applied during the Bretton Woods era.

The Bretton Woods system that governed international monetary relations during 1944 – 1971[34] was born out of a consensus among the major allied nations led by the UK and the USA that exchange rates coordination failure and frequent competitive devaluation of currencies among countries exacerbated political instability and disrupted international trade during the interwar years (League of Nations, 1944). Thus, the chief feature of the system was a 'fixed but adjustable'

[34] The agreement for establish the new monetary system was signed by representatives of 44 allied bastions on 22 July 1944 at a conference held in Bretton Wood, New Hampshire, the USA. On 15 August 1971, the US unilaterally terminated convertibility of the US$ to gold, effectively bringing the system to an end.

exchange rate mechanism managed by the International Monetary Fund (IMF). Each member country of the IMF was required to peg its currency to the US$ (which fully convertible to gold for central bank transactions) and adopt a monetary policy that maintains the exchange rate within one percent band of the officially declared rate. The exchange rate was adjustable only in the context of a fundamental balance of payments disequilibrium and the adjustment was subject to the IMF's approval and monitoring (Williamson, 1985). Member countries were permitted to maintain capital controls as and when required to gain monetary policy autonomy required to maintain the exchange rate commitment. The prime objective of the system, based on the traumatic experience of the inter-war period, was to facilitate the smooth functioning of world merchandise trade under a predictable exchange rate system. Premature liberalizing capital controls without meeting this prerequisite was considered a precursor to exchange rate overvaluation, financial fragility, and subsequent economic crisis (Agénor and Montiel, 2015 chapter 18; McKinnon, 1993).

The collapse of the Bretton Woods system paved the way for a paradigm shift in favour of capital account liberalization and monetary policy autonomy under free-floating exchange rate arrangements. Capital account liberalization, analogous to the case for trade liberalization, was assumed to deliver economic benefits by providing access to larger and cheaper funding for investment, facilitating technological and skill transfer, enabling consumption smoothing, providing diversification to minimize risk, enacting discipline for macro policy formulation (IMF, 2010: Box 1). The shift in policy focus in advanced economies was reflected in the decision to remove short-term flows from exclusion in the OECD's 1961 version of the Code of Liberalization of

Capital Movements. The push for greater financial openness was also incorporated in policy advice to developing countries (Fischer, 2005; Summers, 1998). In 1995, the IMF initiated an amendment to its articles to include capital account convertibility into its jurisdiction.

Following the AFC of 1997 – 1998 and a string of currency crises in other countries in the subsequent years, there have been questions on the benefits of having capital account convertibility and a swing of the pendulum in favour of prudential capital account management. The crisis led to a growing concern that financial liberalization increases competition among financial institutions that could lead to excessive risk-taking behaviour in the form of moral hazard (Demirguc-Kunt and Detragiache, 1998). Volatile asset prices during buoyant periods wear down the ability to sufficiently collateralise the institutions' loans, while competition limits the adjustment of the risk premia on loans. In a liberalized capital account regime with inadequate regulations, currency crises may easily transform into financial crises.

The view that free capital mobility creates economic gains and benefits as in the case of trade liberalization is strongly criticized by Bhagwati (1998). In his paper, Bhagwati reiterates the warning of Kindleberger (1996) that capital flows are susceptible to panics and manias. As observed by Rajan (2011), to minimize risk due to differences in the financial system between advanced and developing economies, foreign investors tend to only be interested in short-term financing, denominated in the foreign currency and channelled through local banks to gain implicit protection from the government of the receiving country. Therefore, any global or domestic event

that prompts significant capital reversal triggered sharp exchange rate depreciation that may lead to an economic crisis.

Rodrik and Subramanian (1998) highlight the lack of evidence for the long-term benefit of opening the capital account, regardless of the liberalization sequencing, and argue that linking international financial markets with the domestic market introduces two major risks. First, the link-up would increase the availability of liquidity for borrowers that could significantly magnify the impacts of market sentiment turnaround. Second, the home country will be more exposed to contagion from one market to another. They also point out that even consistent fiscal and macroeconomic policies cannot eliminate the likelihood of experiencing crises. Kaminsky and Reinhart (1999) analyse the associations between banking and currency crisis and find that financial liberalization often leads to banking crises, which then leads to a currency crisis. Their observation suggests that crises occur following a prolonged bullish period supported by capital inflows surge, high credit growth, and currency overvaluation.

Along with changes in the domestic political and economic setting driven by lessons from the episodes of economic crises, some emerging and developing economies have been adjusting their open macroeconomic policy configuration to achieve a balance between achieving domestic economic goals and maximizing the gains from accessing the international capital markets rather than going for the conventional corner solution. The choice of appropriate capital flows management measures is an integral element of this policy configuration (Aizenman, 2019; Frankel, 1999).

4.2.2. Capital flow management

The term capital flow management (CFM) measures refer to a set of policies that regulate international financial asset transactions and aim to mitigate the risks associated with surges and reversals of capital flows. In the context of an economy experiencing net capital outflows and in the absence of ample foreign exchange reserves, a sudden stop or capital reversal can cause the exchange rate to depreciate drastically thereby increasing inflation. The reduced supply of foreign exchange needed for international trade transactions and fulfilling international financing commitments could also cause economic activity to contract and disrupt economic stability. In the context of net capital inflows, excessive inflows (surges) could disrupt domestic financial and macroeconomic system stability. The surge could lead to increased asset price volatility and create asset price bubbles, stimulate excessive credit growth, and exchange rate appreciation.

The CFM measures could be implemented for capital inflows and outflows. Implementation of measures to manage capital inflows could allow countries to obtain monetary policy independence while at the same time protect them from international speculation. Introducing measures on capital outflows could also be implemented as a way to slow down the shrinkage of international reserves, providing the needed window for authorities to implement sound policies and limit speculative transactions. These can be in the form of taxes, multiple exchange rates, and prohibitions of certain transactions (Edwards, 1999).

The standard IS-LM-BP (Mundell – Fleming) model postulates that net capital inflow appreciates the exchange rate and deteriorate the current account balance, which in turn reduces aggregate demand. However, empirical evidence from various developing economies shows that capital inflows have had a more expansive impact on economic activity through growth in domestic credit that led to the expansion of domestic consumption and investment activities (Caballero, 2016; Milesi-Ferretti and Tille, 2011; Reinhart and Reinhart, 2008). To identify feasible policies for managing the impact of capital mobility in the context of a developing economy, Ghosh et al. (2018, p.162) have modified the Mundell-Fleming model and show that policies that address the volume of foreign capital inflows such as capital control or sterilized intervention, as well as policies that could reduce domestic credit growth such as loan-to-value ratio policy, could help to dampen the expansive impact of capital inflows. The implementation of capital control policies that impose an extra cost for the investor could reduce capital inflows, which then would limit domestic credit expansion and currency appreciation. However, this policy would come at the cost of a forgone higher output level due to the reduction of net capital inflows.

The general view in the theoretical literature of prudential capital control is that in the absence of regulation, market participants could acquire excessive short-term foreign debt and issue risky financial instruments. For market participants, it is rational for them to not internalize the effects of their decision that impose externalities on the economy through the increase of financial fragility. Therefore, liquidity requirements, sterilization of capital inflows, and prudential measures on capital flows that are aimed at internalizing externalities and adjusted according to

risk, could lower the level of financial fragility (Caballero and Krishnamurthy, 2006; Korinek, 2011, 2018). Other than the positive effect on the financial stability dimension, countercyclical capital control policy could help to enhance macroeconomic adjustment in economies with suboptimal exchange-rate or monetary policy and nominal rigidities (Farhi and Werning, 2012; Schmitt-Grohé and Uribe, 2017).

Learning from the episodes of economic crisis associated with surges and reversals of capital flows, emerging economies have been experimenting with various measures to manage the capital flows.[35] Most of these measures deal with the inflows, presumably because it is more manageable to deal with capital inflows early on rather than limiting the outflows. In the mid-2000s, several emerging and developing economies implemented inflow controls in response to surging capital inflows. Colombia and Thailand, for example, employed unremunerated reserve requirements (URR) with different ratios to dampen the appreciation pressure on their exchange rates. A similar policy was introduced in Croatia, where a marginal reserve requirement (MRR) was imposed on bank foreign financing. In the case of Brazil, although the stated aim was to increase fiscal revenue, the tax rate for foreign exchange transaction was increased. During the Global Financial Crisis (GFC) in 2008, some emerging and developing economies experienced sharp capital reversals. However, capital inflows to these economies resurged quickly in the second half of 2009 driven by better domestic growth prospects and supported by the accommodative monetary policy stances in the advanced economies. Responding to

[35] A list of capital flow management policies taken by emerging economies is available in Appendix – Table 4A.1.

the surge of inflows, several countries adopted measures to manage the inflows directly or indirectly by using capital controls or currency-based prudential measures. A literature survey on the effectiveness of CFMs by Magud and Reinhart (2006) shows that capital inflows controls tend to make monetary policy more independent and shifts the composition of capital flows from short-term to longer-term. However, the survey cannot draw a firm conclusion on the impact of the application of CFM on the volume of capital flows and the dynamics of the real exchange rate.

Since the GFC, the case for weighing the actual benefits of having free capital mobility against financial fragility and prudential problems associated with the capital flows has become stronger (Grenville, 2014). Ostry et al. (2010,2011,2012) observed the performance of emerging economies by comparing countries that implemented capital control policies with those that did not before the GFC. Their observations show that countries with capital control policies have smaller output decreases and lower financial stability risk (in terms of portfolio debt in total external liabilities and foreign exchange lending by domestic banking systems) compared to countries that did not implement these policies when the GFC occurred. Multi-country studies for emerging economies indicate that the application of capital control measures discourages capital inflows (Ahmed and Zlate, 2014) and plays a significant role in reducing financial fragilities (Forbes et al., 2015, 2016). The case for capital flow management policy has attracted increasing interest from the IMF. Known for its position in championing capital account convertibility, the IMF's recent institutional view expressed the organization's tolerance for the use of measures to limit the unwanted impacts of full capital mobility (IMF, 2012, 2016).

There has been a large literature on CFM policies in individual countries, with a heavy concentration of studies on the experiences of Chile and Malaysia covering the period before the GFC.[36] Following the GFC, the focus seems to shift to Brazil and South Korea. In the case of South Korea, the application of CFMs was associated with lower financial stability risks and lower volatility in capital flows (Ree et al., 2012; Kim, 2013; Bruno and Shin, 2014). Studies for Brazil indicate that prudential and control measures tend to be associated with higher monetary policy independence, significant decreases in capital inflows, and lower exchange rate appreciation pressures (Forbes et al., 2016; Chamon and Garcia, 2016).

Empirical studies on the effectiveness of CFM measures in Indonesia have been sparse. Park and Song (1998) examine the macroeconomic aspects of capital inflows and related policy responses taken in Indonesia covering the period of 1990 – 1995. Based on an analytical narrative they infer that monetary sterilization and measures to restrict the inflow of foreign capital were successful in moderating domestic demand. Using a structural vector autoregression approach, Jayasuriya and Leu (2012) assess the effectiveness of capital flows restrictions in Indonesia covering the period of pre and post AFC (1990 – 2010). Based on their inflow and outflow restrictions index, the authors find that restrictive policies had an adverse effect on FDI inflows but were largely ineffective for portfolio capital inflows. However, for the period 2000 – 2010, the results indicate inflow restrictions have a short-term impact on

[36] Edwards and Rigobon (2009), Gallego et al. (2002), De Gregorio et al. (2000), Laban and Larrain (1998), Laurens and Cardoso (1998), Valdés-Prieto and Soto (1998). For Malaysia see Athukorala (2001), Athukorala and Jongwanich (2012), De Kaplan and Rodrik (2002), Dornbusch (2001), and Tamirisia (2004).

inward portfolio investments and able to shift funds from short-term to long-term markets.

4.3.Capital account management policy in Indonesia

4.3.1. Pre AFC period

Since independence in 1945, Indonesia has experienced a series of economic crises and has experimented with various policy configurations to maintain economic performance amid the changing political and global economic conditions. In the early period under the Soekarno regime, the economy was marked by lack of investment, macroeconomic instability, and structural rigidity. Economic policies were directed to achieve economic sovereignty and maintain the political stability of the new state intact, rather than on growth and development. In this period, complex trade barriers, foreign exchange controls on current account transactions, and multiple exchange rates were maintained as part of an inward orientated development strategy (Dick, 2002; Hill, 2000).

Under the new order regime that replaced the Soekarno regime in 1967, there was a policy shift to restore the economy's internal and external balance. Given the domestic and international political economy setting at the time and the urgent need to close the foreign exchange gap, the government took a series of rapid macroeconomic stabilization policies to restore credibility in international capital markets and also to impose discipline on domestic policy excess. The policies include balanced fiscal budget, managed money supply growth, multiple exchange rates removal, floating the exchange rate, and capital account liberalization. The reforms started by permitting free convertibility of the rupiah for current account transactions.

In the same year, restrictions of inward FDI were lifted and profits and dividends remittances and capital repatriation were allowed. To attract domestic and foreign savings to the banking system, both residents and non-residents were permitted to borrow or open accounts in dollars and convert them to rupiah. The liberalization culminated with the decision to remove restrictions on capital outflows in 1970 (Bresnan, 1993; Chwieroth, 2010; Grenville, 1976; Mas'oed, 1983).

Liberalization of capital account transactions continued in the 1980s in response to the significant decrease in the oil price, which was the country's main source of foreign exchange. Participation of foreign investors in the domestic stock market was allowed in 1987. In the following year, foreign investors were permitted to form joint-venture securities firms with residents and accommodate the existing foreign banks' branches to open sub-branches in six major cities. In 1992, non-residents were allowed to purchase up to 49 per cent equity in domestic banks and domestic firms were allowed to list up to 30 per cent of their equity on foreign exchanges.

According to the conventional wisdom of sequencing economic liberalization reforms, capital account opening needs to be undertaken after achieving current account convertibility and financial sector reforms (McKinnon, 1993). However, the liberalization reforms in Indonesia were sequenced in the reversed manner: capital account liberalization in 1967, domestic financial market liberalization in 1983, and current account liberalization in 1986.

Before the AFC, some observers cited the Indonesian unconventional liberalization sequencing as a successful case. For instance, Cole and Slade (1996) observed that '[T]he Indonesian experience with implementing policies for the

banking sector demonstrates that freeing up direct controls over prices, allocation and entry of new institutions need not lead to crises and chaos as it has in some countries, but instead can result in reasonably healthy growth, expanded services and improved efficiency' (Cole and Slade, 1996 p.140). According to Quirk and Evens (1995) 'Indonesia, ... is a longstanding example of a successful and sustained opening of the capital account in which capital liberalization took place, in 1971, before the financial sector was reformed' (Quirk and Evens, 1995 p.16). Sustained high economic growth for more than a decade since the latter half of the 1980s has earned Indonesia a place as one of the high-performing Asian economies (HPAEs) (World Bank, 1993).

The AFC served to reveal the fundamental flaw of pre-AFC interpretations of the 'success' of the unconventional sequencing of liberalisation reforms. In reality, the remarkable macroeconomic performance prior to the AFC was simply a manifestation of the financial underdevelopment of the economy. The domestic financial system was characterized by low global exposure and dominated by government-owned banks. There were only a few globally linked companies in the real sector. Therefore, whether the capital account was opened or closed would have had virtually no impact on the exchange rate or domestic macroeconomic instability. Nonetheless, as the economy became increasingly integrated into the global economy through short-term international borrowing by the private sector, volatile capital flows had become to act as a destabilising factor. Worsening risk perception and the rupiah collapse reinforced capital outflows and the collapse of the domestic banking system lead to a full-scale economic crisis (Corden, 2004).

4.3.2. Post AFC period

To restore macroeconomic stability, in 1999 the Indonesian government considered several alternative policy choices to manage its capital account. The alternatives being considered were controls on outflows (Malaysian-style), currency board, foreign exchange monitoring system, and capital inflow tax. Considering the institutional setting, resource availability, investor perception, and political considerations at the time, the government chose a foreign exchange and capital flows monitoring system as promulgated in act number 24 of 1999 concerning the foreign exchange activities and the exchange rate system (Levinson, 1999 p.543-548).

The law emphasized that every resident may freely own and use foreign exchange and should submit information and data concerning foreign exchange transactions to the authority (the central bank, Bank Indonesia (BI))[37]. The political shift following the AFC has given autonomy to the central bank to achieve its objective of maintaining price stability (Marks, 2009). Under the IMF structural adjustment programme, the central bank operates based on monetary-base targeting between 1997 and 2000. In the following period of 2000-2004, BI gradually adopted inflation targeting by using both the monetary base and the central bank's certificate (SBI) interest rate as policy instruments. In 2005, the central bank fully adopts inflation

[37] In the case the resident failed to provide the necessary information, Bank Indonesia can impose an administrative sanction in the form of a written warning or a fine, or a recommendation of revocation of business license by an authoritative agency. Additionally, to implement prudential principle, Bank Indonesia can prescribe provisions on foreign exchange transaction which is conducted through banks.

targeting, using the SBI interest rate as a monetary policy instrument to manage aggregate demand.

There are indications that Indonesia's post-AFC capital account policy has become relatively more restrictive during the post-AFC era compared to the three preceding decades (Aizenman et al., 2013). Driven by the lessons learned from the impact of capital flow surges and reversals following the GFC in 2008, capital flow management is included as part of a policy mix encompassing interest rate, foreign exchange intervention, and macro-prudential policy (Warjiyo, 2013, 2014). Indonesia's capital flow management policy principles, as evolved during the post-AFC era, adopts the following guidelines: First, the capital flow management policy is mainly aimed at mitigating the negative impact of capital flows on the volatility of exchange rates, monetary and financial systems as well as the overall macroeconomics stability. Second, the policies are applied selectively to short-term and speculative capital flows, while accommodating foreign direct investment and other long-term and productive capital flows. Third, the policy does not discriminate transactions based on the residential status of the investor (Warjiyo, 2014; Warjiyo and Juhro, 2019. p.411).

The following are highlights of the capital flow management policy implemented by Bank Indonesia after the GFC. Responding to the impact of quantitative easing policies in advanced economies that led to increased capital inflows, in 2010 the central bank imposed a six-months holding period for SBI transactions and implement a maximum limit of short-term foreign loans in the banking sector of 30% from the capital. The purpose of this policy was to reduce short-term capital inflows and increase the composition of long-term capital flows. Also, to

manage the exchange rate risk, the loan restriction policy in the banking sector is aimed at reducing the risk stemming from maturity mismatch. In 2013, during the taper tantrum episode, foreign capital inflows to Indonesia decreased and even reversed direction. Responding to the limited foreign capital inflows condition, the capital flow management was relaxed by reducing the holding period of SBI to one month and exempt some transactions from the calculation of short-term foreign bank loans limitations. The central bank also imposed regulations at the end of 2014 to strengthen the risk management for foreign debt. For example, for foreign debt in the banking sector, in addition to the foreign loan limitation previously discussed, a bank must obtain prior permission from the central bank for a foreign loan. For non-bank corporations, Bank Indonesia applies risk management provisions in the form of (i) minimum hedging obligations of 25% of net foreign currency liabilities that will mature in the next three and six months, (ii) maintaining a minimum liquidity ratio of 50% of net foreign exchange liabilities due within the next three and six months, and (iii) the company has a credit rating of no lower than one notch below investment grade (Bank Indonesia, 2010 – 2015).

As depicted in Figure 4.1, the capital account openness index compiled by Fernández et al. (2016) indicates that the number of measures employed in managing Indonesia's capital flows has increased after the AFC. The index for inflows has higher values compared to the outflows indicating there is more regulation in place for non-residents purchasing Indonesian financial assets compared to Indonesians purchasing foreign financial assets. Although not as liberalized as Singapore and Australia when compared to neighbouring countries, the capital account openness index indicates

that Indonesia's capital account regulation is more liberalized compared to Malaysia, Thailand and the Philipines (Figure 4.2). However, in terms of foreign asset and liabilities to GDP ratio (as an indicator of *de facto* capital account openness), Figure 4.3 indicates that the degree of Indonesia's *de facto* capital account openness is generally lower compared to Malaysia, Thailand and the Philippines. This suggest the gap of Indonesia's financial market development compared to the other three countries.

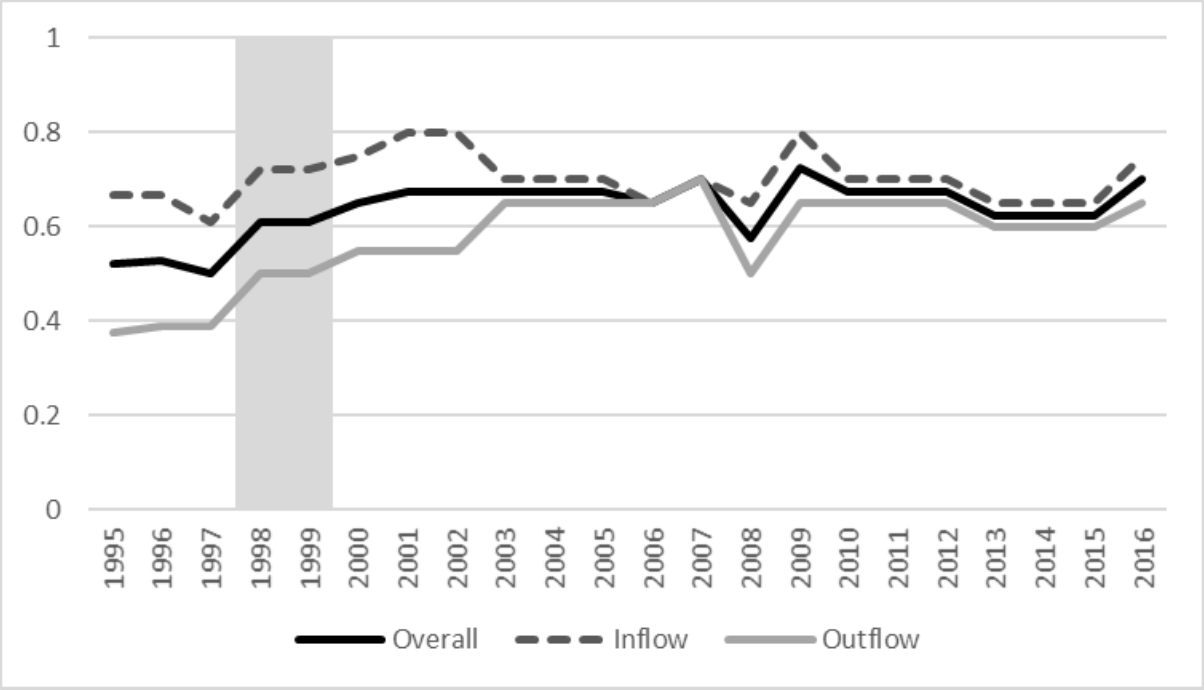


Figure 4.1 Indonesia capital inflow and outflow openness indices

Note: Capital account openness index uses the scale 0 to 1 where a lower value indicates more liberalized capital account.

