Managing monetary and financial stability in a dynamic global environment: Bank Indonesia's policy perspectives

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Abstract

As the Indonesian economy is becoming progressively more integrated with the global economy, the impact of global economic shocks on the domestic economy is becoming more pronounced. Capital inflows, which trigger excessive liquidity and exacerbate the risk of a sudden reversal, pose a serious threat to the Indonesian economy, especially in terms of financial stability. Recent crisis episodes have indicated that monetary policy alone is insufficient to maintain macroeconomic stability; it should be accompanied by macroprudential policy. This paper explores the dynamics of the external and financial sectors as well as the optimal policy mix in order to maintain monetary and financial stability. We use an enhanced or modified small open-economy New Keynesian model to discuss the operation of a flexible inflation targeting framework (ITF). The simulations show that the model's impulse response functions are in line with theoretical and empirical predictions, in which external shocks have significant impacts on both monetary and financial stability. The simulations also show that the adverse macroeconomic and financial effects of external shocks can be mitigated by a mix of monetary and macroprudential policies.

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Keywords: inflation targeting framework, monetary policy, macroprudential policy, policy instrument mix.

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1. Introduction

The Global Financial Crisis (GFC) of 2008–09 showed that keeping inflation in check is not, by itself, sufficient to preserve macroeconomic stability. Several crisis episodes over the past decade have shown that most macroeconomic instability stems from shocks in the financial sector. Financial markets are inherently prone to excessive procyclicality, which ultimately manifests itself in macroeconomic instability. In addition, risk-taking behaviour among economic agents also strengthens financial accelerator mechanisms.

Amidst global economic shocks and more dynamic capital flows, high procyclicality in the financial sector in many emerging markets requires that monetary policy and macroprudential policy be coordinated in order to mitigate excessive economic fluctuations. On the one hand, conventional monetary policy has the potential to bolster financial system stability through its influence on financial conditions and behaviour in financial markets, even if it is focused on financial stability. On the other hand, macroprudential policy is designed to directly ensure financial stability. Given the interactions between them, it is important to adopt a flexible monetary policy regime that can accommodate both monetary and financial system stability. In the case of Indonesia, this takes the form of a flexible inflation targeting framework (ITF), one that is constructed to take account of the wisdom gained from the unconventional monetary policy in the post-GFC era.

In the context of a small open economy, global financial market integration and large capital flows complicate the implementation of monetary policy. There has been a tendency for monetary authorities to shift their preferences from "corner solutions" to "middle solutions" to the classic open economy trilemma, particularly in developing countries. It is widely argued that the policy response should manage exchange rate movements within a certain range (without adopting full flexibility) and restrict capital flows, in addition to targeting domestic inflation. A flexible ITF, incorporating a mix of monetary and macroprudential instruments, can accommodate a compromise between the three intermediate goals of (1) maintaining monetary policy autonomy: (2) stabilising exchange rates; and (3) managing capital flows.

In practice, to optimally support the implementation of flexible ITF in Indonesia, the Bank Indonesia Forecasting and Policy Analysis System (FPAS) uses a model that captures interactions between the financial sector and the real sector as well as the dynamics of the external sector. Bank Indonesia's response to financial and external sector shocks necessitates a mixture of monetary and macroprudential policy tools. To do this requires that we further develop Bank Indonesia's macroeconomic model (ARIMBI).[2] In future, ARIMBI is expected to capture the dynamics of the financial and external sector more fully, thereby improving the accuracy of policy simulations and projections through the FPAS.

This study aims to explore the linkages between monetary and financial stability, especially in the context of a dynamic global environment; to simulate policy and analyse several external shocks to the Indonesian economy and their implication for both monetary and financial stability; and to search for an optimal policy mix in

[2] ARIMBI is a semi-structural New Keynesian model adopted from the IMF's Quarterly Projection Model (QPM), as further developed by Harmanta et al (2013, 2015) and Wimanda et al (2013).

response to global economic dynamics. We use a novel modelling approach, in which the financial sector is highly susceptible to financial accelerators. We consider a number of key variables, including real credit volume growth, the spread between lending rates and deposit rates as well as the banking sector's default risk. The macroprudential policies included in the model are loan-to-value (LTV) policy as well as the reserve requirement (RR). As regards the external sector, we focus on the current account (CA) gap and the capital flow (CF) gap. The model is then used to simulate Bank Indonesia's policy response to a number of shocks and explore the implications for optimal policy.

We find that the flexible ITF is well suited to managing monetary and financial stability in Indonesia. Using the framework, Bank Indonesia can mitigate the impact of external shocks as well as shocks to the exchange rate, current account and capital flows, while simultaneously maintaining both monetary and financial stability. In addition, the integration of monetary and macroprudential policies provides better results in terms of mitigating excessive output and credit fluctuations, as compared with any single policy instrument. We conclude that, for the Indonesian economy, flexible ITF is superior to the standard ITF.

The paper is structured as follows. Section 2 of this paper presents the dynamics and challenges of the post-GFC Indonesian economy. Section 3 discusses Bank Indonesia's policy framework for managing monetary and financial stability, emphasising the flexible ITF. Section 4 concludes.