Source: Fernandez et al. (2016)

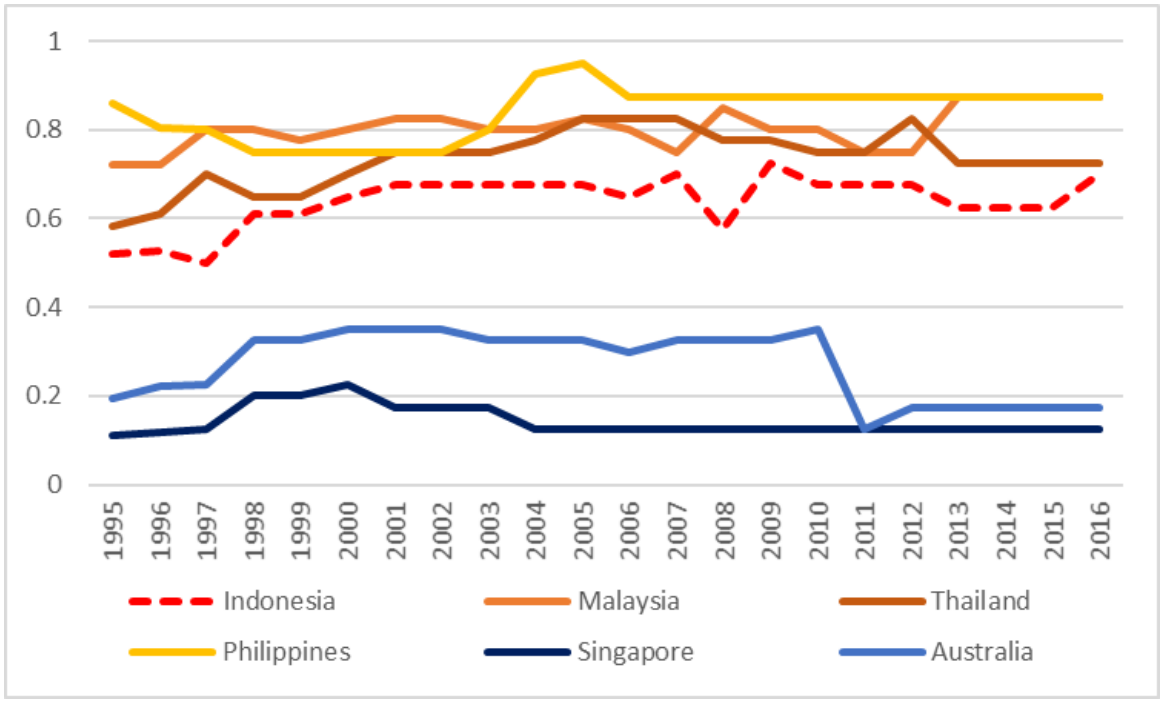


Figure 4.2 Regional *de jure* capital account openness comparison

Note: Capital account openness index uses the scale 0 to 1 where a lower value indicates more liberalized capital account.

Source: Fernandez et al. (2016)

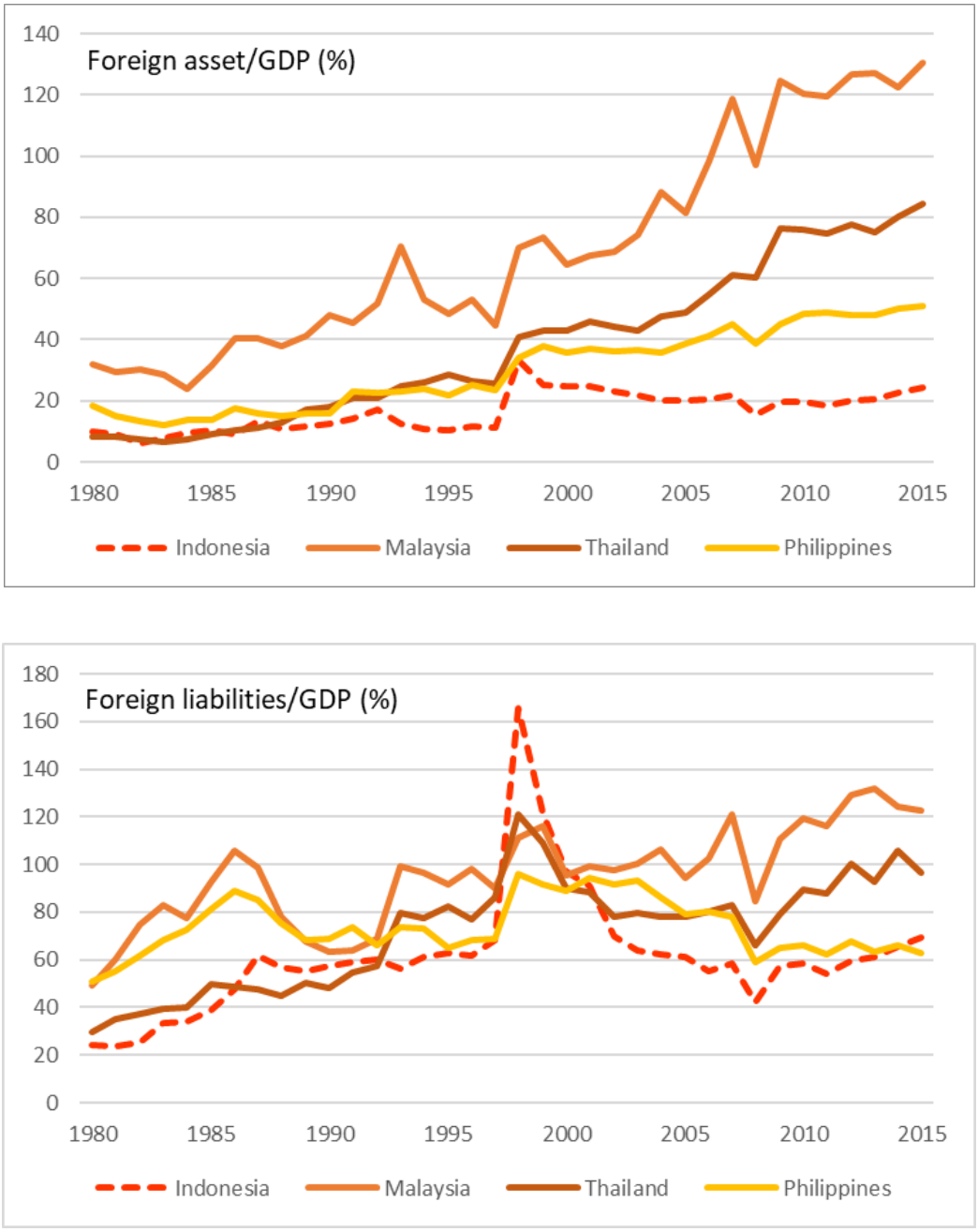


Figure 4.3 The ratio of foreign asset and liabilities to GDP (1980-2015)

Source: Lane and Milesi-Ferretti (2018)

4.3.3. Patterns of capital flows in Indonesia (2000 – 2019)

From about 2004 net capital inflows have increased continuously in-line with the recovery of the capital inflows to the region supported by the country's favourable growth prospect along with increasing commodity prices (Figure 4.4). There were some episodes of capital reversals related to the global financial crisis. However, lower growth prospect in advanced economies and accommodative global monetary policy stance has driven the recurrence of net capital inflows in the following year until mid-2011 when the US sovereign debt was downgraded, which prompted capital flight from Indonesia. In 2012 capital inflows returns to its increasing trend until the Federal Reserve communicated a plan to adjust the quantitative easing policy that spurred the 'taper tantrum' episode of 2013. After the tapering episode, inflows recurred until the mid-2015 when the prospect of China's lower growth and the federal reserves interest rate normalization has decreased the capital flows coming to Indonesia (Basri, 2017).

During 2008 – 2011, the foreign exchange reserve position increased rapidly driven by the positive balance in the financial and current account (Figure 4.5). Since 2012, in line with increasing domestic economic activity, the current account balance has been negative. Therefore, although the financial account continually recorded positive net flows, the level of foreign exchange reserves started to plateau and the nominal exchange rate has been in a depreciative trend (Figure 4.5).

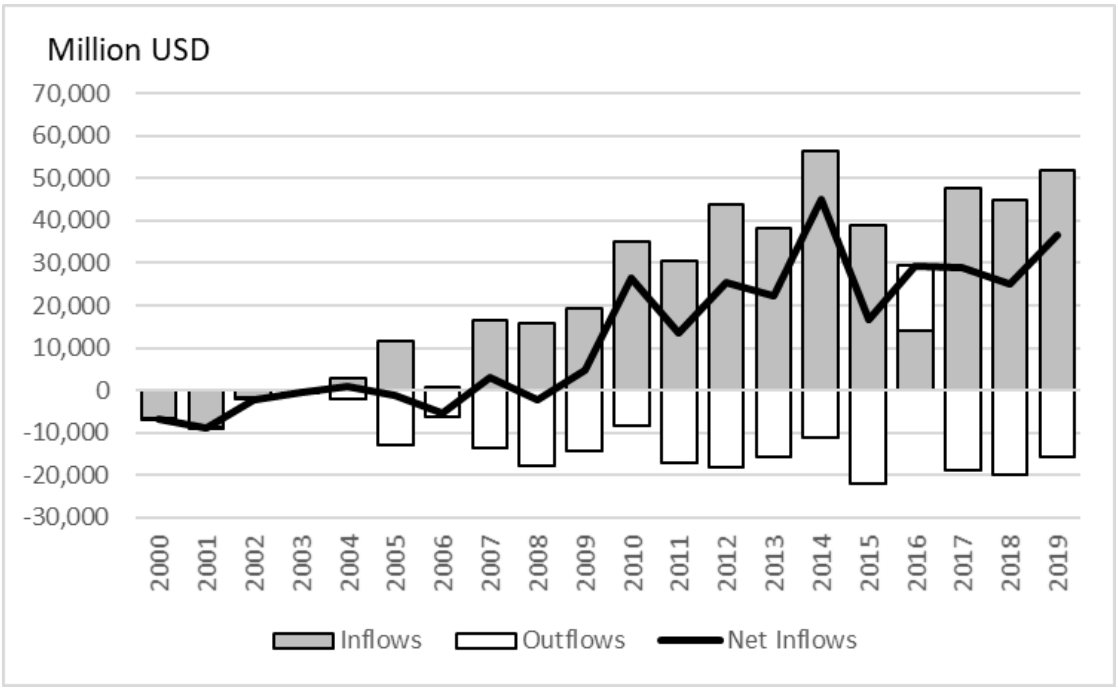


Figure 4.4 Indonesia's net capital flows

Source: IMF

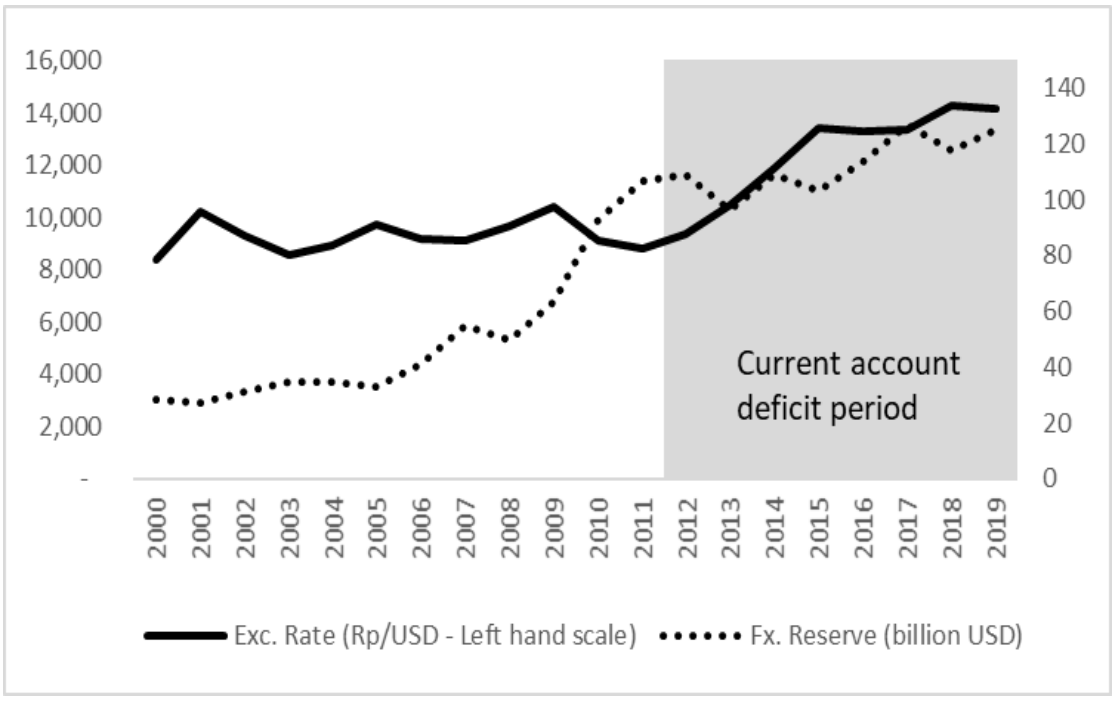


Figure 4.5 Indonesia's nominal exchange rate and foreign reserves

Source: IMF & Bank Indonesia

On the inflow (liabilities) side, foreign direct investment (FDI) dominates the country's financial account liabilities. In the sample period (2000-2019), FDI inflows on average contributed to almost 2% of GDP annually. Most of the FDI inflows were in the form of equity and distributed in the manufacturing, wholesale and retail trade, agriculture, transportation and communication, and mining sector. Another important type of investment in the liabilities side is portfolio investment (PI). The magnitude of PI to Indonesia was increasing overtime and getting closer to the magnitude of FDI. In the sample period, PI liabilities on average reached 1.7% of GDP. Most of the PI flows were in the form of public debt securities (government bonds), followed by investment in the form of equity and debt securities in the private sector. Other investments (OI) that consist of currency and deposits, loans, trade credits, and other assets were relatively small compared to FDI and PI (Figure 4.6). In the asset (outflow) side of the financial account, FDI contributed the largest share to the capital outflow, followed by OI in the form of currency and deposit, loans and trade credit from the private sector while PI only contributed modestly (Figure 4.7).

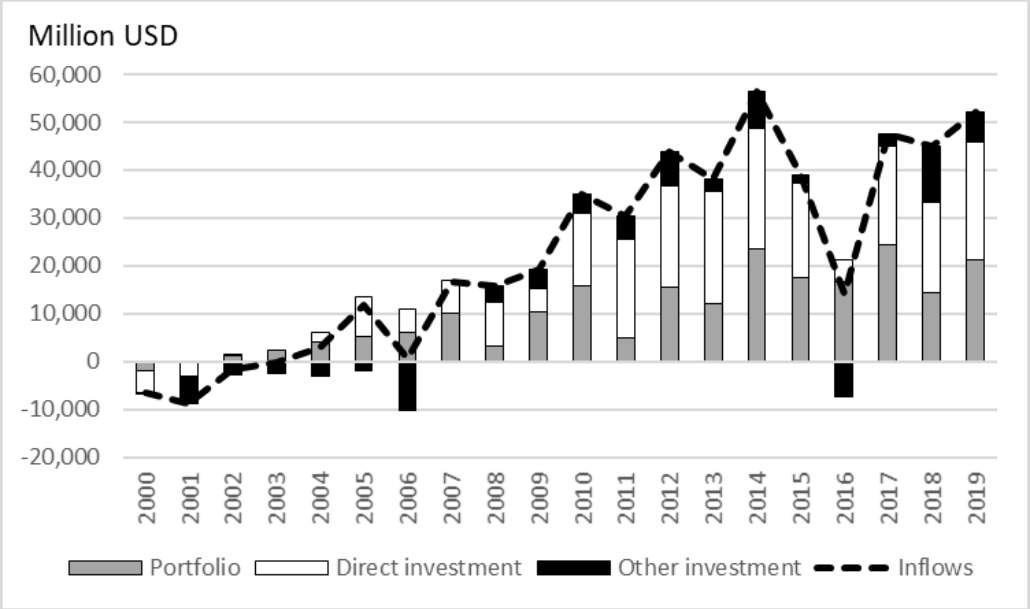


Figure 4.6 Indonesia capital inflows

Source: IMF

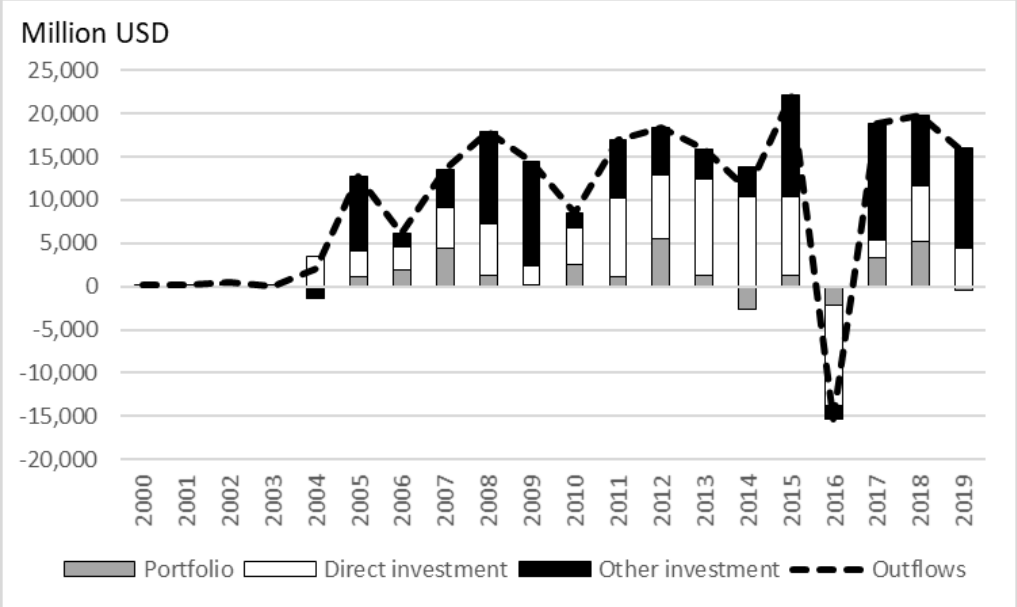


Figure 4.7 Indonesia capital outflows

Source: IMF

To assess the capital flows' volatility, the 3-year rolling standard deviation for each type of inflow and outflow are depicted in Figure 4.8 and Figure 4.9. Foreign direct investment inflows have the lowest overall volatility compared to the portfolio

and other investment[38] (Figure 4.8). In the case of capital outflows, direct investment and portfolio outflows are less volatile compared to other investments outflows (Figure 4.9).

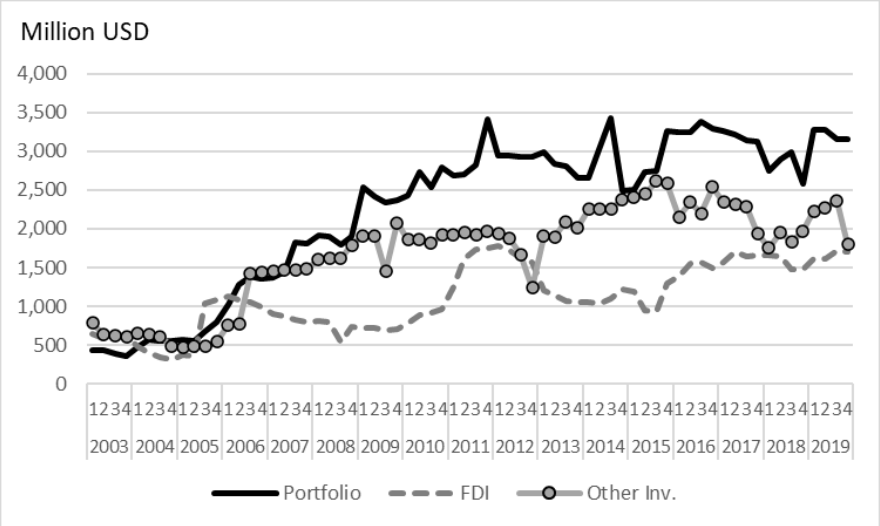


Figure 4.8 Capital inflows volatility

Source: Author's calculation

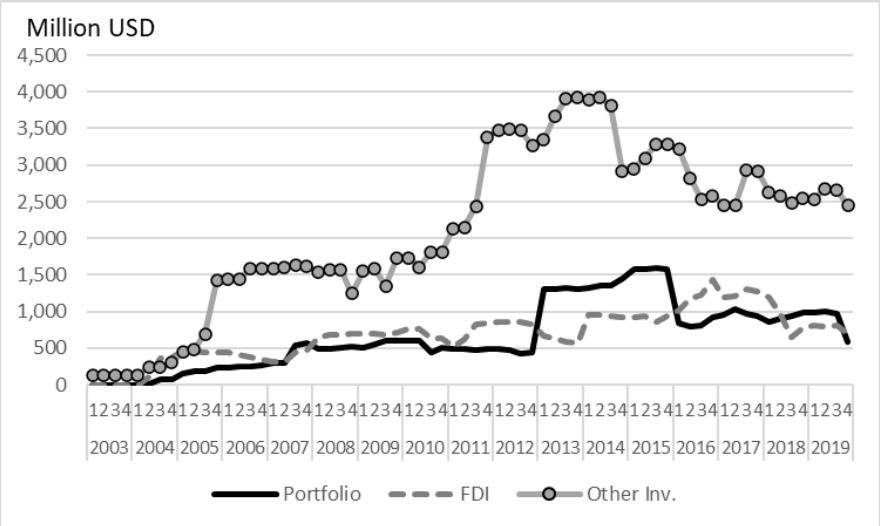


Figure 4.9 Capital outflows volatility

Source: Author's calculation

[38] The rolling standard deviation calculation does not include the observation of 2016 Q4 due to the implementation of tax amnesty policy that prompted liquidation of a special-purpose vehicle's stake and therefore reverse the pattern of capital flows significantly for this specific period.

4.4. Assessing the effectiveness of CFM policy

To examine the association between capital flows and CFM policy adjustments, which is represented by the capital flow management index (CFMIX), this section presents the methodology used to construct the index. The section also covers the discussion on model specification, data used for estimation and analysis, and econometric estimation method.

4.4.1. Capital flow management index (CFMIX)

The capital flow management index (CFMIX) is constructed based on policies relating to capital flows published in the central bank's annual Economic Report (Bank Indonesia, 2001 – 2020). Policies applied based on both residency and the currency involved in the transaction are included in the index calculation. Residency-based policies are measures affecting international financial transactions that discriminate based on residency (revisions on foreign investment negative list, taxes on transactions conducted by a foreigner, unremunerated reserve requirements, etc.). Currency-based policies refer to the currency used in the transaction regardless of the residency of the parties involved (foreign exchange reserve requirement ratio, regulations on bank's net open position, limitations on foreign exchange purchases without underlying documents, etc.). Based on these criteria, there are 55 policies included in the index calculation (available in Appendix – Table 4A.2) with their distribution presented in Figure 4.10. The figure shows that most of the CFM measures taken are associated with capital inflows.

The CFM index is constructed following the methodology employed in recent IMF studies of capital flow management (Schindler 2009; Fernandez et al. 2016)[39]. According to this methodology value of '+1' is assigned for policies that aim to regulate capital flows and '-1' for policies that facilitate international transactions. The values for each CFM category are then summed sequentially and rescaled to values of 0 to 1 where a higher value indicates a more restrictive policy stance for capital flows. The construction of the CFMIX imposes a uniform weight for all the policies included to calculate the index. [40] Compared to the annual index used in the IMF studies, the CFMIX provides quarterly information on the dynamics of capital flows management policy.

The CFMIX relating to inflows and outflows is depicted in Figure 4.11. The figure shows that the capital flows policies in Indonesia tend to be more directed to address capital inflows rather than outflows. The movement of the indices indicates that the CFM policy configuration was becoming more restrictive until about 2007 and then gradually becoming more open continuously since 2012. As for capital outflows, the index indicates that the policy was continually becoming less accommodative.

[39] For recent applications of this index see Bhattarai et al. (2020), Bonciani and Ricci (2020), and Landi and Schiavone (2020).

[40] Studies by Athukorala and Jongwanich (2012), Jayasuriya and Leu (2012), and Jongwanich (2017) assign different weighting for each type of CFM. However, this approach relies heavily on the subjectivity of the researcher and could introduce bias to the results. The use of uniform weighting avoids this subjectivity bias and the result can be interpreted as the average impact of CFM adjustments during the period of the study (Fernandez et al. 2016).

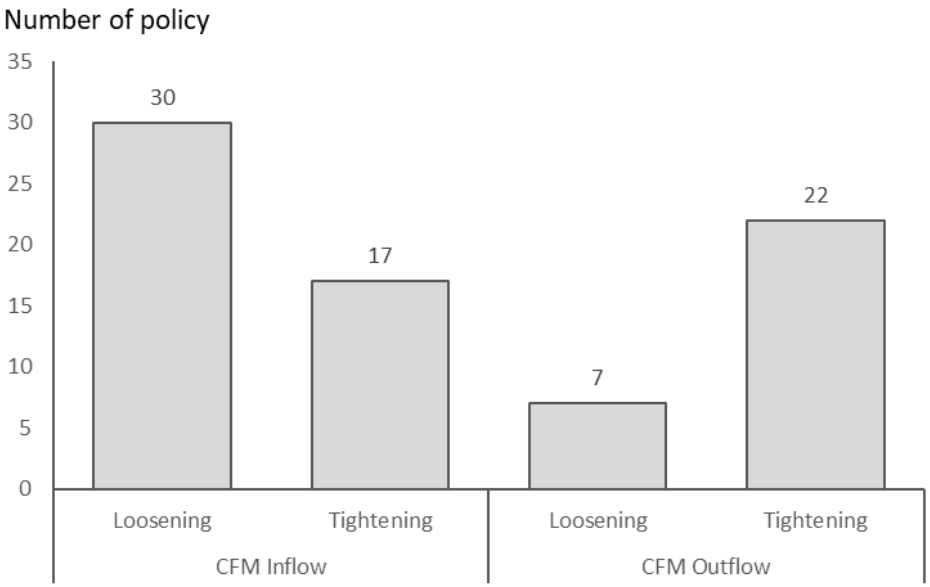


Figure 4.10 CFM policy category

Source: Author's calculation

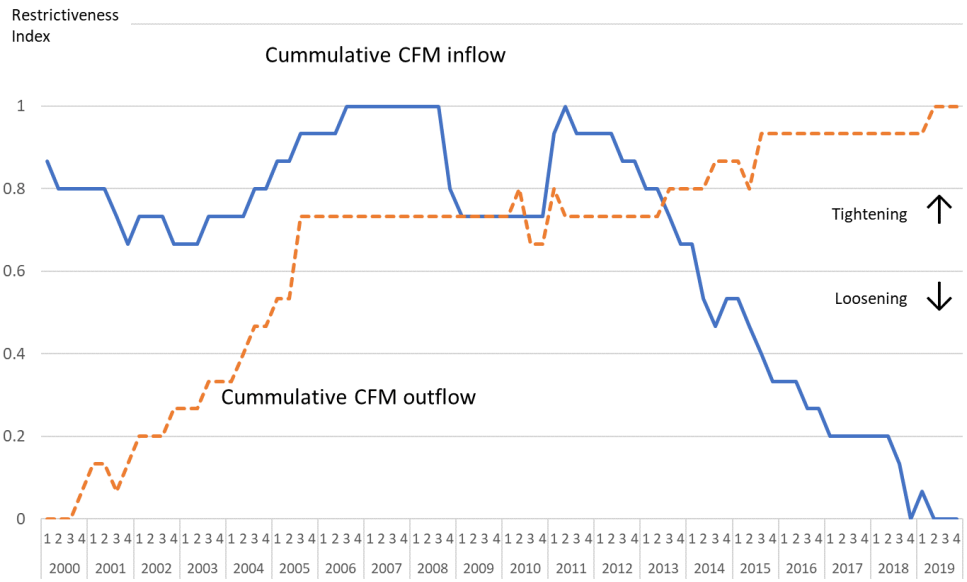


Figure 4.11 The CFM Index

Source: Author's calculation

4.4.2. The model

The model used for examining the effectiveness of CFM is specified to capture both the push and pull drivers of capital flows (Calvo et al., 1993; Koepke, 2019). The push

drivers are external factors which are represented in this study by the expected return of investment in external assets and global financial market condition. The pull drivers are the flows-receiving country-specific factors. In this study, the domestic factors are represented by domestic interest rate, domestic market risk, and the CFM restrictiveness. Adjustments in the push and pull drivers could signal investors to change their investment position in the country. [41]

The model is estimated using structural vector autoregression (SVAR) with recursive restrictions.[42] The choice of this approach is based on its capability to examine linear interdependencies between time-series variables that are hypothesized to affect each other intertemporally. Another advantage of using this method is that it can combine variables that are treated as endogenous and exogenous in a system. With the appropriate lags and variable sequencing, the use of this approach helps to address the reserve causation issue (Christiano, 2012; Sims, 1980).

The general specification of the model estimated using SVAR is illustrated using the following equation:

$$\beta_0 Y_t = \sum_{n=1}^{p} \beta_n Y_{t-n} + \rho D_t + u_t, \tag{4.1}$$

where Y_t is the vector of macroeconomic and policy variables that consist of foreign and domestic factors that affect capital flows. p is the lag chosen for the system. D_t is

[41] The push and pull approach is also applied in works of Baek, 2006; De Vita and Kyaw, 2008; Koepke, 2018; Forbes and Warnock, 2012; Milesi-Ferreti and Tille, 2011; Ananchotikul and Zhang, 2014.

[42] The recursive restrictions are imposed between external and domestic variables. They are imposed to enable external variables to affect domestic variables without any feedback effect, which is consistent with the small-open economy assumption.

the vector time dummies. The vector of structural innovations is represented by u_t and assumed to be independent and serially uncorrelated. β_i is the matrix of structural coefficients for $i = 0, 1, 2, \ldots, p$. The selection of macroeconomic and policy variables included in the system is based on their relevance with economic theory and empirical practice while trying to keep the specification parsimonious due to the limited number of observations.

The model is estimated separately for each type of capital inflows and outflows. The variables included in the model estimation are as follows:

1. CFM index
   a. CFM_IN = CFMIX for estimations on capital inflows
   b. CFM_OUT = CFMIX for estimations on capital outflows

2. Global risk factor
   VIX = Chicago Board Options Exchange's (CBOE) Volatility Index, a measure of the stock market's expectation of volatility based on S&P 500 index options.
3. Domestic risk factor
   ISX = Indonesian stock market price index volatility.

4. Real interest rate differential
   RRATE_DIF = Gap between the domestic and US real interest rate (per cent).

5. Capital flows (one set of SVAR is estimated for each type of flows using corresponding CFM inflows/outflows index)
   a. FA_LIAB = Aggregate capital inflows
   b. FA_AST = Aggregate capital outflows
   c. PI_LIAB = Portfolio investment inflows
   d. PI_LIAB_GD = Portfolio investment inflows –debt
   e. PI_LIAB_PD = Portfolio investment inflows – equity
   f. PI_AST = Portfolio investment outflows
   g. OI_LIAB = Other investment inflows
   h. OI_LIAB_G = Other investment inflows - banks
   i. OI_LIAB_G = Other investment inflows - public
   j. OI_LIAB_P = Other investment inflows - private
   k. OI_AST = Other investment outflows
   l. DI_LIAB = Direct investment inflows

m. DI_ASST = Direct investment outflows

6. Time dummies that consist of:
   a. GFC = Global financial crisis (2007Q3 – 2009Q2)
   b. QE = Quantitative easing episodes (2008Q4 – 2010Q1), (2010Q4 – 2011Q2) and (2012Q3 – 2013Q4).
   c. TXM = Indonesian tax amnesty implementation (2016Q4)

4.4.3. Data

The model is estimated using quarterly data covering the period, 2000 – 2019. Capital flows data in current US dollar are compiled from the IMF's balance of payments database, which is based on the Balance of Payments and International Investment Position Manual – BPM6. Capital inflows are defined as the net purchases of domestic financial instruments by foreign residents. In other words, capital inflows are recorded as the difference between the increase of external liabilities (inflows with a positive sign) and the decrease of external liabilities (inflows with a negative sign). Capital outflows are defined as net purchases of foreign financial instruments by domestic residents.

The VIX index representing the global financial market risk condition is compiled from the FRED database (Federal Reserve Bank of St. Louis, 2020). The domestic financial market risk condition is represented by the Indonesian stock market price index volatility. This variable is calculated as the quarterly standard deviation of the stock market price index daily changes (Indonesia Stock Exchange, 2020). The use of the real, rather than the nominal, interest rate differential is used to capture the dynamics of both nominal interest rate and inflation differentials. The real interest rate differential is calculated as the difference between the domestic real interest rate (the domestic cost of fund (compiled from Bank Indonesia's quarterly

banking survey) adjusted for year-on-year inflation) and the US real interest rate (the US cost of fund (FreddieMac, 2020) adjusted for year-on-year inflation). The descriptive statistics are provided in Table 4.1.

Table 4.1 Descriptive Statistics

No	Variable	Unit	Mean	Median	Maximum	Minimum	St.Dev
1	CBOE Volatility Index (VIX)	Index	19.50	17.21	58.74	10.31	7.87
2	Real interest rate differential	Percent	0.61	0.80	9.28	-8.71	2.89
3	Domestic stock price index volatility	Percent	1.21	1.11	3.73	0.42	0.52
4	CFM inflows index	Index	0.66	0.73	1.00	0.00	0.29
5	CFM outflows index	Index	0.66	0.73	1.00	0.00	0.28
Inflows							
6	Capital inflows	Million USD	5,636	5,385	18,387	-10,599	6,086
7	Portfolio investment (PI)		2,580	1,803	11,489	-4,662	3,038
8	PI -- equity		99	214	1,936	-2,154	893
9	PI -- debt		2,480	1,869	11,464	-3,894	2,881
10	PI -- private debt		481	0	6,655	-1,213	1,272
11	PI -- public debt		1,999	1,472	7,213	-4,270	2,365
12	Foreign direct investment		2,776	2,770	8,097	-9,329	2,967
13	Other investment (OI)		280	-276	6,166	-4,959	2,023
14	OI -- banks		208	88	2,770	-2,265	922
15	OI -- private		414	235	3,171	-2,111	1,141
16	OI -- public		-377	-283	4,607	-4,887	1,149
Outflows							
17	Capital outflows	Million USD	2,494	2,578	11,700	-18,259	3,741
18	Portfolio investment (PI)		293	64	4,855	-1,938	817
19	Direct investment		932	1,029	5,085	-12,870	1,876
20	Other investment (OI)		1,269	449	9,977	-5,344	2,579

Source: IMF, Federal Reserves of St. Louis, Author's calculation

4.4.4. Estimation method

To identify the parameter values for variables included in the SVAR system, the estimation applies the Cholesky orthogonalization (Sims, 1980). The use of this approach applies an assumption on the chronological order of the endogenous variables affecting each other.

Equation (4.2) expresses $\beta_0 Y_t$ from Equation (4.1) that displays the endogenous variables ordering assumption used in the SVAR model for aggregate capital inflow

(*FA_LIAB*). The first row of the matrix $\beta_0 Y_t$ implies that the global financial market risk condition (*VIX*) does not respond contemporaneously to changes from other endogenous variables. The recursive restriction is applied to this variable to prevent any adjustment of the global financial market risk condition driven by movements of lagged domestic variables included in the model. Therefore, the global risk factor is only determined by its lagged value, time dummies[43] and structural innovations. The domestic risk indicator (*IDX*) is placed after the external risk indicator. The policy variables (real interest rate differential - *RRATE_DIF* and CFM index - *CFM_IN*) are placed after the global risk factor with the assumption that these variables could respond contemporaneously to changes in the global and domestic risk indicator. The aggregate capital inflows (*FA_LIAB*) is placed as the most contemporaneously endogenous variable (located on the last row of Equation (4.2)) based on the assumption that capital flows are fickle and able to react at the same time to changes of other variables in the VAR system (Bluedorn et al, 2013; Eichengreen et al., 2018).

$$\beta_0 Y_t = \begin{pmatrix} 1 & 0 & 0 & 0 & 0 \\ * & 1 & 0 & 0 & 0 \\ * & * & 1 & 0 & 0 \\ * & * & * & 1 & 0 \\ * & * & * & * & 1 \end{pmatrix} \begin{pmatrix} VIX \\ IDX \\ RRATE\_DIF \\ CFM\_IN \\ FA\_LIAB \end{pmatrix} \tag{4.2}$$

The Augmented Dickey-Fuller (ADF) unit root testing is undertaken to check the stationarity of variables (Table 4.2). First differencing transformation is applied for

[43] Restrictions are also applied to the dummy variable where the time dummy for the implementation of tax amnesty policy only affect the capital flows variable.

variables with unit root properties[44]. The lag selection for the SVAR system is determined based on the info criterion test statistic, the properties of the residuals (normality and autocorrelation), as well as the stability of the system. Based on the factors considered in determining the lags, all the SVAR are estimated using two lags.

Different ordering of variables implemented in the system could yield different results. Therefore, the sensitivity of the results is tested using different sequences of variables. Based on the comparison of the impulse responses produced by a set of different variables ordering, the dynamic responses of each variable are generally similar with some variety in the level of significance of the responses.[45] This situation is expected given the limited observation available to estimate the SVAR system.

[44] As shown in Table 4.2, CFMIX for inflows and outflows are non-stationary in levels, therefore the two variables are transformed to first difference and could be interpreted as CFM restrictiveness adjustment. The correlation matrix of the variables included in the SVAR estimation are provided in Appendix – Table 4A.3 to facilitate the interpretation of the results.

[45] The comparison of results is available in Section 4.5.1.

Table 4.2 Unit root test results

No	Variable	ADF test t-statistics	
		Level	1st difference
1	CBOE Volatility index - VIX (log transformed)	-3.05 **	-10.24 ***
2	Real interest rate differential	-3.80 ***	-6.83 ***
3	Domestic stock price index volatility	-5.98 ***	-10.58 ***
4	CFMIX inflows	0.65	-7.80 ***
5	CFMIX outflows	-2.54	-10.70 ***
Inflows			
6	Capital inflows	-4.02 ***	-8.03 ***
7	Portfolio investment (PI)	-6.05 ***	-8.03 ***
8	PI -- equity	-7.39 ***	-13.90 ***
9	PI -- debt	-5.68 ***	-8.45 ***
10	PI -- private debt	-9.70 ***	-15.64 ***
11	PI -- public debt	-5.63 ***	-7.93 ***
12	Foreign direct investment	-2.91 **	-8.56 ***
13	Other investment (OI)	-8.43 ***	-12.73 ***
14	OI -- banks	-8.24 ***	-11.66 ***
15	OI -- private	-4.80 ***	-9.93 ***
16	OI -- public	-7.73 ***	-9.62 ***
Outflows			
17	Capital outflows	-7.66 ***	-10.11 ***
18	Portfolio investment (PI)	-6.54 ***	-10.96 ***
19	Direct investment	-6.39 ***	-9.72 ***
20	Other investment (OI)	-10.52 ***	-10.76 ***

Note: ***, **, * denotes 1%, 5%, and 10% level of significance for the t statistics rejecting the null hypothesis of a series with unit root property.

Source: Author's calculation

4.5.Results

In this section, the impact of CFM restrictiveness adjustments on capital inflows is discussed first and then followed by the discussion of the response of capital outflows.[46] This is followed by a discussion based on variance decomposition analysis generated by the basic model estimation and a robustness check using different orderings of variables.

The SVAR estimation results for capital flows and their components are reported in Table 4.3. However, the coefficients displayed in the table only represent the adjustment effect of lagged variables included in the estimation. To examine the full effect of CFM measures adjustments on capital flows, a series of accumulated impulse responses are generated from the estimated model. The impulse response traces the impact of innovation/shock on one variable to all endogenous variables in the system.

[46] All the accumulated impulse responses of capital flows components generated by shocks/innovations to each endogenous variable are displayed in Appendix – Figure 4A.1.