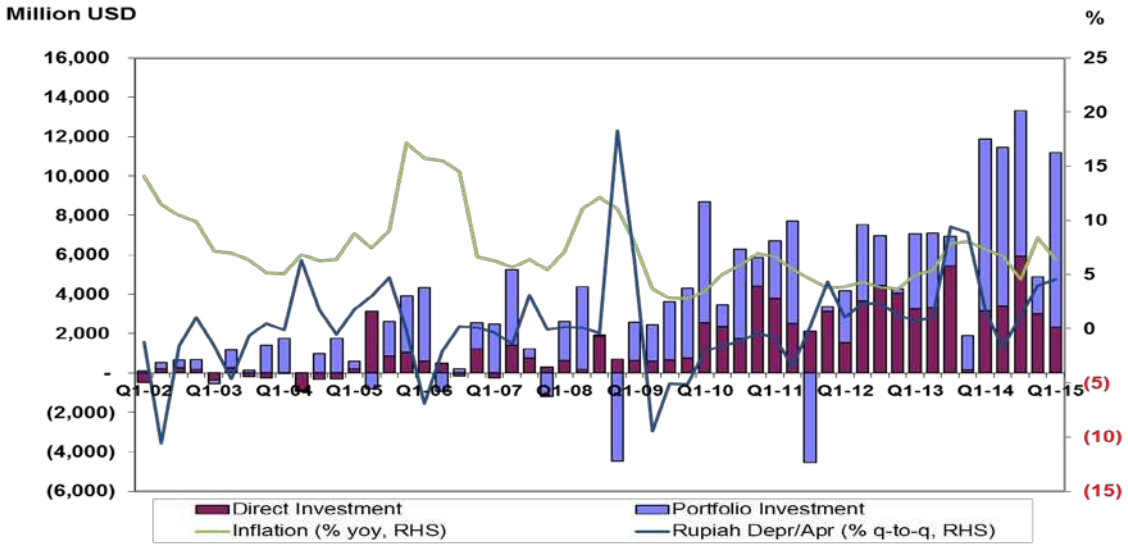
2. Dynamics and challenges of the post-GFC Indonesian economy

The GFC provided a number of valuable lessons, including illustrating that maintaining price stability alone through monetary policy is insufficient. In addition to price stability, financial system stability is also a prerequisite for macroeconomic stability. And, in line with increasing economic openness and integration, the external sector requires considerable attention.

2.1. The post-GFC challenges

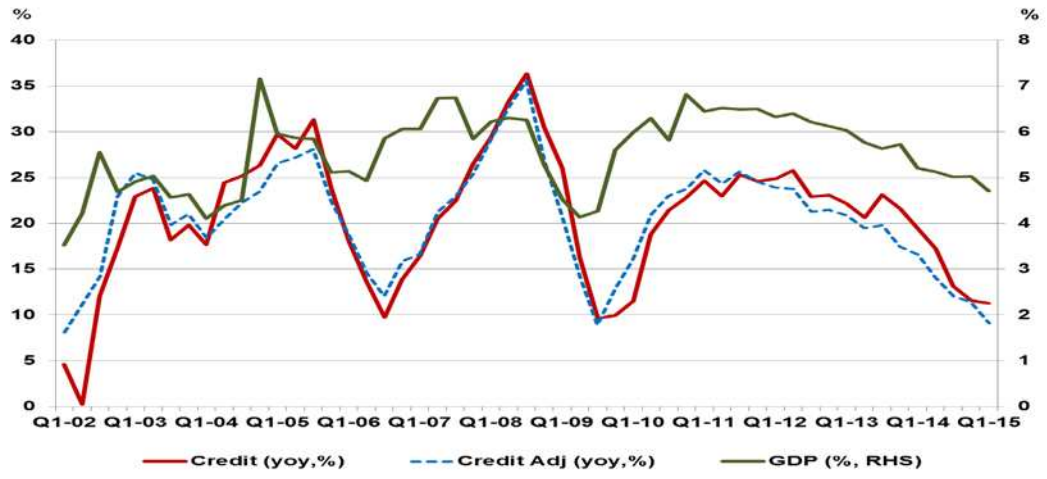
As a small open economy, Indonesia faces a number of challenges in the implementation of monetary policy relating to persistent capital flows arising from quantitative easing (QE) in advanced economies. From Q3 2009 to Q2 2011, these inflows precipitated rupiah appreciation and a widening current account deficit. An open capital account, coupled with an influx of capital flows, ensured that capital flows, rather than the current account, predominantly determined exchange rate behaviour. Accordingly, capital inflows drove nominal rupiah appreciation of 15.9% in 2009 and 4.5% in 2010. In real terms, the value of the rupiah appreciated by 17.8% in 2009 and 11.4% in 2010, even though the currency remained relatively competitive compared with those of some other Asian countries. Combined with the end of the commodity supercycle and a growing middle-income population in Indonesia, rupiah appreciation contributed to a current account (CA) deficit that surpassed 4.27% in the second quarter of 2014.