Table 4.3 SVAR estimates – capital flows equation

	Dependent variable: capital flows (billion USD)													
	Capital Inflows										Capital Outflows			
	Aggregate	Portolio Inv.	Direct Inv.	Other Inv.	Portfolio Pub. Debt	Portfolio Priv. Debt	Portfolio Priv. Equity	Other Inv. Banks	Other Inv. Public	Other Inv. Priv	Aggregate	Portolio Inv.	Direct Inv.	Other Inv.
Independent variables:														
VIX lag 1	-0.07	-0.03	-0.04	-0.03	-0.02	-0.03	0.03	-0.01	0.01	-0.04	-0.06	-0.01	-0.02	-0.03
	[-0.83]	[-0.48]	[-1.37]*	[-0.79]	[-0.39]	[-1.19]	[1.55]*	[-0.47]	[0.45]	[-1.73]*	[-1.06]	[-0.82]	[-1.07]	[-0.65]
VIX lag 2	-0.11	-0.10	-0.07	-0.03	-0.04	0.00	-0.02	-0.03	0.00	0.00	-0.06	-0.01	-0.04	0.00
	[-1.25]	[-1.56]*	[-2.15]**	[-0.62]	[-0.95]	[0.02]	[-0.81]	[-1.56]*	[0.14]	[0.23]	[-1.12]	[-0.77]	[-2.86]***	[0.05]
Indonesia stock market volatility lag 1	-0.15	0.10	-0.59	-0.68	0.67	-0.45	0.14	-1.04	0.41	0.18	-1.64	-0.35	-0.06	-0.77
	[-0.1]	[0.1]	[-1.04]	[-0.89]	[0.91]	[-0.87]	[0.38]	[-2.9]***	[0.98]	[0.46]	[-1.45]*	[-1.07]	[-0.2]	[-0.79]
Indonesia stock market volatility lag 1	-1.02	-0.39	0.11	-0.97	-0.44	0.08	0.20	0.07	-0.04	-0.65	0.13	-0.09	-0.01	0.14
	[-0.63]	[-0.35]	[0.18]	[-1.17]	[-0.54]	[0.14]	[0.52]	[0.18]	[-0.09]	[-1.56]*	[0.11]	[-0.26]	[-0.02]	[0.14]
Real interest rate differential lag 1	0.35	0.20	0.17	0.12	0.04	0.10	0.05	0.00	0.06	0.06	0.20	-0.05	0.04	0.23
	[1.29]	[1.05]	[1.71]*	[0.88]	[0.32]	[1.1]	[0.83]	[0]	[0.72]	[0.84]	[0.93]	[-0.78]	[0.76]	[1.26]
Real interest rate differential lag 2	0.14	0.01	0.06	0.10	0.06	0.03	-0.07	-0.02	0.14	-0.01	-0.01	0.04	0.03	-0.05
	[0.6]	[0.09]	[0.69]	[0.86]	[0.54]	[0.41]	[-1.25]	[-0.27]	[1.95]**	[-0.08]	[-0.08]	[0.7]	[0.69]	[-0.34]
Δ CFMIX lag 1	-10.45	-5.38	-2.27	-9.43	-5.69	-2.56	3.23	-4.77	-1.46	-2.31	-10.01	-2.18	1.70	-9.09
	[-1.24]	[-0.92]	[-0.73]	[-2.24]***	[-1.4]*	[-0.88]	[1.67]*	[-2.42]***	[-0.64]	[-1.1]	[-1.42]*	[-1.06]	[0.91]	[-1.49]*
Δ CFMIX lag 2	-10.55	-12.44	-3.62	-3.01	-10.75	2.92	-1.61	-0.06	-0.32	-1.76	3.66	-2.33	-0.47	4.73
	[-1.29]	[-2.19]***	[-1.19]	[-0.72]	[-2.68]***	[1.03]	[-0.83]	[-0.03]	[-0.14]	[-0.85]	[0.49]	[-1.09]	[-0.24]	[0.73]
Capital flows lag 1	0.31	0.16	0.34	0.02	0.16	-0.11	0.23	-0.02	-0.08	0.37	-0.05	0.18	0.16	-0.20
	[3.26]***	[1.38]*	[5.18]***	[0.19]	[1.51]*	[-0.87]	[2.01]**	[-0.22]	[-0.73]	[3.13]***	[-0.59]	[1.45]*	[3.55]***	[-1.89]**
Capital flows lag 2	0.20	-0.10	0.22	-0.13	0.20	0.01	0.01	-0.19	-0.23	0.12	0.04	-0.10	0.18	0.10
	[2.2]***	[-0.9]	[3.45]***	[-1.25]	[1.89]**	[0.1]	[0.13]	[-1.74]*	[-2.29]***	[1.08]	[0.53]	[-0.93]	[4.08]***	[1.00]
Constant term	6.02	4.74	3.25	1.03	2.28	1.19	-0.14	0.96	-1.12	0.82	4.93	0.81	1.74	2.02
	[3.49]***	[3.58]***	[5.39]***	[1.66]*	[2.48]***	[2.51]***	[-0.48]	[3.16]***	[-3.07]***	[2.52]***	[4.97]***	[2.71]***	[6.8]***	[2.47]***
GFC Dummy	-0.36	-0.93	0.50	0.45	-0.73	-0.26	-0.08	0.02	0.10	0.38	2.11	0.05	0.71	1.43
	[-0.23]	[-0.81]	[0.84]	[0.56]	[-0.85]	[-0.48]	[-0.22]	[0.06]	[0.23]	[0.94]	[1.76]*	[0.15]	[2.2]***	[1.38]*
Quant. Easing Dummy	2.40	1.05	1.32	1.07	0.91	0.07	-0.11	0.26	0.97	-0.12	1.27	0.31	0.92	-0.16
	[1.88]**	[1.18]	[2.8]***	[1.7]*	[1.38]*	[0.18]	[-0.37]	[0.91]	[2.77]***	[-0.4]	[1.38]*	[1.15]	[3.73]***	[-0.21]
Tax Amnesty dummy	-21.03	-4.20	-15.14	-2.20	-2.54	-1.99	-1.50	0.12	0.11	-1.63	-22.60	-0.16	-14.17	-8.23
	[-6.29]***	[-1.75]*	[-11.89]***	[-1.18]	[-1.42]*	[-1.67]*	[-1.76]*	[0.14]	[0.11]	[-1.67]*	[-8.41]***	[-0.19]	[-20.13]***	[-3.56]***
R-squared	0.65	0.29	0.80	0.26	0.36	0.16	0.16	0.20	0.26	0.39	0.52	0.17	0.86	0.25
Sum sq. resids	963.73	498.12	133.53	239.32	273.51	107.08	51.91	52.19	73.73	60.23	517.90	43.38	38.05	390.10
Mean dependent	5.92	2.70	2.92	0.30	2.09	0.50	0.11	0.23	-0.43	0.45	2.59	0.30	0.97	1.32
S.D. dependent	6.03	3.03	2.93	2.06	2.37	1.29	0.90	0.93	1.14	1.14	3.78	0.83	1.90	2.62

Note: The coefficients only indicate the adjustment effect of lagged variables on capital flows and its disaggregation. The type of lagged capital flows under the independent variables corresponds to the type of capital flows being estimated. For estimates on capital inflows (outflows), the CFM restrictiveness index is represented by CFMIX-inflow (CFMIX-outflow). Δ CFMIX is the first difference transformation of CFMIX. The value in parenthesis is the t-statistics where ***, **, * represents 5%, 10%, and 20% level of significance respectively. Source: Author's calculation

4.5.1. Impulse responses

4.5.1.1. Capital inflows

The responses of capital inflows to a one standard deviation shock to other variables in the SVAR system are presented in Figure 4.12. A worsening of global financial market risk condition (represented by a positive shock to the VIX) leads to statistically significant (at the 95% confidence interval) lower capital inflows (FA_LIAB), which is consistent with the theoretical framework and the empirical regularities. The pattern confirms the importance of global financial market risk condition as one of the push factors of capital flows. An increase in the domestic financial market risk condition (represented by an increase in the volatility of the domestic stock market price index (IDX)) also results in lower capital inflows, although the impact is not as significant as the one driven by the external shock[47].

Capital inflows responded positively to an increase in the real interest rate differential (RRATE_DIF). By contrast, a tightening adjustment of the CFM measures restrictiveness for capital inflows (D_CFM_IN) leads to statistically significant lower capital inflows. Based on the dynamics and the magnitude of the responses to both of these shocks, a policy mix that combines higher domestic interest rate and tightening on capital inflows regulation could help in addressing economic overheating and reducing the magnitude of capital inflows induced by the increase of the real interest rate.

[47] Estimations using alternative domestic financial market risk indicators (exchange rate volatility and sovereign credit default swap (CDS) premium) result in similar results. The use of domestic stock price index to reflect domestic financial market risk condition is preferred considering the tendency of the central bank to intervene to limit exchange rate volatility and the limited availability of CDS data.

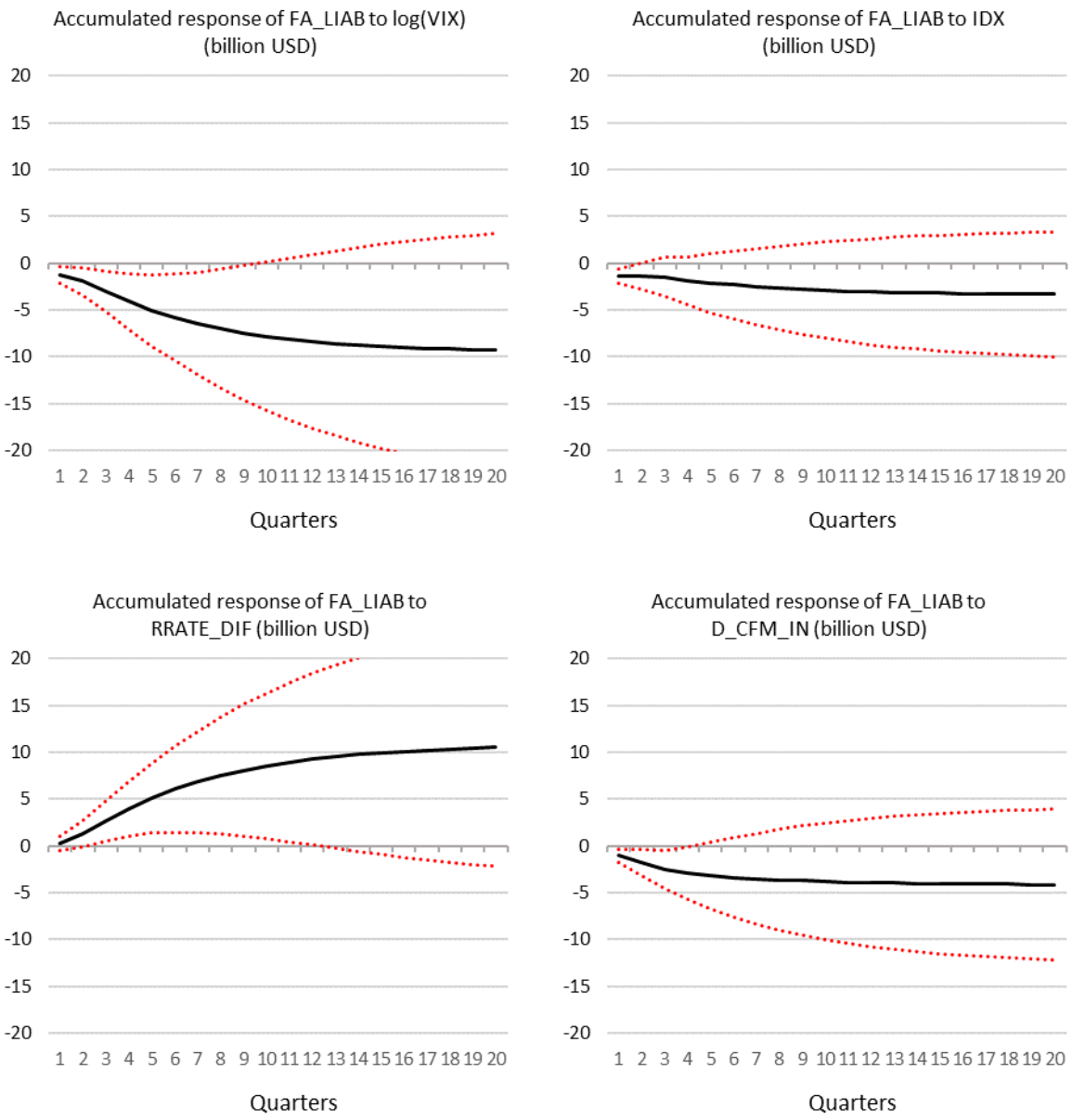


Figure 4.12 Accumulated impulse responses of capital inflows

Note: FA_LIAB represents aggregate capital inflows, VIX represents the global financial market risk condition, IDX represents the domestic financial market risk condition, RRATE_DIF represents the real interest rate differential, D_CFM_IN represents the adjustment in CFM-inflow restrictiveness. The solid line represents the accumulated impulse response; the dotted lines represent 2 analytic (asymptotic) standard error of the impulse response. The response is generated using Cholesky decomposition (degrees of freedom adjusted) with a one standard deviation shock of other variables.

Source: Author's calculation

The accumulated responses of disaggregated capital inflows and the composition of capital flows generated from CFM-inflow adjustment shock are plotted in Figure 4.13. The impulse responses are generated by the same CFM-inflow

adjustment shock and derived from the estimated SVAR for each type of capital flows. Among the three types of capital flows, portfolio investment (PI_LIAB) shows a significant reduction in response to an increase in CFM restrictiveness (top-left graph). Responses of other investment (OI_LIAB) (top-right graph) and direct investment (DI_LIAB) (bottom-left graph) are not statistically significant, even though the direction of the accumulated response is similar to the response of portfolio investment.

The insignificant impact of the policy adjustment on other investment inflows is expected because this category contains both long and short-term capital, and dominated by transactions related to the public sector and trade credit. The public sector transactions recorded under other investments inflow mainly consist of government's debt payments and withdrawals, which are organized through a government-to-government arrangement instead of through the financial market mechanism. Trade credit transactions are related to payment settlements of international trade instead of financial asset transactions.

The insignificant response of direct investment inflows is in line with one of the features of the CFM measures previously discussed where policies are applied selectively to short-term and speculative capital flows while accommodating foreign direct investment and other long-term and productive capital flows. This result also supports the previous finding in the literature on the characteristics and determinants of foreign direct investments. Unlike portfolio and other investments, both of which are short-term flows, foreign direct investments flows are relatively less volatile. This is related to the fact that foreign direct investment (FDI) is channelled directly to firms

without going through the general financial market. The investment flows also becoming more stable once FDI firms are established and generate earnings sustainably (Lipsey, 2000). In general, direct investment is driven by long-term fundamental factors such as relative wages, the strength of bilateral trade relations, and the conduciveness of the domestic business climate for international production (De Vita and Kyaw, 2008; Koepke, 2019). A study by Athukorala (2003) indicates that FDI flows to Indonesia is relatively stable during the AFC and plays an important part in supporting the economic recovery process by providing the needed investments.

The impact of CFM-inflow adjustment on the composition of capital inflows is presented in the bottom-right graph of Figure 4.13. As discussed, increasing the restrictiveness of CFM-inflow is associated with statistically significant lower inflows of portfolio investment. This is consistent with the accumulated response in the graph that indicates that direct investment's share in total inflows slightly increases over time. However, as indicated by the distribution of the standard error, the effect is not statistically significant.

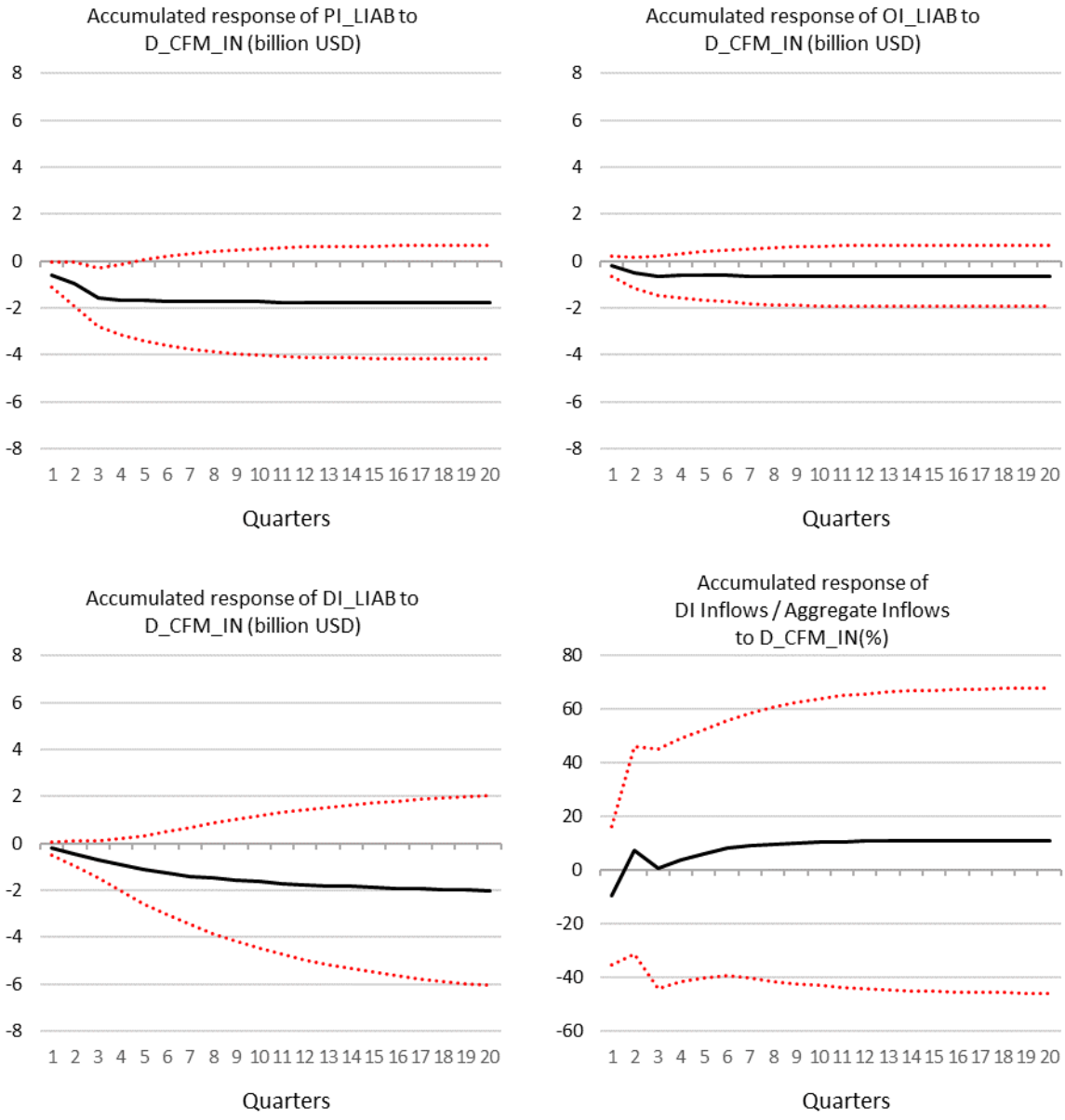


Figure 4.13 Accumulated impulse responses of disaggregated capital inflows

Note: PI_LIAB represents portfolio investments inflow, OI_LIAB represents other investments inflow, DI_LIAB represents FDI inflow, D_CFM_IN represents the adjustment in CFM-inflow restrictiveness. The solid line represents the accumulated impulse response; the dotted lines represent 2 analytic (asymptotic) standard error of the impulse response. The response is generated using Cholesky decomposition (degrees of freedom adjusted) with a one standard deviation shock of CFM restrictiveness adjustment.

Source: Author's calculation

To shed further light on the effect of the adjustment of the CFM-inflow on portfolio and other investments, the response of the disaggregated of both flows are summarized in Table 4.4. In general, the accumulated response of the components of

portfolio and other investments inflows are negative with varying degree of statistical significance. For portfolio investment flows, inflows to public and private sector debt instrument are negatively and significantly affected by the adjustment of CFM-inflow restrictiveness. Inflows to equity are not significantly affected by the adjustment of CFM policy. As for the subcomponents of other investment inflows, there is limited evidence that the flows are responding negatively to the CFM-inflow shock. However, none of the accumulated responses is statistically insignificant at the 95% confidence interval.

Table 4.4 Accumulated impulse responses of disaggregated portfolio and other investments inflows to CFM-inflow shock.

Type of capital inflow	Accumulated response at the corresponding quarter (billion USD)					
	1	2	3	4	8	16
Portfolio investment inflows						
Public sector debt	-0.13	-0.51*	-1.11**	-1.31**	-1.75*	-1.93*
Private sector debt	-0.31**	-0.40*	-0.25*	-0.30	-0.29	-0.28
Private sector equity	-0.15*	-0.03	-0.05	0.00	0.08	0.10
Other investment inflows						
Banking sector	-0.02	-0.16*	-0.11	-0.06	-0.03	-0.03
Public sector	-0.13*	-0.20*	-0.23*	-0.25*	-0.31*	-0.31*
Others	-0.02	-0.07	-0.17	-0.18	-0.20	-0.20

Note: ** and * indicates the significance of the accumulated impulse response at the 95% and 68% confidence interval.

Source: Author's calculation

4.5.1.2. Capital outflows

To assess the implication of the CFM-outflow policy changes towards the volume of outflows, several estimations using the CFM-outflow index for different categories of capital outflows are estimated. The approach is similar to that of the previous subsection where the model is estimated individually for the aggregate

capital outflows (FA_AST) and its' component: portfolio investment (PI_AST), other investment (OI_AST), and direct investment (DI_AST).

The impulse responses of the capital outflows are generated by a one standard deviation increase on the CFM-outflow, which can be interpreted as an increase of capital outflow measures restrictiveness. Therefore, it is expected that capital outflows would respond negatively to this shock. The pattern of responses that are displayed in Figure 4.14 indicates that CFM-outflows adjustment is associated with lower capital outflows. However, none of the accumulated response is statistically significant at the 95% confidence interval. In other words, CFM measures for outflows in Indonesia are less effective compared to capital inflow measures, which is in line with the findings of Jayasuriya and Leu (2012).

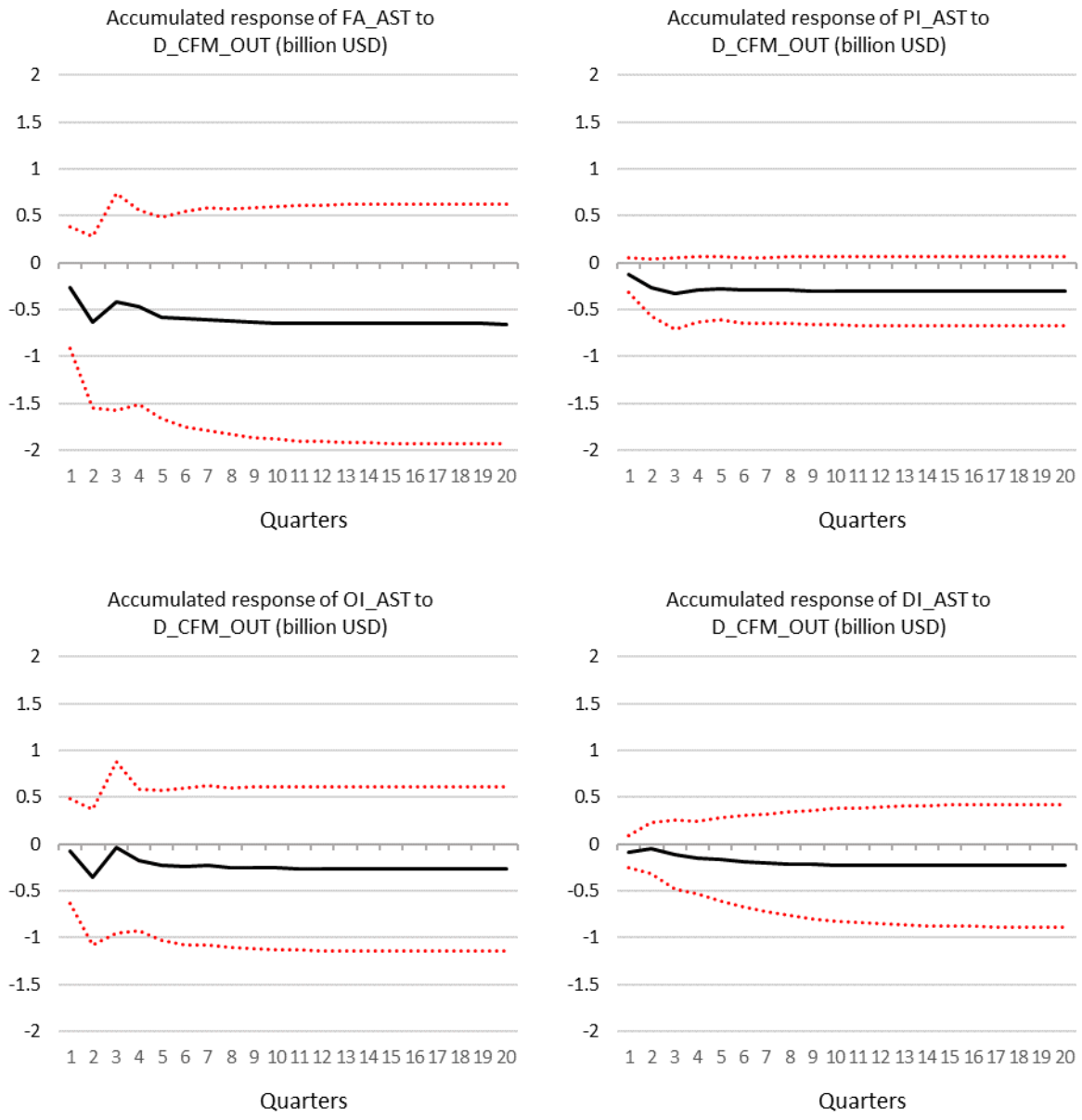


Figure 4.14 Accumulated impulse responses of disaggregated capital outflows

Note: FA_AST represents aggregate capital outflow, PI_AST represents portfolio investments outflow, OI_AST represents other investments outflow, DI_AST represents direct investment outflow, D_CFM_OUT represents the adjustment in CFM-outflow restrictiveness. The solid line represents the accumulated impulse response; the dotted lines represent 2 analytic (asymptotic) standard error of the impulse response. The response is generated using Cholesky decomposition (degrees of freedom adjusted) with a one standard deviation shock of CFM restrictiveness adjustment.

Source: Author's calculation

The failure of the impulse responses to reflect the significant impact of CFM measures on capital outflows is understandable given the nature of the data series. As discussed (section 4.3.3), during the period under study, the size of aggregate capital outflows is relatively small and less volatile compared to aggregate capital inflows. The quarterly fluctuations of capital outflows are heavily driven by other investment flows (the largest component of outflows and has the highest volatility), which is not responsive to the adjustment of CFM for outflows.

The failure to detect significant impact could also be due to the ability of agents involved in the transaction under control to circumvent the regulation using various informal practices such as over-invoicing exports or under-invoicing imports). Problems related to the implementation of the policy due to institutional setting or the nature of regulation (through price or administrative mechanism) could also affect the effectiveness of the outflow management policies (Garber, 1998; Edwards, 1999). In the case of Indonesia, the capital account convertibility policy that was adopted relatively early might explain the limited institutional and mechanism support for imposing effective capital outflow restriction (Habermeier et al., 2011).

4.5.2. Variance decomposition

To measure the relative importance of CFM policies adjustments in affecting the capital flows, the magnitude of the variance explained by the innovation in the CFM index for each category of the flows are assessed using the variance decomposition. This approach indicates the amount of information each variable contributes to other variables in the SVAR. In the context of this study, the variance decomposition measure how much of the forecast error variance of capital flows can be explained by

exogenous shocks to the CFM restrictiveness. The entries given in Table 4.5 indicate the cumulative percentage of the variance of the first four quarters ahead, 8, 12, 16, and 20 quarters-ahead forecast error of the capital flows that are due to changes in the restrictiveness of the CFM measures.

The results confirm the previous inference that an adjustment of CFM restrictiveness resulted in changes in capital flows volume within four quarters. The first column in Table 4.5 indicates that adjustments from the CFM-inflow contributes around 8% of the portfolio investment inflows' variance in the first quarter, and then increase to around 9% in the following three quarters. After the fourth quarter, the CFM-inflow's contribution stabilizes at around 7% of the aggregate capital inflows' variance. Shocks from CFM-inflow contributes to around 8%, 3%, and 5% for the inflows in the form of portfolio investment, other investment and direct investment. As for the CFM-outflow, consistent with the impulse responses, the changes of outflow policies only contribute to a small portion of the variance for all class of flows. The largest contribution is on portfolio outflows, followed by other investments.

Table 4.5 Contribution of innovations in CFMIX on the variance of capital flows

Period (quarter)	Contribution of CFM inflows on inflows (%)				Contribution of CFM outflows on outflows (%)			
	Aggregate Inflow	Portfolio inv.	Other inv.	Direct Inv.	Aggregate Outflow	Portfolio inv.	Other inv.	Direct Inv.
1	7.66	4.28	1.25	2.11	0.85	2.42	0.09	1.17
2	9.13	5.78	3.26	3.34	2.30	4.80	1.24	1.35
3	9.77	9.00	3.28	4.02	2.69	5.10	2.56	1.72
4	8.87	8.84	3.15	4.72	2.67	5.26	2.77	1.69
8	7.44	8.59	3.11	4.63	2.74	5.24	2.79	1.55
12	7.16	8.57	3.11	4.50	2.74	5.24	2.79	1.54
16	7.10	8.57	3.11	4.47	2.74	5.24	2.79	1.54
20	7.08	8.57	3.10	4.47	2.74	5.24	2.79	1.54

Source: Author's calculation

4.5.3. Robustness checks

To further confirm the association between CFM restrictiveness adjustments and capital inflows discussed in Section 4.5.1.1, the impulse responses generated from modifications of the benchmark model are compared in Figure 4.15. The modification of the model specification is done by using different orderings of the endogenous variables. The benchmark model specification that is estimated to derive the results uses the following endogenous variables ordering: global financial market risk → domestic financial market risk → real interest rate differential → CFM policies → capital inflows. The modification is done by using different orderings of domestic risk factor, real interest rate differential, and CFM policies. The assumption that global financial risk as the most exogenous variable and capital flows is the most endogenous variable (able to respond to adjustments of other endogenous variables contemporaneously) is maintained. The reason for this approach is based on the possibility that adjustments to the interest rate and CFM respond to changes in the

domestic risk. There could be also situations where authorities choose to deploy CFM policies followed by the interest rate adjustment policy.

As shown by the charts in Figure 4.15, the use of different orderings of domestic risk and policy variables confirm the interpretation of the result generated using the benchmark model where the increase of CFM restrictiveness is significantly associated with lower portfolio investment inflows. The direction and dynamics of the impulse response remain similar and differences in the standard error of the impulse response appear to be trivial.

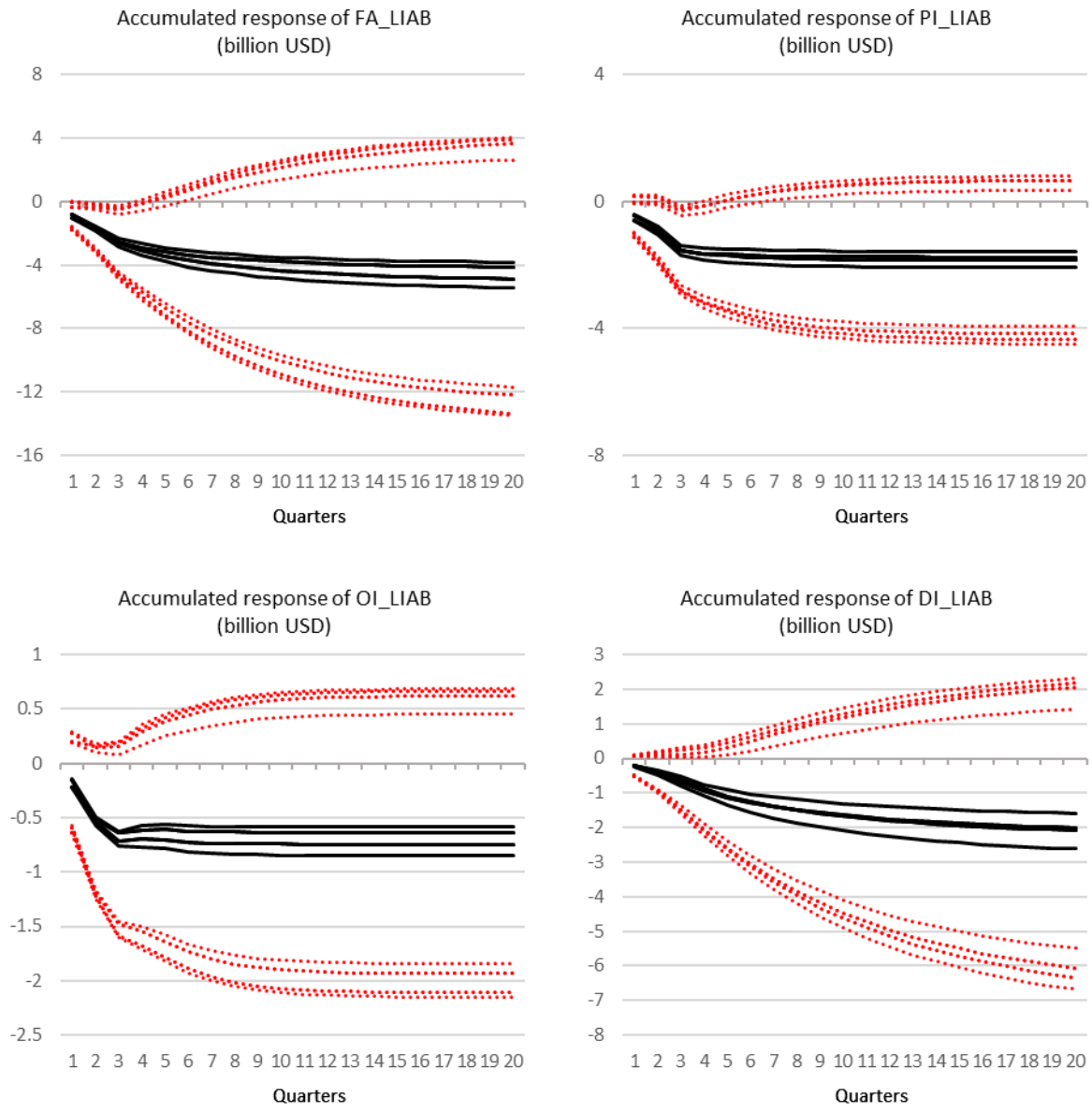


Figure 4.15 Robustness check using different SVAR orderings

Note: PI_LIAB represents portfolio investments inflow, OI_LIAB represents other investments inflow, DI_LIAB represents FDI inflow. The solid line represents the accumulated impulse response; the dotted lines represent 2 analytic (asymptotic) standard error of the impulse response. The impulse response is generated using Cholesky decomposition (degrees of freedom adjusted) with a one standard deviation shock of CFM-inflow restrictiveness adjustment. The impulse responses are generated using six estimations that include the basic specification, five alternative orderings of endogenous variables.

Source: Author's calculation

4.6. Conclusion

While advanced economies have embraced capital account opening and independent monetary policy as the preferred macroeconomic policy configuration, emerging and developing economies have been increasingly moving towards an 'intermediate regime', which involves fine-tuning the exchange rate and maintaining a viable level of monetary policy autonomy combined with measures to regulate capital mobility. An important issue relating to this policy configuration is the effectiveness of capital flow management policy. The purpose of this study has been to contribute to the fledgling literature on capital flow management effectiveness through a case study of Indonesia.

Indonesia is one of the countries that undertook capital account liberalization relatively early and before liberalizing international trade and reforming the financial sector. This reversed sequencing works adequately at a time when the domestic financial system was at the formative stage and the economy was not globally integrated. The traumatic experience of the AFC has made policymakers realise the need to pay attention to the trilemma in macroeconomic management. By learning from the AFC and adapting the policy practices from peer countries, a series of CFM measures have been introduced to balance the need for accessing external financing and managing risks related to international capital flows.

The movement of CFMIX indicates that CFM policy in Indonesia has become less restrictive for inflows and more restrictive on outflows during the recent period. To investigate the association of the CFM policies with capital flows, the study applies

the model of push and pull drivers of capital flows. As suggested by the impulse responses generated from the SVAR model estimations, an adjustment in the CFM restrictiveness on the inflow side results in a significant change of the size of capital inflows to debt instruments (portfolio flows). Additionally, the analysis points out the compatibility of capital inflow policy measures and interest rate policy to address domestic macroeconomic imbalances while managing potential externalities that originate from the volatility of portfolio capital flows. The analysis also suggests that increasing CFM restrictiveness for inflows increase the share of direct investment inflows in the aggregate flows. However, the impact is not statistically significant.

There is no statistically significant evidence on the effect of CFM policy on capital outflows. Allowing for the low level and limited variability of the capital outflow data series, this finding is in line with previous studies suggesting that policies to contain outflow have limited effectiveness. This limited effectiveness could be related to Indonesia's institutional setting that is not equipped with the necessary mechanism to implement capital outflow controls.

The results suggest that, given the recent move towards relaxing CFM restriction on the capital inflows, Indonesia is at a higher risk of exposing itself to the volatile global market sentiment. To cushion the economy against the risk, it is important to combine this policy shift with strengthening balance sheets of the domestic financial institutions, reducing restrictions on foreign direct investment, developing longer-term domestic financial instruments, and maintaining foreign exchange reserves to match the increased exposure to capital exodus.

Appendix

Table 4A. 1 Cases of capital flow management in emerging economies

Country	Years	Measures
Pre GFC selected cases of capital flow management		
Brazil	1993 – 1997	Set minimum term for external borrowing and external borrowing eligible for exemption on the income tax on interest. Raised (reduced) limit on authorized banks' long (short) position in the forex market. Imposed foreign transactions tax on proceeds from foreign borrowing. Restricted portfolio investment by foreign investors in fixed-income instruments to a single class of fixed-income funds. Increased the period for exchange contracting on exports to delay the flow of export revenues.
	2008	Tightened foreign exchange transaction tax.
Chile	1991 – 1998	Introduced unremunerated reserve requirement (URR) on foreign borrowing, later extended to cover non-debt flows, American Depository Receipts, and potentially speculative FDI.
Colombia	1993 – 1998	Introduced URR on external borrowing (limited to loans with maturities up to 18 months), and later extended to cover certain trade credits.
	2007 – 2008	Introduced URR of 40 per cent on foreign borrowing and portfolio inflows. Imposed limits on the currency derivative positions of banks (500 per cent of the capital).
Croatia	2004 – 2008	Introduced marginal reserve requirement (MRRs) on bank foreign financing.
Malaysia	1994	Banned sale to non-residents of private and government debt securities with less than 12 months maturity, and money-market instruments. Banned commercial banks from performing non-trade related swaps or forward transactions with non-residents. Imposed ceilings on banks' net liability position (excluding trade-related and FDI flows). Imposed a non-interest bearing deposit requirement for commercial banks against ringgit funds of foreign banks.
Thailand	1995 – 1996	Imposed URR on bank's non-resident baht accounts. Introduced open-position limits for short and long positions with smaller limits on short foreign currency positions to discourage foreign borrowing. Imposed reporting requirements for banks on risk control measures in forex and derivatives trading
	2006 – 2008	Imposed a URR of 30 per cent on foreign currencies sold or exchanged against baht with authorized financial institutions (except for FDI and amounts not exceeding US$20,000). Equity investments in companies listed in the stock exchange were exempt from the URR

Table 4A. 1 Cases of capital flow management in emerging economies (continued)

Country	Years	Measures
Post GFC selected cases of capital flow management		
Brazil	2009 – 2012	A tax of 2 per cent was levied on foreign portfolio equity and fixed-income inflows in October 2009. The tax rate was gradually increased to 6 per cent and extended to cover other sources of foreign flows, such as the issuance of depository receipts (DRs) into local equities, borrowing abroad with a maturity of less than a year (later tightened to maturity of less than two, three, and five years), and currency derivatives. A URR of 60 per cent on banks' gross FX positions beyond US$ 3 billion (later tightened to US$ 1 billion) was also levied.
Costa Rica	2014	Activation (for a period of up to six months) of an increase in the income tax rate (from 8 to 33 per cent) on interest earned on investments in fixed-income assets issued by private-sector entities to non-residents. Establishment of a URR for new investments in these financial instruments.
South Korea	2010 – 2011	Setting the maximum limits on banks' foreign exchange derivative contracts at 50 per cent (domestic banks) and 250 per cent (foreign banks branches) of bank capital in the previous month. Restoration of a 14 per cent withholding tax on interest income on non-resident purchases of treasure and monetary stabilization bonds (a similar tax was already in place for domestic investors).
Peru	2010 – 2011	Extension of a 60 per cent reserve requirement for new foreign holders of debt with maturity up to three years. Extension of the application of income tax rate of 30 per cent to all non-resident gains on financial derivatives transactions with residents.
Russia	2011	Increase in the reserve requirement for (1) liabilities to non-resident legal entities in rubles and foreign currency, from 2.5 to 3.5 per cent; (2) liabilities to individuals in rubles and foreign currency, from 2.5 to 3 per cent; and (3) other liabilities in rubles and foreign currency, from 2.5 to 3 per cent.
Thailand	2010	Restoration of a 15 per cent withholding tax on non-residents' interest earnings and capital gains on new purchases of government bonds.
Uruguay	2012	Introduction of a reserve requirement of 40 per cent (later raised to 50 per cent) on new foreign purchase of central bank notes and central government securities.

Source: Ghosh et al. (2018)

Table 4A. 2 Policies included for CFM index calculation

No	Time	Policy	Classification
1	2000Q2	BI guarantees interbank foreign loans as stated in the master loan agreement	Inflow (Relaxation - R)
2	2000Q4	BI issues provisions on foreign debt reporting obligations	Inflow (Tightening - T)
3	2000Q4	ASEAN short-term liquidity support agreement to cover the short-term balance of payments adjustments	Inflow (R)
4	2001Q1	Limiting the types of international transaction for domestic banks	Outflow (T)
5	2001Q3	Regulation on Interbank Debt Exchange Offer Guarantee. Allows domestic banks to pay off all or part of their loans through prepayments and buybacks.	Inflow (R) Outflow (R)
6	2001Q4	The state sells some of its share on several large state-owned enterprises.	Inflow (R) Outflow (T)
7	2002Q1	Regulate foreign exchange transaction reporting for non-financial institution	Inflow (T) Outflow (T)
8	2002Q4	Refining open market operation regulation including facilitating the domestic securities transaction using foreign exchange.	Inflow (R) Outflow (T)
9	2003Q3	Domestic banks were required to maintain overall net open position (on and off-balance sheet) maximum 20% of the capital	Inflow (T) Outflow (T)
10	2004Q2	Simplification of FDI approval through one-roof service system (Presidential decree 29/2004)	Inflow (R)
11	2004Q2	Deposits in foreign currency were subject to a 3% reserve requirement (6/15/PBI/2004).	Inflow (T) Outflow (T)
12	2004Q3	Banks were required to maintain overall net open position (on and off-balance sheet) maximum of 20% of capital and a net open position for an on-balance-sheet maximum of 20% of capital in the middle and of the working day. (6/20/PBI/2004)	Inflow (T) Outflow (T)
13	2005Q1	Short-term offshore borrowings by banks were limited to 30% of bank capital. Long-term borrowings (maturities of over one year) by banks required approval by the central bank. (7/1/PBI/2005)"	Inflow (T)
14	2005Q1	Banks were prohibited from owning productive assets in the form of stock and securities with an underlying reference asset in the form of stock. (7/2/PBI/2005)	Outflow (T)
15	2005Q3	The limit on forward and swap transactions of banks with non-residents without an underlying investment-related transaction was reduced to $1 million from $5 million (7/14/PBI/2005)	Inflow (T) Outflow (T)
16	2005Q3	Revision on the ratio of the bank's net open position (20% of capital - real-time). (7/37/PBI/2005)	Inflow (T) Outflow (T)
17	2005Q3	Domestic banks are allowed to conduct swap hedging transaction with the central bank (7/36/PBI/2005)	Inflow (R)
18	2005Q3	Limiting the loss from derivative transactions conducted by banks (10% of the bank's capital). Banks only allowed to conduct derivative transaction based on foreign exchange and interest rate. (7/31/PBI/2005)	Outflow (T)
19	2006Q3	The termination of interbank debt exchange offer program (EOP). The government no longer act as the guarantor for interbank offshore loans. (No. 8/11/PBI/2006)	Inflow (T)
20	2007Q3	Enactment of the use of foreign worker regulation in the banking sector (No. 9/8/PBI/2006)	Inflow (T)
21	2007Q3	Revision of investment negative list (Perpres 77/2007)	Inflow (R)
22	2008Q4	Increasing the availability of foreign exchange (FX) for domestic corporation beyond the market mechanism through USD repo transaction with BI (using banks as an intermediary) (10/22/PBI/2008)	Inflow (R)
23	2008Q4	Due to global financial crisis, there is a need to increase the sustainability of FX supply by not requiring banks to maintain the daily balance of short-term offshore loans ratio (30% of capital) (10/20/PBI/2008)	Inflow (R)

Table 4A. 2 Policies included for CFM index calculation (continued)