Capital flows, exchange rate, and inflation Graph 2.1



Second, capital flow volatility created financial system vulnerability. Capital flows that fluctuated widely, amid ubiquitous herding behaviour, might reverse suddenly if market sentiment changed. They also threatened to increase financial market volatility and, in turn, act as a shock amplifier. Such consequences were further exacerbated by weak infrastructure and a lack of financial deepening, as is often the case in developing countries such as Indonesia. Furthermore, a significant portion of the capital inflows was invested in short-term financial instruments, such as SBIs, government bonds (Surat Utang Negara/SUNs) and stocks, which are particularly vulnerable to sudden reversals. As the Federal Reserve began to "taper" in January 2014, domestic liquidity shrank. Investors withdrew their money from emerging markets, including Indonesia, and switched their investments to US markets.

Credit and GDP growth Graph 2.2



Third, financial sector procyclicality was amplified by foreign capital inflows. The influx of capital drove more liquidity into the banking system and more credit was

channelled to the real sector. Credit growth induced overheating in the economy. As a result, an asset price bubble emerged, especially in housing prices. The financial sector tended to exacerbate economic fluctuations. In Indonesia, procyclicality is reflected in the performance of bank credit during expansionary and contractionary phases. Observing credit growth during periods of expansion and contraction revealed the magnitude of procyclicality in the Indonesian banking system. Risk behaviour also contributed to procyclicality in the financial sector. Optimism about the Indonesian economy and diminishing concerns about the Fed's tapering may have contributed to high portfolio investment in 2014.

2.2. The optimal policy response

Persistent foreign capital inflows undermine the efficacy of monetary management, given that measures to manage liquidity in the economy, such as an interest rate increase, could ultimately be offset by the sheer magnitude of the capital inflows. To manage upward exchange rate pressures, high capital inflows demand intensive intervention, which causes the amount of excess liquidity in the banking system to increase significantly. Such capital flow dynamics could reduce the degree of autonomy in monetary policy and shift its orientation from a sole focus on inflation control towards mitigating rupiah appreciation through intensive intervention.

The orientation of monetary policy in the midst of high global uncertainty is tactically directed towards not only controlling inflation but also to managing exchange rates in line with macroeconomic fundamentals through active intervention in the foreign exchange market. In addition, it simultaneously manages international reserves at a safe level in accordance with best international practice. This has the logical consequence that exchange rate dynamics will not be completely influenced by market forces but also by domestic monetary policy.

Post-GFC challenges have revealed some valuable lessons for monetary policy implementation in Indonesia. First, the multiple challenges facing monetary policy imply that Bank Indonesia should employ multiple instruments. In the face of capital flows, while the exchange rate should remain flexible, it should also be maintained in such a way that the exchange rate is not misaligned from its fundamental value. Concomitantly, measures are required to accumulate foreign exchange reserves as self-insurance given that short-term capital flows are particularly vulnerable to a sudden stop. In terms of capital flow management, a variety of policy options are available to deal with the excessive procyclicality of capital flows, especially short-term and volatile capital. In terms of monetary management, the dilemmas have been partially resolved by applying a quantitative-based monetary policy to support the standard interest rate policy instrument. In addition, macroprudential policies aimed at maintaining financial system stability should also be adopted to mitigate the risk of asset bubbles in the economy.

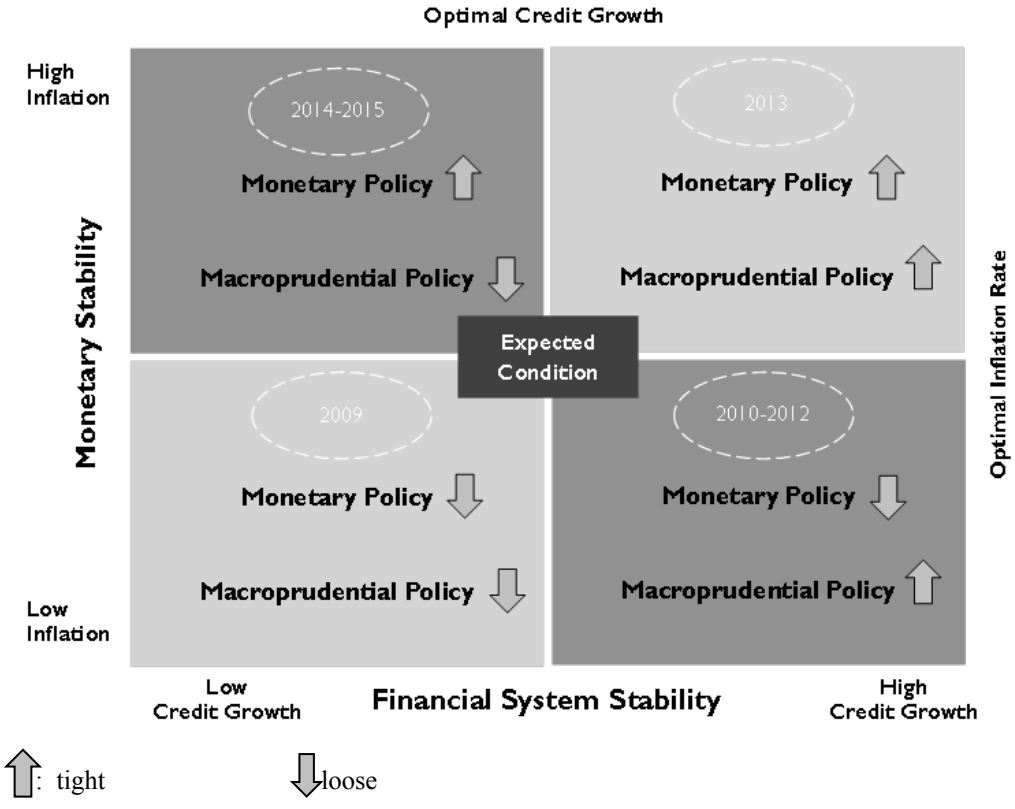
Second, while price stability should remain the primary goal of Bank Indonesia, the GFC showed that keeping inflation in check is not, by itself, sufficient to preserve macroeconomic stability. A number of crises in recent decades have also shown that macroeconomic instability is primarily rooted in financial crises. Therefore, the key to managing macroeconomic stability is to manage not only the imbalance of goods (inflation) and externalities (balance of payments) but also imbalances in the financial sector, such as excessive credit growth, asset price bubbles and the cycle of risk-taking behaviour in the financial sector. In this regard, Bank Indonesia would be

effective in maintaining macroeconomic stability if also mandated to promote financial system stability. Hence, the monetary policy framework of ITF requires enhancement by including the substantial role of the financial sector.

Third, exchange rate policy should play an important role in the ITF of a small open economy. Under a standard ITF, Bank Indonesia would not attempt to manage the exchange rate. This benign view argues that the exchange rate system should be allowed to float freely, thus acting as a shock absorber for the economy. However, in a small open economy with open capital movements, exchange rate dynamics are largely influenced by investor risk perception, which triggers capital movements. In this environment, there is a case for managing the exchange rate in order to avoid excess volatility that could push the exchange rate beyond a level conducive to achieving the inflation target.

Based on the aforementioned rationale, there is a justification for implementing a less rigid ITF, otherwise known as flexible ITF. Flexible ITF requires monetary and macroprudential policy to be integrated, including capital flow management and exchange rate policy. The policy mix should be an optimal response to tackling multiple challenges in managing monetary and financial stability.

The policy mix under several circumstances — Graph 2.3



The formulation of an optimal policy mix in Indonesia depends on what kinds of shocks hit the economy. A fall in world GDP would elicit an accommodative monetary policy response and looser macroprudential measures. An increase in global interest rates would be followed by tighter monetary and macroprudential policy. Meanwhile, a broader current account deficit would require tighter monetary policy and looser macroprudential measures. On the other hand, capital outflows would require raising

the policy rate and looser macroprudential measures. As Indonesia faces multiple challenges, for which there are multiple shocks, the formulation of a policy mix is significantly more complex. In Graph 2.3 we describe the policy mix of Bank Indonesia under specific circumstances.

Macroprudential measures in Indonesia

Table 2.1

No	Measure	Objectives
1	Minimum holding period on BI bills	To "put the brake" on short-term and speculative capital inflows and mitigate the risk of a sudden reversal.
2	Lengthen auctions and offer longer maturity of BI bills.	To enhance the effectiveness of domestic liquidity management, including capital inflows, by locking investments into the longer term and helping develop domestic financial markets.
3	Non-tradable rupiah term deposits for banks	To lock domestic liquidity into the longer term and limit the supply of BI bills on the market.
4	Limits on short-term offshore borrowing by banks	• To limit short-term and volatile capital inflows. • To limit FX exposure of the banking system stemming from capital inflows.
5	Mandatory reporting of foreign exchange originating from export earnings	To increase dollar supply.
6	Primary rupiah reserve requirement (checking accounts held at BI)	To help absorb domestic liquidity.
7	Secondary rupiah reserve requirement (checking accounts held at BI, SBI and government bonds)	To absorb liquidity and to strengthen the banking system.
8	FX reserve requirements of the banks	• To strengthen FX liquidity management, and thereby banking system resilience, in the face of increasing FX exposure stemming from capital inflows • To help absorb domestic liquidity.
9	LDR-based reserve requirement	To absorb domestic liquidity and enhance liquidity management at banks without exerting negative impacts on lending that is needed to stimulate growth.
10	Loan-to-value (LTV) ratio for the property sector and downpayments on automotive loans	To control accelerating credit growth in consumer sectors (especially the property and automobile sectors).
11	LTV for second and third properties	To slow the rate of increase of credit risk concentration in the property sector and to foster prudential principles.