No	Time	Policy	Classification
24	2008Q4	Reducing the reserve requirement both in rupiah (7.5%) and foreign exchange (1%) (10/19/PBI/2008)	Inflow (R) Outflow (R)
25	2008Q4	The purchase of foreign currency against rupiah through banks exceeding $100,000 a month requires underlying document (No. 10/28/PBI/2008)	Outflow (T)
26	2009Q1	USD Repo transaction using USD denominated securities to Bank Indonesia with the obligation to repurchase at an agreed term and price were enabled. The securities intended are the global bonds issued by the Government of Indonesia (No. 11/4/PBI/2009)	Inflow (R)
27	2010Q2	Banks are required to only offer their customer products which are officially listed to the authority in the country of origin (12/9/PBI/2010)	Outflow (T)
28	2010Q3	Implementing a 1-month minimum holding period for Bank Indonesia's certificate (SBI) (12/11/PBI/2010)	Inflow (T) Outflow (R)
29	2010Q3	The on-balance-sheet NOP limit of 20% of the capital was abolished, however, the overall on and off-balance sheet combined - NOP was maintained at 20% of capital (12/10/PBI/2010)	Inflow (R) Outflow (R)
30	2011Q1	Bank Indonesia reinstated the limit of 30% of capital on the daily balance of banks' short-term external debt (PBI No. 13/7/PBI/2011).	Inflow (T) Outflow (T)
31	2011Q1	Revocation of Bank Indonesia Regulation number 10/22/PBI/2008 concerning Fulfilment of Domestic Corporation Foreign Exchange Requirement through Banks (13/4/PBI/2011)	Inflow (R)
32	2011Q1	The reserve requirement on deposit accounts in foreign exchange was raised to 5% from 1% (PBI No. 13/10/PBI/2011).	Inflow (T) Outflow (T)
33	2011Q2	The minimum holding period for SBI was lengthened from one month to six months (No.13/13/DPM)	Inflow (T) Outflow (R)
34	2011Q3	Issuance and Sale of Sharia Government Securities in Foreign Currency in the International Primary Market (No. 119 PMK.08 2011)	Inflow (R)
35	2012Q3	Allowing derivative transaction for the purpose of hedging at a period and an amount consistent with the underlying transaction (14/10/PBI/2012)	Inflow (R)
36	2013Q1	Revisions on the regulation concerning auctions of Government Bond in Rupiah and Foreign Currency in Domestic Primary Market (No.43/PMK.08/2013)	Inflow (R)
37	2013Q3	Introduce more flexibility to non-residents to deposit their proceeds from divestment in domestic currency or foreign currency (No.15/6/PBI/2013)	Inflow (R) Outflow (T)
38	2013Q4	Regulate hedging transaction facility to banks (No.15/8/PBI/2013)	Inflow (R)
39	2014Q2	Amendments of regulation No. 7/14/PBI/2005 to deepen the domestic foreign exchange market by giving flexibility to market, especially in hedging investments income.	Inflow (R)
40	2014Q2	Adding more exceptions in the calculation of a bank's foreign debt (more flexibility in the calculation of debt to capital ratio) (No. 16/7/PBI/2014)	Inflow (R)
41	2014Q3	Regulating foreign exchange transactions against rupiah between domestic banks and foreign parties (No. 16/17/PBI/2014)	Inflow (R)
42	2014Q3	Foreign exchange transaction above 100k USD must be supported with underlying documents. Transaction categories that are acceptable as underlying transactions for derivative transactions were expanded (No.16/16/PBI/2014)	Outflow (T)
43	2014Q4	Requiring nonbank corporation need to manage external debt based on prudential principles (No. 16/21/PBI/2014)"	Inflow (T)
44	2015Q2	Pension funds are allowed to invest abroad up to 5% of total investment (OJK Regulation No.3/POJK.05/2015)	Outflow (R)

Table 4A. 2 Policies included for CFM index calculation (continued)

No	Time	Policy	Classification
45	2015Q2	Amendment in BI regulation No. 16/17/PBI/2014 to increase liquidity in the domestic foreign exchange financial market, by expanding the scope of transactions of foreign exchange derivative instruments to the Rupiah. The definition of derivative transaction in the new regulation not only covers forward, swap, option but also in the form of a cross-currency swap. This regulation also removes the minimum 1-week term requirement for derivative transactions. (No. 17/7/PBI/2015)	Inflow (R)
46	2015Q3	Lowering the threshold of spot transaction without underlying documents to US$25.000/month (No. 17/14/PBI/2015)	Outflow (T)
47	2015Q3	Shorten the minimum holding period from one month to one week	Inflow (R) Outflow (T)
48	2015Q4	Increasing the threshold for forward transactions from 1 to 5 million USD (No. 17/16/PBI/2015)	Inflow (R)
49	2016Q3	Revision on the regulation of FX transaction against Rp between banks and foreign party. This regulation also aims to increase the portion of derivative transactions on the domestic foreign exchange market. (No. 18/19/PBI/2016)"	Inflow (R)
50	2017Q1	Regulating the trading of deposit certificates in the money market. (19/2/PBI/2017).	Inflow (R)
51	2018Q3	Allowing the Bank to conduct domestic non-deliverable forward transactions. (No. 20/10/PBI/2018)	Inflow (R)
52	2018Q4	The reserve requirement ratio on deposits in foreign exchange were modified from 8% daily to 6% daily and 2% average.	Inflow (R) Outflow (R)
53	2018Q4	Adding domestic non-deliverable forward (DNDF) transactions as instruments for open market operations.	Inflow (R) Outflow (T)
54	2019Q1	Revision on domestic bank's foreign debt and other foreign exchange liabilities regulation.	Inflow (T)
55	2019Q2	Adding domestic non-deliverable forward (DNDF) transactions as instruments for open market operations.	Inflow (R) Outflow (T)

Note: (R) represents policies that are interpreted to relax the capital account regulation or encourage capital account transactions. (T) represents policies that are interpreted to tighten the capital account regulation or discourage capital account transactions.

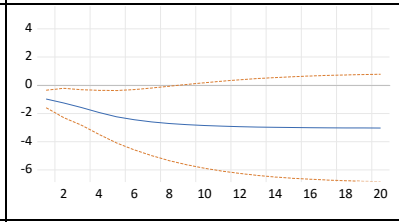
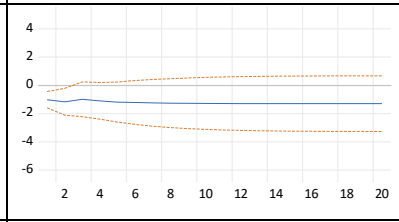
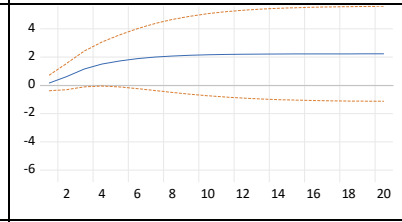
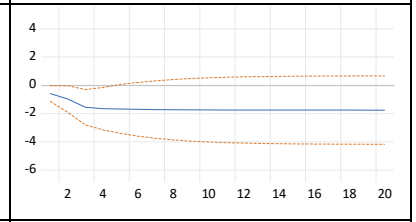
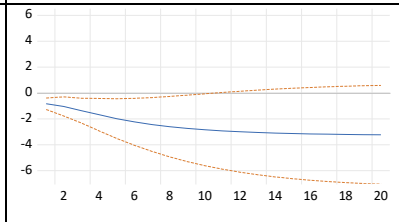
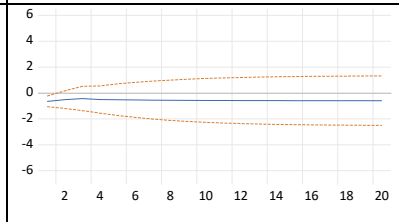
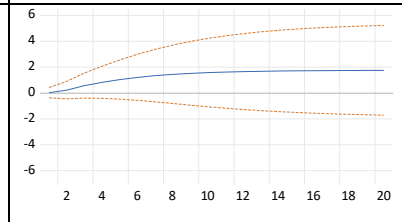
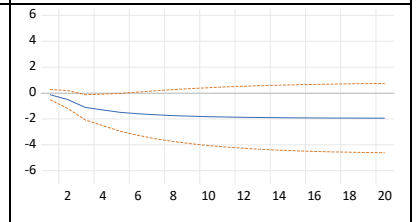
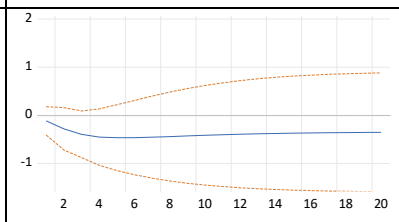
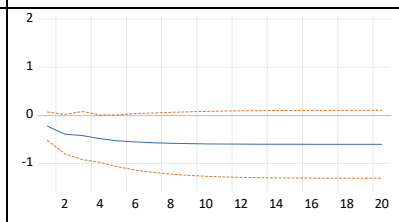
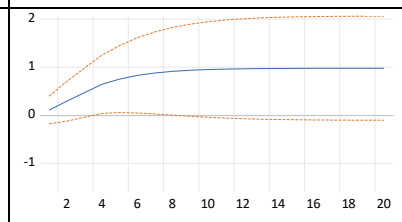
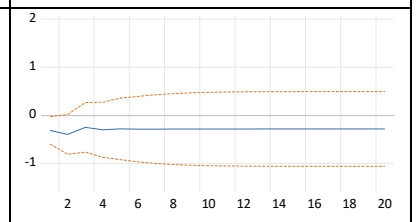
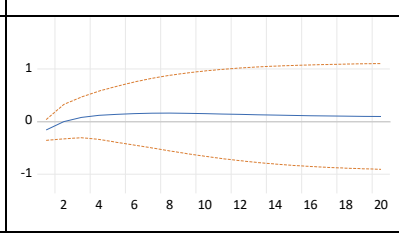
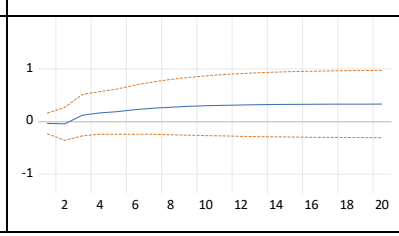
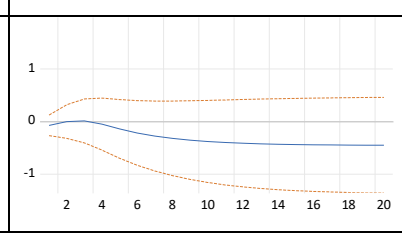
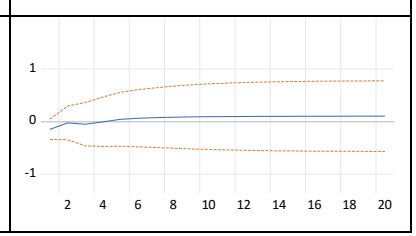
Source: Bank Indonesia's Economic Report on Indonesia (2000 – 2019)
https://www.bi.go.id/en/publikasi/laporan-tahunan/perekonomian/Default.aspx

Table 4A. 3 Correlation matrix of variables

Variables	VIX	IDX_VOL	RRDIF	D(CFM_IN)	D(CFM_OUT)
Log of CBOE volatility index (VIX)	1.00				
Indonesian stock market price index volatility (IDX)	0.64	1.00			
Real interest rate differential (RRDIF)	0.00	-0.30	1.00		
CFMIX-inflow adjustment (D_CFM_IN)	-0.21	-0.24	-0.05	1.00	
CFMIX-outflow adjustment (D_CFM_OUT)	-0.05	0.16	-0.06	0.23	1.00
Aggregate capital inflows (FA_LIAB)	-0.36	-0.51	0.24	-0.15	-0.20
Portfolio investment inflows (PI_LIAB)	-0.45	-0.59	0.19	-0.05	-0.23
Other investment inflows (OI_LIAB)	0.06	-0.18	0.21	-0.18	-0.13
Direct investment inflows (FDI_LIAB)	-0.33	-0.31	0.15	-0.12	-0.09
Portfolio - public debt inflow (PI_LIAB_DPB)	-0.47	-0.59	0.16	0.03	-0.15
Portfolio - private debt inflow (PI_LIAB_DPR)	-0.20	-0.29	0.25	-0.17	-0.21
Portfolio - equity inflow (PI_LIAB_EQ)	0.00	-0.05	-0.11	-0.03	-0.11
Other inv. - banking sector (OI_LIAB_BNK)	-0.09	-0.05	0.08	-0.07	-0.18
Other inv. - public sector (OI_LIAB_PUB)	0.24	-0.06	0.15	-0.20	0.01
Other inv. - other sector (OI_LIAB_OTH)	-0.08	-0.23	0.15	-0.07	-0.10
Aggregate capital outflows (FA_AST)	-0.04	-0.01	-0.05	-0.13	-0.04
Portfolio investment outflows (PI_AST)	-0.10	-0.08	-0.03	-0.02	-0.10
Other investment outflows (OI_AST)	0.00	0.02	0.06	-0.13	0.01
Direct investment outflows (FDI_AST)	-0.03	-0.02	-0.17	-0.07	-0.04

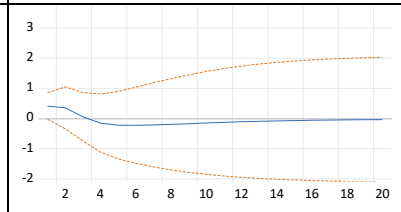
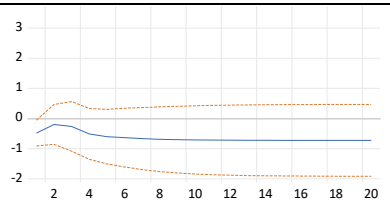
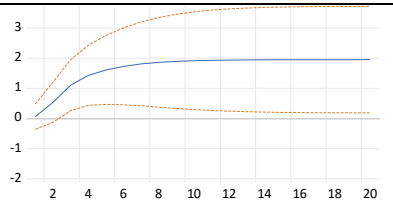
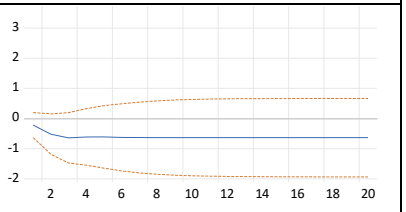
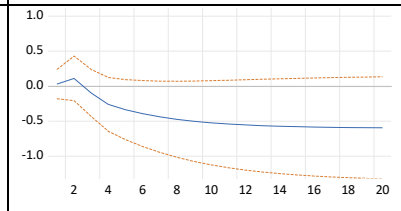
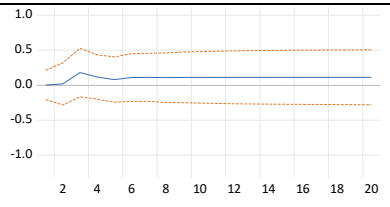
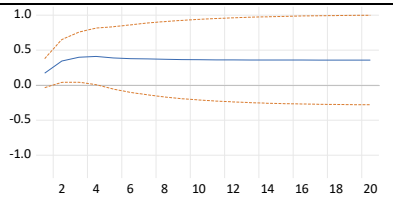
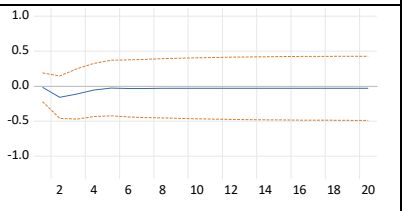
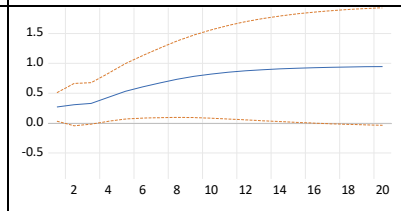
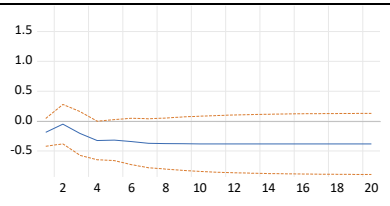
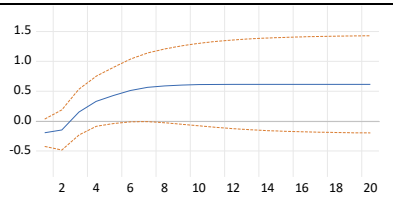
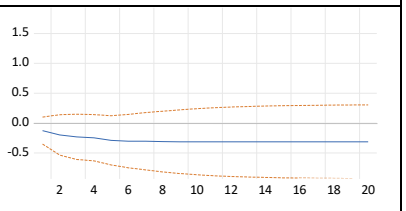
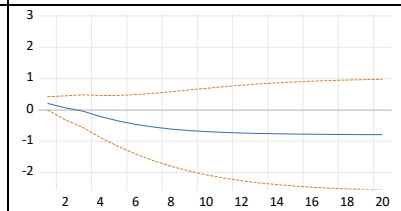
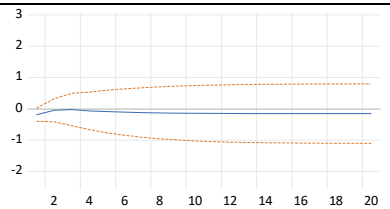
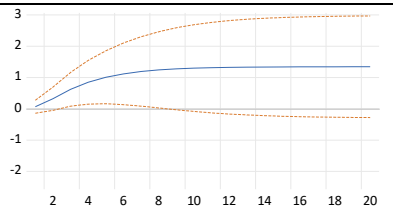
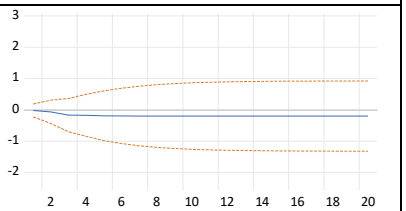
Source: Author's calculation

Figure 4A. 1 Accumulated impulse responses of capital flows to Cholesky one standard deviation innovations of other endogenous variables

Capital inflows category	Log VIX	IDX	RRATE_DIF	D_CFMIX_IN
Portfolio inv. (PI)				
PI – public debt				
PI – priv. debt				
PI – equity				

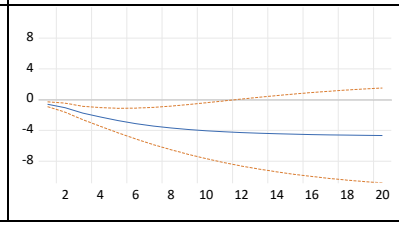
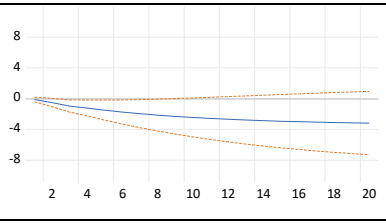
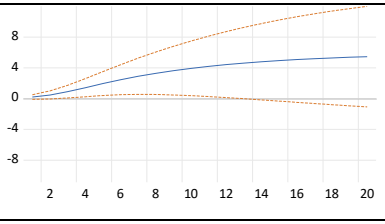
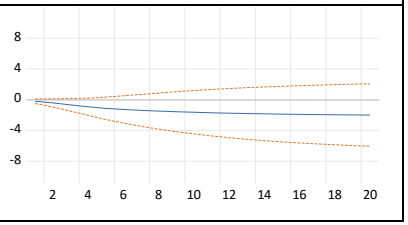
Note: VIX represents the global financial market risk condition, IDX represents the domestic financial market risk condition, RRATE_DIF represents the real interest rate differential, D_CFM_IN represents the adjustment in CFM-inflow restrictiveness. The solid line represents the accumulated impulse response; the dotted lines represent 2 analytic (asymptotic) standard error of the impulse response. The response is generated using Cholesky decomposition (degrees of freedom adjusted) with a one standard deviation shock of other variables. The vertical axis is in billion USD, the horizontal axis represents the time period (quarter). Source: Author's calculation

Figure 4A. 1 Accumulated impulse responses of capital flows to Cholesky one standard deviation innovations of other endogenous variables (continued)

Capital inflows category	Log VIX	IDX	RRATE_DIF	D_CFMIX_IN
Other inv. (OI)				
OI – bank				
OI – public				
OI – other				