As a result of the global financial crisis that hit the global economy in 2008–09, Indonesia's GDP growth dropped to 4.6% in 2009, while nominal credit growth fell to its lowest level, namely 5%. Under such circumstances, it was optimal for Bank Indonesia to lower its policy rate in order to catalyse economic activity, while loosening macroprudential measures (required reserve ratio (RR)). From 2010–12, however, as the economy strengthened and inflation was well managed, Bank Indonesia maintained a low policy rate. Regarding credit growth, which skyrocketed

to around 25%, macroprudential measures (loan-to-value ratio (LTV)) were tightened in 2012. Furthermore, rapid credit growth was spurred by an influx of capital into the country as investors regarded Indonesia as a prospective investment destination. To curb credit growth, Bank Indonesia continued to tighten macroprudential measures in 2013 by regulating LTV policy for second and third properties and by raising the secondary RR. Despite decelerating GDP growth, Bank Indonesia raised its policy rate as inflation increased on volatile food and administered prices. From 2014–15, Bank Indonesia maintained a high policy rate in order to control inflation. Simultaneously, Bank Indonesia loosened macroprudential measures (LTV and RR) to stimulate waning credit growth that had sunk to 10%. At the time, the LTV policy was targeted on specific sectors, such as property, so that the divergent stances of macroprudential policy and monetary policy did not confuse the market (by conveying misleading signals). Such conditions are evidence of the advantages of macroprudential tools, which clearly require the support of good policy communication. Table 2.1 presents a number of macroprudential measures implemented by Bank Indonesia, while Appendix 1 presents the same but in chronological order.

3. Framework for managing monetary-financial stability

Bank Indonesia currently implements a de facto flexible inflation targeting framework (ITF) as its policy framework. It is an enhanced framework, given that the Indonesian economy is confronting multiple challenges and that merely achieving the inflation target is insufficient. The framework requires monetary and macroprudential policy to be integrated, which is believed to be the optimal response from a monetary and financial stability viewpoint.

3.1. The framework

Bank Indonesia has operated an inflation targeting framework (ITF) since July 2005. This is a "standard" ITF. Bank Indonesia perceives ITF as a reliable monetary policy strategy, although capable of further enhancement by refining the future ITF implementation strategy. There are two rationales for this enhancement. First, evaluations of ITF implementation in Indonesia have evidenced the requirement for a number of adjustments and refinements, which have been undertaken according to the conventional monetary policy wisdom. In this case, there is justification for implementing a less rigid ITF as an ideal format for the Indonesian economy. Second, Indonesian economic performance during the GFC instilled confidence concerning the aptness of ITF as a reliable monetary policy strategy for Indonesia. However, considering the dynamics and complexity of challenges faced, the framework requires further enhancements.

3.1.1 Integration of monetary and macroprudential policy

The macroeconomic stability attained during the Great Moderation of 1987–2007 did not protect the global economy from the impact of a crisis propagated by financial sector fragility. This experience suggests that monetary policy should anticipate macroeconomic instability risk stemming from the financial system, and that financial system stability is the foundation for a sustainable macroeconomic environment.

Within this policy perspective, the central bank requires flexibility in responding to emerging uncertainties within the economy. Such flexibility is crucial in overcoming the potential conflicts or trade-offs between targeting monetary stability and financial system stability. It can be achieved through, among other means, additional instruments (in this case macroprudential policies) and by extending the horizon for attaining the inflation target in order to accommodate near-term output stabilisation. To overcome potential policy conflict, it is also important to prioritise the policy goal, for example, by setting price stability as the overarching aim.

The pressing need to strengthen the monetary and financial system stability framework requires a strong financial infrastructure coupled with an effective supervisory function. In this regard, Borio (2003) emphasises the need to strengthen the regulatory framework or macroprudential policy, thereby limiting the risk that prolonged financial markets instability would undermine real economic output.

Conceptually, macroprudential policy aims at enforcing financial system stability as a whole, instead of the wellbeing of individual financial institutions. "Macroprudential policy seeks to develop, oversee and deliver an appropriate policy response to the financial system as a whole. It aims to enhance the resilience of the financial system and dampen systemic risks that spread through the financial system" (G30). In maintaining the stability of financial intermediation, macroprudential policy is thus a key factor in backing the monetary policy goal of price and output stability.

Especially after the 2008–09 crisis, many central banks have applied macroprudential policy instruments more broadly. Consequently, several instruments previously considered to be microprudential (such as loan-loss provisioning requirements or loan-to-value) or monetary instruments (such as reserve requirements) have been utilised to curb systemic risk and maintain financial system stability. Rather than focusing on efforts to deal with risk at individual banks, such policy instruments have encompassed a wider macroprudential perspective.

Strengthening the monetary and financial system stability framework requires appropriate monetary and macroprudential policy integration. It is generally accepted that the main goal of monetary policy is to maintain price stability. Accordingly, central banks traditionally use interest rates as their primary instrument to attain that goal. Maintaining price stability, however, is still not sufficient to guarantee macroeconomic stability because the financial system, with its procyclical behaviour, triggers excessive economic fluctuations. Meanwhile, the goal of macroprudential policy is to safeguard overall financial system resilience in a bid to support financial intermediation in the economy as a whole. With its countercyclical role, macroprudential policy supports the goal of monetary policy by preserving price and output stability.

The objectives achieved through monetary and macroprudential policies should be mutually reinforcing. Steps to reinforce financial system resilience will also strengthen monetary policy, by protecting the economy from sharp fluctuations in the financial system. On the other hand, macroeconomic stability will lessen the vulnerability of the financial system, with its procylical characteristics. Therefore, the interest rate may not require adjusting to the extent that would be needed in the absence of policy integration or coordination. Meanwhile, macroprudential policy affects credit supply conditions and, consequently, monetary policy transmission. The efficacy of policy coordination relies on the macroeconomic environment, financial conditions, the intermediation process and the level of capital and assets in the banking system. Hence, it is not realistic to expect the combination of monetary and

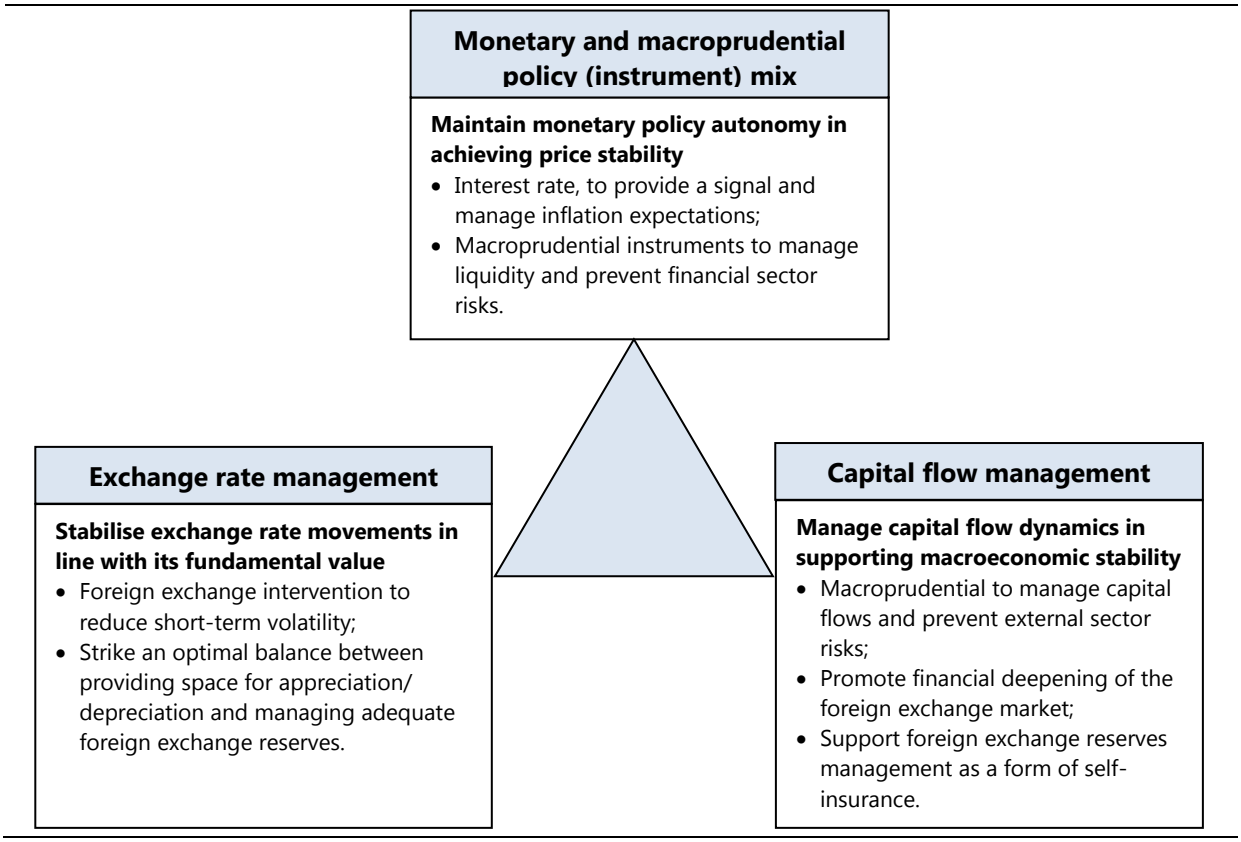
macroprudential policy to fully eliminate economic cycles. The main goal of such policy integration is to moderate cycles and bolster financial system resilience at a macro level.

Several conditions are required to ensure that monetary and macroprudential policy integration runs smoothly. First, there is a need to understand the framework of linkages amongst monetary, macroprudential and microprudential policies. This is to take into account potential trade-offs when pursuing policy objectives. That is why the use of an instrument mix or adding new instruments can be considered desirable. Second, there is a need to understand the workings of monetary and macroprudential policy transmission in terms of catalysing economic activity. This requires a more integrated analytical framework, especially when evaluating the important role of the financial sector. Third, there is a need to measure appropriate risk behaviour indicators in monitoring system risk. Measuring the risk indicators in addition to supporting the right monitoring system will also strengthen the analysis of transmission mechanisms through the risk-taking channel.

3.1.2. Managing the monetary policy trilemma

The purpose of a flexible ITF is to manage the monetary policy trilemma (as presented in Graph 3.1), namely to achieve three intermediate goals as follows: (1) maintaining monetary policy autonomy in achieving price stability by employing a monetary and macroprudential policy (instrument) mix; (2) stabilising the movement of the exchange rate in line with its fundamental value by employing exchange rate management; and (3) managing capital flow dynamics to support macroeconomic stability by implementing capital flow management.