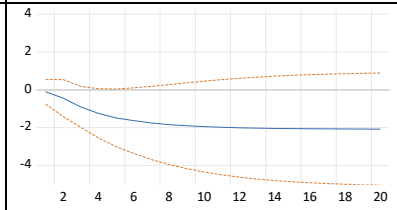
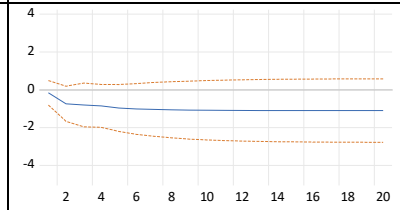
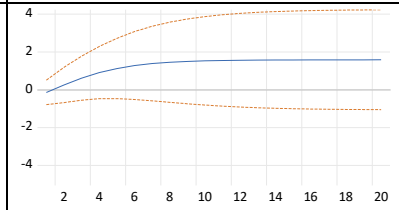
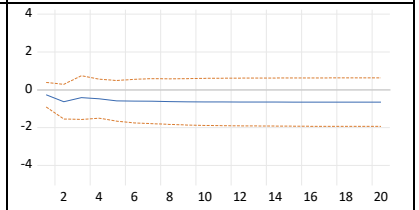
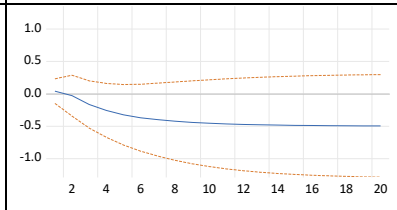
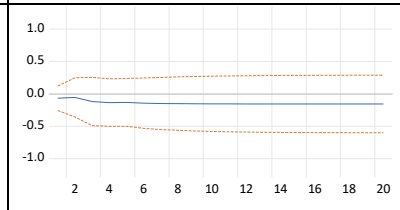
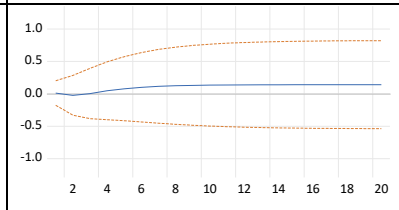
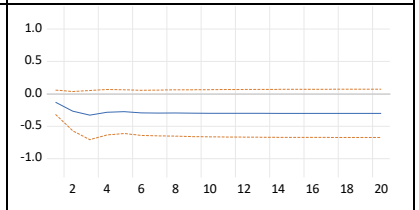
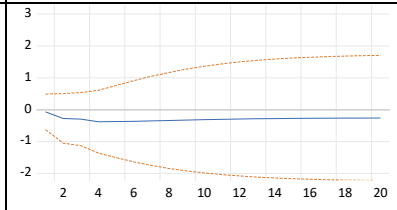
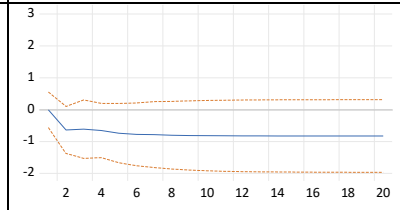
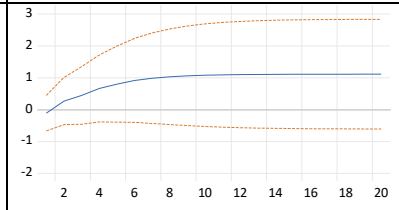
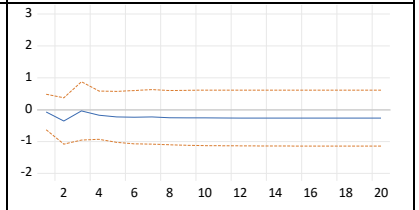
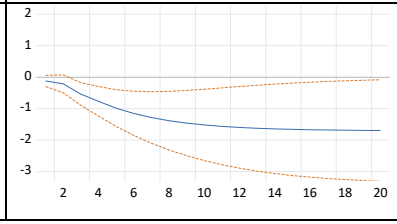
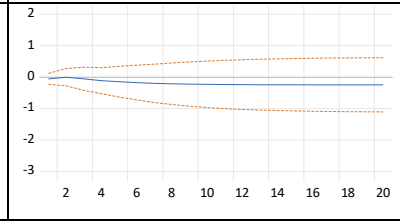
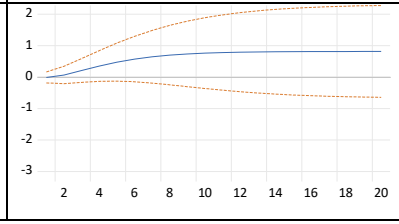
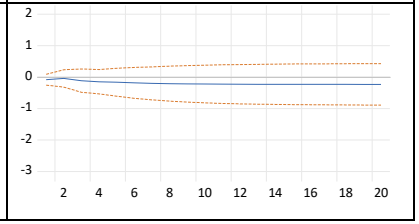
Note: VIX represents the global financial market risk condition, IDX represents the domestic financial market risk condition, RRATE_DIF represents the real interest rate differential, D_CFM_IN represents the adjustment in CFM-inflow restrictiveness. The solid line represents the accumulated impulse response; the dotted lines represent 2 analytic (asymptotic) standard error of the impulse response. The response is generated using Cholesky decomposition (degrees of freedom adjusted) with a one standard deviation shock of other variables. The vertical axis is in billion USD, the horizontal axis represents the time period (quarter). Source: Author's calculation

Figure 4A. 1 Accumulated impulse responses of capital flows to Cholesky one standard deviation innovations of other endogenous variables (continued)

Capital inflows category	Log VIX	IDX	RRATE_DIF	D_CFMIX_IN
FDI				

Note: VIX represents the global financial market risk condition, IDX represents the domestic financial market risk condition, RRATE_DIF represents the real interest rate differential, D_CFM_IN represents the adjustment in CFM-inflow restrictiveness. The solid line represents the accumulated impulse response; the dotted lines represent 2 analytic (asymptotic) standard error of the impulse response. The response is generated using Cholesky decomposition (degrees of freedom adjusted) with a one standard deviation shock of other variables. The vertical axis is in billion USD, the horizontal axis represents the time period (quarter). Source: Author's calculation

Figure 4A. 1 Accumulated impulse responses of capital flows to Cholesky one standard deviation innovations of other endogenous variables (continued)

Capital outflows category	Log VIX	IDX	RRATE_DIF	D_CFMIX_OUT
Aggregate outflows				
Portfolio inv.				
Other inv.				
Direct inv.				

Note: VIX represents the global financial market risk condition, IDX represents the domestic financial market risk condition, RRATE_DIF represents the real interest rate differential, D_CFM_OUT represents the adjustment in CFM-outflow restrictiveness. The solid line represents the accumulated impulse response; the dotted lines represent 2 analytic (asymptotic) standard error of the impulse response. The response is generated using Cholesky decomposition (degrees of freedom adjusted) with a one standard deviation shock of other variables. The vertical axis is in billion USD, the horizontal axis represents the time period (quarter). Source: Author's calculation

5. Conclusion

Financial globalization— the increased cross-border mobility of capital — has been an important dimension of national development in this era of economic globalization. Access to global finance could assist the economic advancement of a country by broadening sources of investment finance, enabling financial risk sharing, and disciplining agents in the domestic financial system through exposure to global competition. Notwithstanding these gains, increased reliance on capital inflows could disturb international competitiveness of the economy through real exchange rate appreciation and makes the economy potentially vulnerable to financial crises caused by sudden exodus of capital. The upshot is that in this era of financial globalization, the traditional macroeconomic policy configuration that relies solely on fiscal and monetary policies is not sufficient to reap gains from access to international capital markets while cushioning the economy against potential adverse implications. Consequently, there has been a significant emphasis on capital flows management (CFM) as an additional instrument of open economy macroeconomic policy.

The purpose of this thesis is to contribute to the emerging literature on financial globalization and capital inflow management measures. The thesis begins with a stage-setting overview of the trends and patterns of financial globalization and the newfound emphasis on CFM as part of the open economy macroeconomic policy configuration. The ensuing three core chapters investigate the relationship between the accumulation of foreign exchange reserves and private investment (Chapter 2); the relationship between real exchange rate misalignment and the exchange rate regime

and the level of openness of capital account (Chapter 3); and an assessment of the effectiveness of capital flow management on capital flows through a case study on Indonesia (Chapter 4).

Chapter 2 investigates the relationship between the accumulation of foreign exchange reserves and domestic private investment using dynamic panel data analysis for a sample of 58 countries for the period 2000 – 2014. Foreign exchange reserves accumulation helps cushioning the economy against the negative impact from the volatility of the international capital flows and reduce the susceptibility of experiencing a financial crisis. Additionally, having foreign exchange reserves at a sufficient level has the potential to support domestic investment growth by reducing international borrowing costs associated with improving international creditworthiness. However, the policy of accumulating foreign exchange reserves is generally accompanied by a contractionary sterilization policy that could crowd out the financing for domestic investment. The findings of the econometric analysis of this chapter suggests that the positive effects more than counterbalance the negative effects to yield a net positive of the accumulation of foreign exchange reserves on domestic private investment in the long run.

Chapter 3 explores the relation between the real exchange rate (RER) misalignment, exchange rate flexibility, and capital account openness using a panel dataset for 60 developing countries from 1980 to 2014. The study is based on an alternative RER index calculation that is more compatible with the theoretical definition of RER than the widely used index and misalignment calculations that account for country-specific underlying variables. The findings show that the degree

of persistence and the extent of RER misalignment are strongly linked to the exchange rate regime and the degree of capital account openness.

Chapter 4 examines the effectiveness of capital flow management (CFM) policy through an in-depth case study of the Indonesian experience during 2000 - 2019. The methodology involves construction of a new capital flows management index (CFMIX) for capital inflows and outflows, as well as analysing the accumulated impulse response of these flows to CFMIX adjustment based on push and pull model estimated using structural vector autoregression (SVAR) with recursive restrictions. The index illustrates that over time, the Indonesian CFM policy posture has become more accommodative of capital inflows and restrictive of outflows. The findings of the SVAR estimations show that capital inflows, particularly in the form of portfolio investment, are substantially sensitive to CFM interventions. However, there is little evidence that the CFM programme has had a major effect on capital outflows.

The findings of the three core chapters have implications for further research in the subject area of macroeconomic prudential policy, which has gained importance as the third pillar of open economy macroeconomic policy. Relating to the subject area of investment crowding out of reserve accumulation (Chapter 2) there is need for further research into the cost of sterilization policy implemented as part of reserve management in order to further strengthen the key findings of this chapter. The estimation of a theoretical consistent RER index in chapter 3 has implications for further research on various dimensions of exchange rate economics. In particular, there is need for revisiting the available empirical evidence on determinants of the real exchange rate and its impact on economic performance based on the widely used IMF

RER index. Chapter 4 has only examined the effectiveness of CFM measures in influencing capital flows. How regulation of capital flows impact on domestic macroeconomic performance is an area of further study. Moreover, the impact of CFM implementation on the effectiveness of conventional policy warrants further research to help policymakers in formulating appropriate policy framework. Another potential area for further research relating to this subject is international spill over effect of CFM policy in order to inform the debate on international policy coordination. Finally, there is always room for revisiting the findings of the three core chapters by using different methodologies, high-frequency and disaggregated data, or alternative indicators.

References

Agénor, P.R. and Montiel, P.J., 2015. Development macroeconomics. Princeton University Press.

Aghion, P., Bacchetta, P., Ranciere, R. and Rogoff, K., 2009. Exchange rate volatility and productivity growth: The role of financial development. Journal of Monetary Economics, 56(4), pp.494-513.

Aguiar, M. and Gopinath, G., 2007. Emerging market business cycles: The cycle is the trend. Journal of Political Economy, 115(1), pp.69-102.

Aguirre, A. and Calderón, C., 2005. Real exchange rate misalignments and economic performance. Documentos de Trabajo (Banco Central de Chile), (315), pp.1-49.

Ahmed, S. and Zlate, A., 2014. Capital flows to emerging market economies: A brave new world?. Journal of International Money and Finance, 48, pp.221-248.

Aizenman, J., 2019. A modern reincarnation of Mundell-Fleming's trilemma. Economic Modelling, 81, pp.444-454.

Aizenman, J. and Lee, J., 2007. International reserves: precautionary versus mercantilist views, theory and evidence. Open Economies Review, 18(2), pp.191-214.

Aizenman, J. and Riera-Crichton, D., 2008. Real exchange rate and international reserves in an era of growing financial and trade integration. The Review of Economics and Statistics, 90(4), pp.812-815.

Aizenman, J., Cheung, Y.W. and Ito, H., 2015. International reserves before and after the global crisis: Is there no end to hoarding? Journal of International Money and Finance, 52, pp.102-126.

Aizenman, J., Chinn, M.D. and Ito, H., 2013. The "impossible trinity" hypothesis in an era of global imbalances: Measurement and testing. Review of International Economics, 21(3), pp.447-458.

Ananchotikul, N. and Zhang, M.L., 2014. Portfolio flows, global risk aversion and asset prices in emerging markets (No. 14-156). International Monetary Fund.

Athukorala, P., 1998. Interest rates, saving and investment: Evidence from India. Oxford Development Studies, 26(2), pp.153-169.

Athukorala, P., 2001. Crisis and recovery in Malaysia: the role of capital controls. Edward Elgar Publishing.

Athukorala, P., 2003. Foreign direct investment in crisis and recovery: Lessons from the 1997–1998 Asian crisis. Australian Economic History Review, 43(2), pp.197-213.

Athukorala, P., 2012. The Malaysian Economy During Three Crises. In Malaysia's Development Challenge: Graduating from the Middle, edited by Hal Hill, Tham Siew Yean and Ragayah Haji Mat Zin. London: Routledge, 2012, pp.83-105.

Athukorala, P. and Jongwanich, J., 2012. How effective are capital controls? Evidence from Malaysia. Asian Development Review, 29(2), pp.1-47.

Athukorala, P. and Rajapatirana, S., 2003. Capital inflows and the real exchange rate: a comparative study of Asia and Latin America. World Economy, 26(4), pp.613-637.

Baek, I.M., 2006. Portfolio investment flows to Asia and Latin America: Pull, push or market sentiment?. Journal of Asian Economics, 17(2), pp.363-373.

Baffes, J., Elbadawi, I. A., and O'Connell, S. A., 1999. Single-equation estimation of the equilibrium exchange rate. In Exchange Rate Misalignment: Concepts and Measurement for Developing Countries, Edited by L. E. Hinkle and P. J. Montiel, pp.405-465. Oxford University Press.

Balassa, B., 1964. The purchasing-power parity doctrine: a reappraisal. Journal of Political Economy, 72(6), pp.584-596.

Bank Indonesia, 2020, https://www.bi.go.id/id/statistik/seki/terkini/moneter/Contents/ Default.aspx. Accessed on 18 February 2020.

Bank Indonesia, 2001 – 2020. Economic Report on Indonesia. https://www.bi.go.id/en/publikasi/ laporan-tahunan/perekonomian/Default.aspx

Barbosa, L.O.S., Jayme Jr, F.G. and Missio, F.J., 2018. Determinants of the real exchange rate in the long-run for developing and emerging countries: a theoretical and empirical approach. International Review of Applied Economics, 32(1), pp.62-83.

Basri, M.C., 2017. India and Indonesia: Lessons learned from the 2013 taper tantrum. Bulletin of Indonesian Economic Studies, 53(2), pp.137-160.

Baum, C.F., Caglayan, M. and Talavera, O., 2010. On the investment sensitivity of debt under uncertainty. Economics Letters, 106(1), pp.25-27.

Bayoumi, T.A., 2017. Unfinished business: the unexplored causes of the financial crisis and the lessons yet to be learned. Yale University Press.

Benhamou, Z.A., 2018. Are all cycles alike? An empirical investigation of regional and global factors in developed and emerging economies. International economics, 156, pp.45-60.

Betts, C.M. and Kehoe, T.J., 2008. Real exchange rate movements and the relative price of non-traded goods (No. w14437). National Bureau of Economic Research.

Bhagwati, J., 1998. The capital myth: the difference between trade in widgets and dollars. Foreign Affairs, pp.7-12.

Bhattarai, S., Chatterjee, A. and Park, W.Y., 2020. Global spillover effects of US uncertainty. Journal of Monetary Economics, 114, pp.71-89.

Bird, G. and Mandilaras, A., 2005. Reserve accumulation in Asia. World Economics, 6(1), pp.85-99.

Blanchard, O.J., Dell'Ariccia, M.G. and Mauro, M.P., 2014. Rethinking macro policy II: getting granular. In What have we learned?: Macroeconomic policy after the crisis. Edited by O. Blanchard, G. A. Akerlof, D, Romer, and J. E. Stiglitz, pp.1-30. MIT Press.

Blejer, M.I. and Khan, M.S., 1984. Government policy and private investment in developing countries. Staff Papers, 31(2), pp.379-403.

Bloom, N., 2009. The impact of uncertainty shocks. Econometrica, 77(3), pp.623-685.

Bloom, N., Bond, S. and Van Reenen, J., 2007. Uncertainty and investment dynamics. The review of economic studies, 74(2), pp.391-415.

Bluedorn, M.J.C., Duttagupta, R., Guajardo, J. and Topalova, P., 2013. Capital flows are fickle: anytime, anywhere (No. 13-183). International Monetary Fund.

Bonciani, D. and Ricci, M., 2020. The international effects of global financial uncertainty shocks. Journal of International Money and Finance, 109, p.102236.

Bosworth, B.P., Collins, S.M. and Reinhart, C.M., 1999. Capital flows to developing economies: implications for saving and investment. Brookings papers on economic activity, 1999(1), pp.143-180.

Bresnan, J., 1993. Managing Indonesia: The modern political economy. Columbia University Press.

Broner, F. and Ventura, J., 2016. Rethinking the effects of financial globalization. The quarterly journal of economics, 131(3), pp.1497-1542.

Bruno, V. and Shin, H.S., 2014. Assessing macroprudential policies: the case of South Korea. The Scandinavian Journal of Economics, 116(1), pp.128-157.

Buchanan, B.G., Le, Q.V. and Rishi, M., 2012. Foreign direct investment and institutional quality: Some empirical evidence. International Review of financial analysis, 21, pp.81-89.

Burstein, A. and Gopinath, G., 2014. International prices and exchange rates. In Handbook of international economics (Vol. 4, pp. 391-451). Elsevier.

Caballero, J.A., 2016. Do surges in international capital inflows influence the likelihood of banking crises? The Economic Journal, 126(591), pp.281-316.

Caballero, R.J., 1999. Aggregate investment. Handbook of macroeconomics, 1, pp.813-862.

Caballero, R.J. and Krishnamurthy, A., 2006. Bubbles and capital flow volatility: Causes and risk management. Journal of Monetary Economics, 53(1), pp.35-53.

Calvo, G.A., 1991. The perils of sterilization. IMF Staff Papers, 38(4), pp.921-926.

Calvo, G.A., Leiderman, L. and Reinhart, C.M., 1993. Capital inflows and real exchange rate appreciation in Latin America: the role of external factors. IMF Staff Papers, 40(1), pp.108-151.

Calvo, G.A., Leiderman, L. and Reinhart, C.M., 1996. Inflows of Capital to Developing Countries in the 1990s. Journal of economic perspectives, 10(2), pp.123-139.

Chamon, M. and Garcia, M., 2016. Capital controls in Brazil: effective? Journal of International Money and Finance, 61, pp.163-187.

Chinn, M.D., 2000. Before the fall: were East Asian currencies overvalued? Emerging Markets Review, 1(2), pp.101-126.

Chinn, M.D., 2002. The measurement of real effective exchange rates: a survey and applications to East Asia. UCSC Center for International Economics Working Paper, (02-9).

Chirinko, R.S., 1993. Business fixed investment spending: Modeling strategies, empirical results, and policy implications. Journal of Economic Literature, 31(4), pp.1875-1911.

Christiano, L.J., 2012. Christopher A. Sims and vector autoregressions. The Scandinavian Journal of Economics, 114(4), pp.1082-1104.

Christopoulos, D.K., Gente, K. and León-Ledesma, M.A., 2012. Net foreign assets, productivity and real exchange rates in constrained economies. European Economic Review, 56(3), pp.295-316.

Chwieroth, J.M., 2010. How do crises lead to change? Liberalizing capital controls in the early years of new order Indonesia. World politics, 62(3), pp.496-527.

Cole, D.C. and Slade, B.F., 1996. Building a modern financial system: The Indonesian experience. Cambridge University Press.

Combes, J.L., Kinda, T. and Plane, P., 2012. Capital flows, exchange rate flexibility, and the real exchange rate. Journal of Macroeconomics, 34(4), pp.1034-1043.

Cook, D. and Yetman, J., 2012. Expanding central bank balance sheets in emerging Asia: a compendium of risks and some evidence. BIS Paper No.66d. https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2185323

Corden, W. M.,1994. Economic policy, exchange rates, and the international system. OUP Oxford.

Corden, W.M., 2004. Too sensational: on the choice of exchange rate regimes. Cambridge. MIT Press.

De Grauwe, P. and Grimaldi, M., 2006. Exchange rate puzzles: a tale of switching attractors. European Economic Review, 50(1), pp.1-33.

De Gregorio, J., Edwards, S. and Valdés, R.O., 2000. Controls on capital inflows: do they work?. Journal of Development Economics, 63(1), pp.59-83.

De Kaplan, E. and D. Rodrik, 2002. "Did the Malaysian Capital Controls Work?," in S. Edwards and J. Frankel, eds., Preventing Currency Crises in Emerging Markets, Chicago: University of Chicago Press for the NBER, 2002.

De Vita, G. and Kyaw, K.S., 2008. Determinants of FDI and portfolio flows to developing countries: A panel cointegration analysis. European Journal of Economics, Finance and Administrative Sciences, 13(13), pp.161-168.

Demirgüç-Kunt, A. and Detragiache, E., 1998. The determinants of banking crises in developing and developed countries. IMF Staff Papers, 45(1), pp.81-109.

Devarajan, S., Swaroop, V. and Zou, H.F., 1996. The composition of public expenditure and economic growth. Journal of monetary economics, 37(2), pp.313-344.

Dick, H., 2002. Formation of the nation-state, 1930s-1966. In The emergence of a national economy: An economic history of Indonesia, 1800-2000. Edited by H. Dick, V. J. Houben, J. T. Linblad, Thee K. W. University of Hawaii Press. pp.153-193.

Dixit, A.K. and Pindyck, R.S., 1994. Investment under uncertainty. Princeton University Press.

Dornbusch, R., 2001. Malaysia: Was It Different?. National Bureau of Economic Research Working Paper 8325, June 2001.

Edwards, S., 1989. Real exchange rates, devaluation, and adjustment: exchange rate policy in developing countries. Cambridge, MA: MIT Press.

Edwards, S., 1999. How effective are capital controls?. Journal of Economic Perspectives, 13(4), pp.65-84.

Edwards, S., 2000. Capital flows, real exchange rates, and capital controls: Some Latin American experiences. In Capital flows and the emerging economies: Theory, evidence, and controversies, Edited by S. Edwards, (pp. 197-246). University of Chicago Press.

Edwards, S., 2018. Finding equilibrium: on the relation between exchange rates and monetary policy. BIS Paper (96), pp.81-107

Edwards, S. and Rigobon, R., 2009. Capital controls on inflows, exchange rate volatility and external vulnerability. Journal of International Economics, 78(2), pp.256-267.

Égert, B., Lahrèche-Révil, A. and Lommatzsch, K., 2004. The stock-flow approach to the real exchange rate of CEE transition economies. CEPII.

Eichengreen, B., 2019. Globalizing Capital: A History of the International Monetary System. Princeton University Press.

Eichengreen, B., Gupta, P. and Masetti, O., 2018. Are capital flows fickle? Increasingly? And does the answer still depend on type?. Asian Economic Papers, 17(1), pp.22-41.

Elbadawi, I.A., Kaltani, L. and Soto, R., 2012. Aid, real exchange rate misalignment, and economic growth in Sub-Saharan Africa. World Development, 40(4), pp.681-700.