Bank Indonesia monetary policy trilemma management — Graph 3.1



There are five principles of enhancement, as follows:

a. Continuing the adherence of a policy framework to the inflation target as the overriding objective of monetary policy. The main characteristics of an ITF will remain, ie pre-emptive, independent, transparent and accountable policy implementation.

b. Integrating monetary and macroprudential policy. Appropriate monetary and macroprudential policy integration is required in order to buttress monetary and financial system stability.

c. Managing the dynamics of capital flows and exchange rates. To support macroeconomic stability, coordinated implementation of a policy instrument mix is ultimately part of an important strategy to optimally manage the monetary policy trilemma.

d. Strengthening the policy communication strategy as part of the policy framework. Policy communication is no longer merely for the sake of transparency and accountability but also serves as a monetary policy instrument.

e. Strengthening Bank Indonesia and government policy coordination. Policy coordination is crucial, given that inflation stemming from the supply side creates the majority of inflation volatility.

Monetary policy complexity stemming from the interest rate can be partially resolved through quantitatively tighter monetary policy by raising the reserve requirement. In addition, macroprudential policy aims to avoid financial risks, such as asset bubbles and excessive credit growth, which could trigger potential financial system instability. This type of macroprudential policy is effective if banks intermediate the majority of capital flows. Nevertheless, if the capital flows originate directly from unregulated sectors, such as direct loans from the private sector, measures to control capital inflows are another option, for example, by limiting private loans.

In terms of the exchange rate, the rupiah should be managed to remain flexible, with scope to appreciate/depreciate, but the currency should also be managed so that it avoids misalignment with the economic fundamentals, as this will jeopardise macroeconomic stability. Consequently, Bank Indonesia's presence is required on the foreign exchange market to ensure that the rupiah does not incur excessive volatility. Of course, this option is no longer available if the rupiah becomes overvalued. Simultaneously, efforts to accumulate foreign exchange reserves are vital as a form of self-insurance, given that short-term capital flows are particularly vulnerable to the risk of a sudden reversal.

Regarding capital flows, by continuing to adhere to a free foreign exchange regime, macroprudential measures also consist of policy options designed to reduce excessive short-term capital flows, which could potentially lead to financial risks from the external side. Such measures have been introduced by Bank Indonesia through regulations that require investors to hold Bank Indonesia Certificates (SBI) for a minimum period of one month. This policy has helped diversify foreign portfolio capital flows and extend the duration of SBIs, which consequently nurtured financial deepening, especially of the foreign exchange market.

The coordinated implementation of a policy instrument mix is ultimately part of an important strategy to manage the monetary policy trilemma in the current

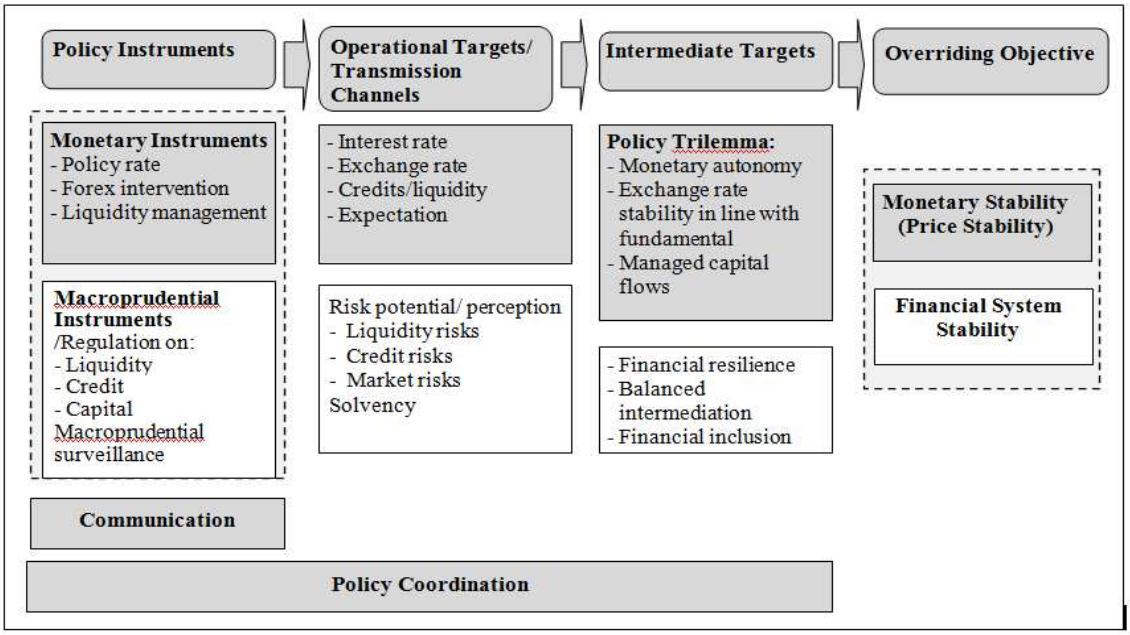
uncertain climate. Coordination is critical, not only to address sources of external and internal imbalances but also to optimally manage the impact of monetary policy.