Engel, C., 1999. Accounting for US real exchange rate changes. Journal of Political Economy, 107(3), pp.507-538.

Farhi, E. and Werning, I., 2012. Dealing with the trilemma: Optimal capital controls with fixed exchange rates (No. w18199). National Bureau of Economic Research.

Federal Reserve St. Louis, 2020. https://fred.stlouisfed.org/ Accessed on 18 February 2020.

Feenstra, R.C., Inklaar, R. and Timmer, M.P., 2015. The next generation of the Penn World Table. American economic review, 105(10), pp.3150-82.

Feldstein, M., 1999. A self-help guide for emerging markets. Foreign Affairs, New York, 78, pp.93-109.

Fernández, A., Klein, M.W., Rebucci, A., Schindler, M. and Uribe, M., 2016. Capital control measures: A new dataset. IMF Economic Review, 64(3), pp.548-574.

Filardo, A. and Grenville, S., 2012. Central bank balance sheets and foreign exchange rate regimes: understanding the nexus in Asia. https://www.bis.org/publ/bppdf/bispap66e_rh.pdf

Filardo, A.J. and Yetman, J., 2012. The expansion of central bank balance sheets in emerging Asia: what are the risks? BIS Quarterly Review, July, pp.47-63

Fischer, S., 2005. IMF essays from a time of crisis: the international financial system, stabilization, and development. MIT Press Books.

Fleming, J.M., 1962. Domestic financial policies under fixed and under floating exchange rates. Staff Papers, 9(3), pp.369-380.

Flood, R., Marion, N., Agénor, P.R. and Eichengreen, B., 2001, January. Holding International Reserves in an Era of High Capital Mobility [with Comments and Discussion]. In Brookings trade forum (pp. 1-68). Brookings Institution Press.

Forbes, K., Fratzscher, M. and Straub, R., 2015. Capital flow management measures: What are they good for?. Journal of International Economics, 96, pp.S76-S97.

Forbes, K., Fratzscher, M., Kostka, T. and Straub, R., 2016. Bubble thy neighbour: Portfolio effects and externalities from capital controls. Journal of International Economics, 99, pp.85-104.

Forbes, K.J. and Warnock, F.E., 2012. Capital flow waves: Surges, stops, flight, and retrenchment. Journal of international economics, 88(2), pp.235-251.

Frankel, J.A., 1994. Sterilization of money inflows: difficult (Calvo) or easy (Reisen)? (No. 94-159). International Monetary Fund.

Frankel, J.A., 1999. No single currency regime is right for all countries or at all times (No. w7338). National Bureau of Economic Research.

Frankel, J. and Saravelos, G., 2012. Can leading indicators assess country vulnerability? Evidence from the 2008–09 global financial crisis. Journal of International Economics, 87(2), pp.216-231.

FreddieMac, 2020. http://www.freddiemac.com/research/datasets/cofi.page. Accessed on 26 August 2020.

Fukuda, S.I. and Kon, Y., 2012. 'Macroeconomic impacts of foreign exchange reserve accumulation: theory and international evidence', in Kawai, M., Morgan, P.J., and

Takagi, S. Monetary and Currency Policy Management in Asia. Edward Elgar Publishing, pp.120.

Funke, M. and Rahn, J., 2005. Just how undervalued is the Chinese renminbi? World Economy, 28(4), pp.465-489

Gallego, F., Hernandez, L. and Schmidt-Hebbel, K., 2002. Capital controls in Chile: were they effective?. Banking, Financial Integration, and International Crises, pp.361-412.

Garber, P.M., 1998. Buttressing Capital-Account Liberalization with Prudential Regulation and Foreign Entry. Essays in International Finance, pp.28-33.

Garton, P., 2004. Foreign reserve accumulation in Asia: Can it be sustained? Economic Round-up, (Spring 2004), p.1.

Gemmell, N., Kneller, R. and Sanz, I., 2016. Does the Composition of Government Expenditure Matter for Long-Run GDP Levels? Oxford Bulletin of Economics and Statistics, 78(4), pp.522-547.

Ghosh, A.R., Ostry, J.D. and Qureshi, M.S., 2018. Taming the tide of capital flows: A policy guide. MIT Press.

Gnimassoun, B. and Mignon, V., 2015. Persistence of Current-account Disequilibria and Real Exchange rate Misalignments. Review of International Economics, 23(1), pp.137-159.

Grenville, S., 1976. Money, prices and finance in Indonesia: 1960-74. PhD Dissertation. Australian National University

Grenville, S., 2014. Rethinking capital flows for emerging East Asia. In Reform of the International Monetary System (pp. 43-72). Springer, Tokyo.

Guzman, M., Ocampo, J.A. and Stiglitz, J.E., 2018. Real exchange rate policies for economic development. World Development, 110, pp.51-62.

Habermeier, M.K.F., Kokenyne, A. and Baba, C., 2011. The effectiveness of capital controls and prudential policies in managing large inflows (No. 11-14). International Monetary Fund.

Hanif, M.N., Iqbal, J. and Choudhary, M.A., 2017. Fully Modified HP Filter, Working Paper 88. State Bank of Pakistan.

Harris, R.D. and Tzavalis, E., 1999. Inference for unit roots in dynamic panels where the time dimension is fixed. Journal of econometrics, 91(2), pp.201-226.

Hayashi, F., 2000. Econometrics. Princeton University Press.

Helleiner, G.K., 1997. Capital account regimes and the developing countries. International Monetary and Financial Issues for the 1990s, Vol. VIII, p.956.

Heller, H.R., 1966. Optimal international reserves. The Economic Journal, 76(302), pp.296-311.

Hill, H., 2000. The Indonesian Economy. Cambridge University Press.

Hodrick, R.J. and Prescott, E.C., 1997. Postwar US business cycles: an empirical investigation. Journal of Money, credit, and Banking, pp.1-16.

Ilzetzki, E., Reinhart, C.M. and Rogoff, K.S., 2017. The Country Chronologies to Exchange Rate Arrangements into the 21st Century: will the anchor currency hold? (No. w23135). National Bureau of Economic Research.

Indonesia Stock Exchange, 2020. https://insights-ceicdata-com. Accessed on 18 February 2020.

International Monetary Fund., 2010. The Fund's Role Regarding Cross-border Capital Flows. Washington, DC: IMF

International Monetary Fund., 2012. The Liberalization and Management of Capital Flows: An Institutional View. IMF. https://www.imf.org/external/np/pp/eng/2012/111412.pdf

International Monetary Fund, 2015. Making public investment more efficient. Policy Paper http://www.imf.org/en/Publications/Policy-Papers/Issues/2016/12/31/Making-Public-Investment-More-Efficient-PP4959

International Monetary Fund., 2016. Capital Flows – Review of Experience with the Institutional View. https://www.imf.org/en/Publications/Policy-Papers/Issues/2017/01/13/PP5081 -Capital flows-Review-of-Experience-with-the-Institutional-View

International Monetary Fund., 2020. IMF advice on capital flows: evaluation report 2020. International Monetary Fund, Washington DC. https://ieo.imf.org/en/our-work/Evaluations/Completed/2020-0930-imf-advice-on-capital-flows

International Monetary Fund., various years. Annual Report on Exchange Arrangements and Exchange Restrictions. https://www.elibrary-areaer.imf.org/Pages/Home.aspx

International Monetary Fund. Direction of Trade Statistics. https://data.imf.org/?sk=9D6028D4-F14A-464C-A2F2-59B2CD424B85

International Monetary Fund. International Financial Statistics. https://data.imf.org/?sk=4C514D48-B6BA-49ED-8AB9-52B0C1A0179B

International Monetary Fund. Investment and Capital Stock Dataset. https://www.imf.org/external/np/fad/publicinvestment/

Isard, P., 2005. Globalization and the international financial system: what's wrong and what can be done. Cambridge University Press.

Jayasuriya, S. and Leu, S.C.Y., 2012. Fine-Tuning an Open Capital Account in a Developing Country: The Indonesian Experience. Asian Development Review, 29(2), pp.136-182.

Jeanne, O., 2012. Capital account policies and the real exchange rate (No. w18404). National Bureau of Economic Research. https://www.nber.org/papers/w18404

Jongwanich, J., 2017. Capital Mobility in Asia: Causes and Consequences. ISEAS-Yusof Ishak Institute.

Jorgenson, D., 1967. The theory of investment behavior. In Determinants of investment behavior (pp. 129-175). NBER.

Kaltenbrunner, A., 2015. A post Keynesian framework of exchange rate determination: a Minskyan approach. Journal of Post Keynesian Economics, 38(3), pp.426-448.

Kaminsky, G.L. and Reinhart, C.M., 1999. The twin crises: the causes of banking and balance-of-payments problems. American economic review, 89(3), pp.473-500.

Khan, F.H., 2014, Three essays on determinants and impact of institutional quality, PhD thesis, The Australian National University, viewed 15 October 2018, https://openresearch-repository.anu.edu.au/handle/1885/12089

Kim, C., 2013, April. Macroprudential policies: Korea's experiences. In Rethinking Macro Policy II: First Steps and Early Lessons Conference, hosted by the International Monetary Fund, Washington, DC (pp. 16-17).

Kindleberger, C.P., 1996. Manias, Panics and crashes: a history of financial crises, New York: John Wiley & Sons.

King, M., 2016. The end of alchemy: money, banking, and the future of the global economy. WW Norton & Company.

Koepke, R., 2018. Fed policy expectations and portfolio flows to emerging markets. Journal of International Financial Markets, Institutions and Money, 55, pp.170-194.

Koepke, R., 2019. What drives capital flows to emerging markets? A survey of the empirical literature. Journal of Economic Surveys, 33(2), pp.516-540.

Korinek, A., 2011. The new economics of prudential capital controls: A research agenda. IMF Economic Review, 59(3), pp.523-561.

Korinek, A., 2018. Regulating capital flows to emerging markets: An externality view. Journal of International Economics, 111, pp.61-80.

Laban, R., and F. Larrain, 1998. "The Return of Private Capital to Chile in the 1990s: Causes, Effects, and Policy Reactions," Faculty Research Working Paper Series R98-02, JFK School of Government, Harvard University.

Laeven, M.L. and Valencia, M.F., 2018. Systemic banking crises revisited. IMF Working Paper WP/18/206. International Monetary Fund.

Landi, V.N. and Schiavone, A., 2020. The effectiveness of capital controls. Open Economies Review, pp.1-29.

Lane, P.R. and Milesi-Ferretti, G.M., 2007. The external wealth of nations mark II: Revised and extended estimates of foreign assets and liabilities, 1970–2004. Journal of International Economics, 73(2), pp.223-250.

Lane, P.R. and Milesi-Ferretti, G.M., 2018. The external wealth of nations revisited: international financial integration in the aftermath of the global financial crisis. IMF Economic Review, 66(1), pp.189-222.

Lartey, E.K., 2011. Financial openness and the Dutch disease. Review of Development Economics, 15(3), pp.556-568.

Laurens, M.B. and Cardoso, M.J., 1998. Managing capital flows: lessons from the experience of Chile (No. 98-168). International Monetary Fund.

League of Nations., 1944. International Currency Experience: Lessons of the Interwar Period. Princeton: Princeton University Press.

Lee, M.I.H. and Choi, W.G., 2010. Monetary transmission of global imbalances in Asian countries (No. 10-214). International Monetary Fund.

Levinson, J., 1999. Fragile, Handle with Care: Indonesia and the Issue of Capital Controls in a Nation Facing Disintegration. Wisconsin International Law Journal, 17, p.529.

Libman, E., 2018. The effects of exchange rate regimes on real exchange rate misalignment. International Review of Applied Economics, 32(1), pp.39-61.

MacDonald, R. and Taylor, M.P., 1992. Exchange rate economics: a survey. IMF Staff Papers, 39(1), pp.1-57.

Lipsey, R. E., 2000. The role of foreign direct investment in international capital flows. In International Capital Flows. Edited by Martin Feldstein, Chicago: University of Chicago Press.

Magud, N. and Reinhart, C.M., 2006. Capital controls: an evaluation. In Capital Controls and Capital Flows in Emerging Economies: Policies, Practices, and Consequences. Edited by Sebastian Edwards, University of Chicago: University of Chicago Press, 2007.

Marks, S.V., 2009. Economic policies of the Habibie presidency: a retrospective. Bulletin of Indonesian Economic Studies, 45(1), pp.39-60.

Martin, F.E., 2016. Exchange rate regimes and current account adjustment: An empirical investigation. Journal of International Money and Finance, 65, pp.69-93.

Mas'oed, M., 1983. The Indonesian economy and political structure during the early new order, 1966-1971 (Doctoral dissertation, The Ohio State University).

McKinnon, R.I., 1993. The order of economic liberalization: Financial control in the transition to a market economy. JHU Press.

Milesi-Ferretti, G.M. and Tille, C., 2011. The great retrenchment: international capital flows during the global financial crisis. Economic policy, 26(66), pp.289-346.

Mohanty, M.S. and Turner, P., 2006. Foreign exchange reserve accumulation in emerging markets: what are the domestic implications? BIS Quarterly Review, September, pp.39-52

Montecino, J.A., 2018. Capital controls and the real exchange rate: Do controls promote disequilibria? Journal of International Economics, 114, pp.80-95.

Montiel, P. J., 1999. The long-run equilibrium real exchange rate: Conceptual issues and empirical research. In Exchange Rate Misalignment: Concepts and Measurement for Developing Countries. Edited by L. E. Hinkle and P. J. Montiel, pp.405-465. Oxford: Oxford University Press.

Montiel, P.J., 2007. Equilibrium real exchange rates, misalignment and competitiveness in the Southern Cone. United Nations Publications (Vol. 62).

Mundell, R.A., 1963. Capital mobility and stabilization policy under fixed and flexible exchange rates. Canadian Journal of Economics and Political Science/Revue canadienne de economiques et science politique, 29(4), pp.475-485.

Nickell, S., 1981. Biases in dynamic models with fixed effects. Econometrica, Vol. 49, No. 6 (Nov. 1981), pp. 1417-1426.

Nouira, R. and Sekkat, K., 2015. What determines the extent of real exchange rate misalignment in developing countries? International Economics, 141, pp.135-151.

Obstfeld, M. and Taylor, A.M., 2005. Global capital markets: integration, crisis, and growth. Cambridge University Press.

Obstfeld, M., Rogoff, K.S. and Wren-Lewis, S., 1996. Foundations of international macroeconomics (Vol. 30). Cambridge, MA: MIT Press.

Obstfeld, M., Shambaugh, J.C. and Taylor, A.M., 2010. Financial stability, the trilemma, and international reserves. American Economic Journal: Macroeconomics, 2(2), pp.57-94.

Oliner, S., Rudebusch, G. and Sichel, D., 1995. New and old models of business investment: a comparison of forecasting performance. Journal of Money, Credit and Banking, 27(3), pp.806-826.

Ostry, J.D., Ghosh, A.R., Chamon, M. and Qureshi, M.S., 2011. Capital controls: when and why?. IMF Economic Review, 59(3), pp.562-580.

Ostry, J.D., Ghosh, A.R., Chamon, M. and Qureshi, M.S., 2012. Tools for managing financial-stability risks from capital inflows. Journal of International Economics, 88(2), pp.407-421.

Ostry, J.D., Ghosh, A.R., Habermeier, K., Chamon, M., Qureshi, M.S. and Reinhardt, D., 2010. Capital inflows: The role of controls,". IMF Staff Position Note. International Monetary Fund, Washington, DC.

Park, Y.C. and Song, C.Y., 1998. Managing foreign capital flows: the experiences of the Republic of Korea, Thailand, Malaysia and Indonesia. In Capital Account Regimes and the Developing Countries (pp. 82-140). Palgrave Macmillan, London.

Pesaran, M.H., 2015. Time series and panel data econometrics. Oxford University Press.

Pesaran, M.H., Shin, Y. and Smith, R.P., 1999. Pooled mean group estimation of dynamic heterogeneous panels. Journal of the American Statistical Association, 94(446), pp.621-634.

PRS Group, https://epub.prsgroup.com/products/icrg

Quirk, P.J. and Evens, O., 1995. Capital Account Convertibility: Review of Experience and Implications for IMF Policies (Vol. 131). International Monetary Fund.

Rajan, R.G., 2011. Fault lines: How hidden fractures still threaten the world economy. Princeton University Press.

Ree, M.J., Yoon, M.K. and Park, M.H., 2012. FX funding risks and exchange rate volatility–Korea's case (No. 12-268). International Monetary Fund.

Reinhart, C.M. and Reinhart, V.R., 2008. Capital flow bonanzas: an encompassing view of the past and present (No. w14321). National Bureau of Economic Research.

Reinhart, C.M. and Rogoff, K.S., 2011. From financial crash to debt crisis. American Economic Review, 101(5), pp.1676-1706.

Reinhart, C.M., Reinhart, V. and Tashiro, T., 2016. Does reserve accumulation crowd out investment?. Journal of International Money and Finance, 63, pp.89-111.

Rey, H., 2015. Dilemma not trilemma: the global financial cycle and monetary policy independence (No. w21162). National Bureau of Economic Research.

Rodrik, D., 2006. The social cost of foreign exchange reserves. International Economic Journal, 20(3), pp.253-266.

Rodrik, D., 2008. The real exchange rate and economic growth. Brookings papers on economic activity, 2008(2), pp.365-412.

Rodrik, D. and Subramanian, A., 2008. We must curb international flows of capital. Financial Times, 25.

Rogoff, K., 1996. The purchasing power parity puzzle. Journal of Economic Literature, 34(2), pp.647-668.

Rossini, R., Quispe, Z., Rodríguez, D., Guinigundo, D., Banbula, P., Koziński, W., Rubaszek, M., Al-Hamidy, A., Binici, M., Yorukoglu, M. and Mihaljek, D., 2011. The Influence of External Factors on Monetary Policy Frameworks and Operations. BIS Paper No.57.

Saadma, T.S. and Steiner, A., 2016. Measuring De Facto Financial Openness: A New Index. In Annual Conference February 2016.

Saikkonen, P., 1991. Asymptotically efficient estimation of cointegration regressions. Econometric Theory, 7(1), pp.1-21.

Samuelson, P.A., 1964. Theoretical notes on trade problems. The review of economics and statistics, Vol 46, No.2 (May, 1964), pp.145-154.

Schindler, M., 2009. Measuring financial integration: A new data set. IMF Staff Papers, 56(1), pp.222-238.

Schmitt-Grohé, S. and Uribe, M., 2017. Is optimal capital control policy countercyclical in open economy models with collateral constraints?. IMF Economic Review, 65(3), pp.498-527.

Schröder, M., 2013. Should developing countries undervalue their currencies? Journal of Development Economics, 105, pp.140-151.

Shiller, R.J., 2012. The subprime solution: How today's global financial crisis happened, and what to do about it. Princeton University Press.

Sims, C.A., 1980. Macroeconomics and reality. Econometrica: Journal of the Econometric Society, pp.1-48.

Stiglitz, J. E., 2014. The lessons of the North Atlantic for economic theory and policy. In What have we learned?: Macroeconomic policy after the crisis. Edited by O. Blanchard, G. A. Akerlof, D, Romer, and J. E. Stiglitz, pp.335-347. MIT Press.

Stock, J.H. and Watson, M.W., 1993. A simple estimator of cointegrating vectors in higher order integrated systems. Econometrica, Vol 61, No.4 (Jul. 1993), pp.783-820.

Summers, L.H., 1998. Building an international financial architecture for the 21st century. Cato J., 18, p.321.

Summers, L.H., 2000. International financial crises: causes, prevention, and cures. American Economic Review, 90(2), pp.1-16.

Sunner, D., 2017. Trends in Global Foreign Currency Reserves. The Transmission of Monetary Policy: How Does It Work? The Neutral Interest Rate The Rising Share of Part-time Employment The Resources Economy and the Terms of Trade Boom Structural Liquidity and Domestic Market Operations. Reserves Bank of Australia Bulletin, September, pp.75 – 83.

Svensson, J., 1998. Investment, property rights and political instability: Theory and evidence. European Economic Review, 42(7), pp.1317-1341.

Tamirisia, N., "Do Macroeconomic Effects of Capital Controls Vary by Their Type? Evidence from Malaysia," International Monetary Fund Working Paper 04/3, January 2004

Taylor, A.M. and Taylor, M.P., 2004. The purchasing power parity debate. Journal of economic perspectives, 18(4), pp.135-158.

Terrones, M. and Cardarelli, R., 2005. Global imbalances: A saving and investment perspective. World economic outlook, pp.91-124.

Turner, P., 1991. Capital flows in the 1980s: a survey of major trends (No. 30). Basle: Bank for International Settlements, Monetary and Economic Department.

Valdés-Prieto, S. and Soto, M., 1998. The effectiveness of capital controls: theory and evidence from Chile. Empirica, 25(2), pp.133-164.

Warjiyo, P., 2013. Indonesia: stabilizing the exchange rate along its fundamental. BIS Paper

Warjiyo, P., 2014. The transmission mechanism and policy responses to global monetary developments: the Indonesian experience. BIS Paper

Warjiyo, P. and Juhro, S.M., 2019. Central Bank Policy: Theory and Practice. Emerald Publishing Limited.

Warr, P.G., 1986. Indonesia's Other Dutch Disease: Economic Effects of the Petroleum Boom. In Natural Resources and the Macroeconomy. Edited by JP Neary and S. van Wijnbergen. Oxford: Basil Blackwell.

Williamson, J., 1985. On the system in Bretton Woods. The American Economic Review, 75(2), pp.74-79.

Williamson, J., 2009. Exchange rate economics. Open Economies Review, 20(1), pp.123-146.

World Bank, 1993. The East Asian Miracle. Oxford University Press, New York.

World Bank. World Development Indicators. https://datacatalog.worldbank.org/dataset/world-development-indicators.