According to the above policy perspective, the achievement of macroeconomic stability is tied not only to monetary stability (price stability) but also to its interaction with financial system stability. Under a flexible ITF, the flexibility of policy implementation is achieved through macroprudential instruments in addition to monetary instruments that are mutually reinforcing. While monetary instruments are utilised to influence monetary variables, such as the interest rate, exchange rate, credit and expectations, macroprudential instruments are utilised primarily to manage potential risk or risk perception in financial markets. Concerning the measures to overcome potential policy conflict, it is imperative to prioritise policy objectives by setting price stability (inflation) as the overriding objective.

Graph 3.2 shows schematically how the monetary framework under a flexible ITF can be enhanced through a mix of monetary and macroprudential policy instruments.

Monetary policy framework under a flexible ITF

Graph 3.2



In response to the aforementioned challenges, the tasks faced by Bank Indonesia are becoming increasingly complex, particularly in terms of maintaining financial system stability. Consequently, Bank Indonesia strives to consistently implement a flexible ITF. This is achieved in the form of macroprudential policy in addition to monetary policy (interest rate). Concerning macroprudential policy, Agung (2010) recommends monetary and macroprudential policy be conducted within the confines of the same institution considering the close interconnectedness between the two, in this case Bank Indonesia. Furthermore, at the practical level, Agung (2010) recommends several alternative macroprudential instruments for Bank Indonesia, namely countercyclical CAR, forward-looking provisioning (so that when a bank is appropriating reserves, expected losses are also included), the LTV ratio (as an upper limit for credit to asset value that can be offered to a borrower) and the reserve requirement (RR).

Meanwhile, for a small open economy such as Indonesia, the exchange rate plays a central role in the economy. Monetary policy is transmitted partly through its impact on the exchange rate. Changes to the policy rate will influence the rupiah exchange rate through interest rate parity (IRP). Raising the policy rate (which subsequently increases deposit rates) will cause the rupiah to appreciate and vice versa. Furthermore, changes in the value of the rupiah will have direct pass-through and/or indirect pass-through effects on exports, imports, GDP and inflation.

3.2. Modelling a flexible ITF for the Indonesian economy

Here we use an enhanced or modified small open-economy New Keynesian model to explain the flexible ITF and how the policy mix works. We then present policy simulations on the impact of external shocks on the Indonesian economy, especially the impact on monetary and financial stability, and the Bank Indonesia response using monetary and macroprudential policy.

3.2.1. Modelling strategy

Some recent literature explored the integration of monetary and macroprudential policy using quantitative models. Galati and Moessner (2011) state that there is lack of clarification and consensus regarding a definition of financial stability and effective models to explain interactions between the financial system and macroeconomy. A selection of the literature tries to include financial frictions in the corresponding models, in this context relating to credit constraints of loans and non-financial sectors, which are built based on the financial accelerator mechanism of Bernanke et al (1996). Furthermore, efforts have also been taken to include financial frictions relating to financial intermediaries.

Angelini et al (2011) argued that macroprudential policy is expected to have a direct and indirect influence on the monetary policy transmission mechanism. Based on their research, it was found that incorporating macroprudential policy is most beneficial when the economy experiences shocks stemming from the money market or households, where both types of shock affect the supply of credit. As suggested by Gerali et al (2010), banks accumulate capital from retained earnings and strive to maintain a capital-to-assets ratio close to that of the regulated target. According to Angelini et al (2011), using capital requirements as a macroprudential policy tool is based on the argument that systemic crises affect bank capital and the supply of credit. Capital requirements increase when economic conditions are good and, conversely, decrease when economic conditions deteriorate.

Beau et al (2011) identified circumstances where monetary policy and macroprudential policy had a complementary, independent or conflicting effect on price stability. Their findings, amongst others, showed that the best results for price stability were achieved by combining monetary policy focused on price stability with macroprudential policy centred on credit growth. Such a policy mix generates several types of Taylor rule, namely the plain vanilla Taylor rule (using the standard Taylor rule to achieve the overarching goal of price stability) or the augmented Taylor rule (to the original Taylor rule is added the argument that short-term nominal interest rates must be raised in line with stronger credit growth). Independent macroprudential policy can use the augmented Taylor rule accompanied by separate macroprudential policy.

Cúrdia and Woodford (2009) found a need to accommodate the response to variations in aggregate credit in the Taylor rule, with explorations based on a New Keynesian model with financial friction. Monetary policy should be used to help stabilise aggregate private credit by tightening policy during periods of abnormally robust credit growth and, conversely, by loosening policy when credit contracts.

Efforts to model macroprudential policy and incorporate it into monetary policy were also undertaken by Peñaloza (2011), namely by adding a financial block to a standard semi-structural small open-economy Neo Keynesian model. The simulations benefited greatly from the inclusion of macroprudential tools (in this case the CAR rule), enabling the monetary authority to better mitigate output gap shocks, as compared with just using the standard Taylor rule. Therefore, financial shocks could be isolated and their adverse impact on macroeconomic variables alleviated. In this context, the financial block basically represented a set of reduced form equations that facilitate analysis of lending spreads, the delinquency index and credit volume, which can be integrated into the core model. Such a model accommodates the feedback effect from the core model to the financial sector.

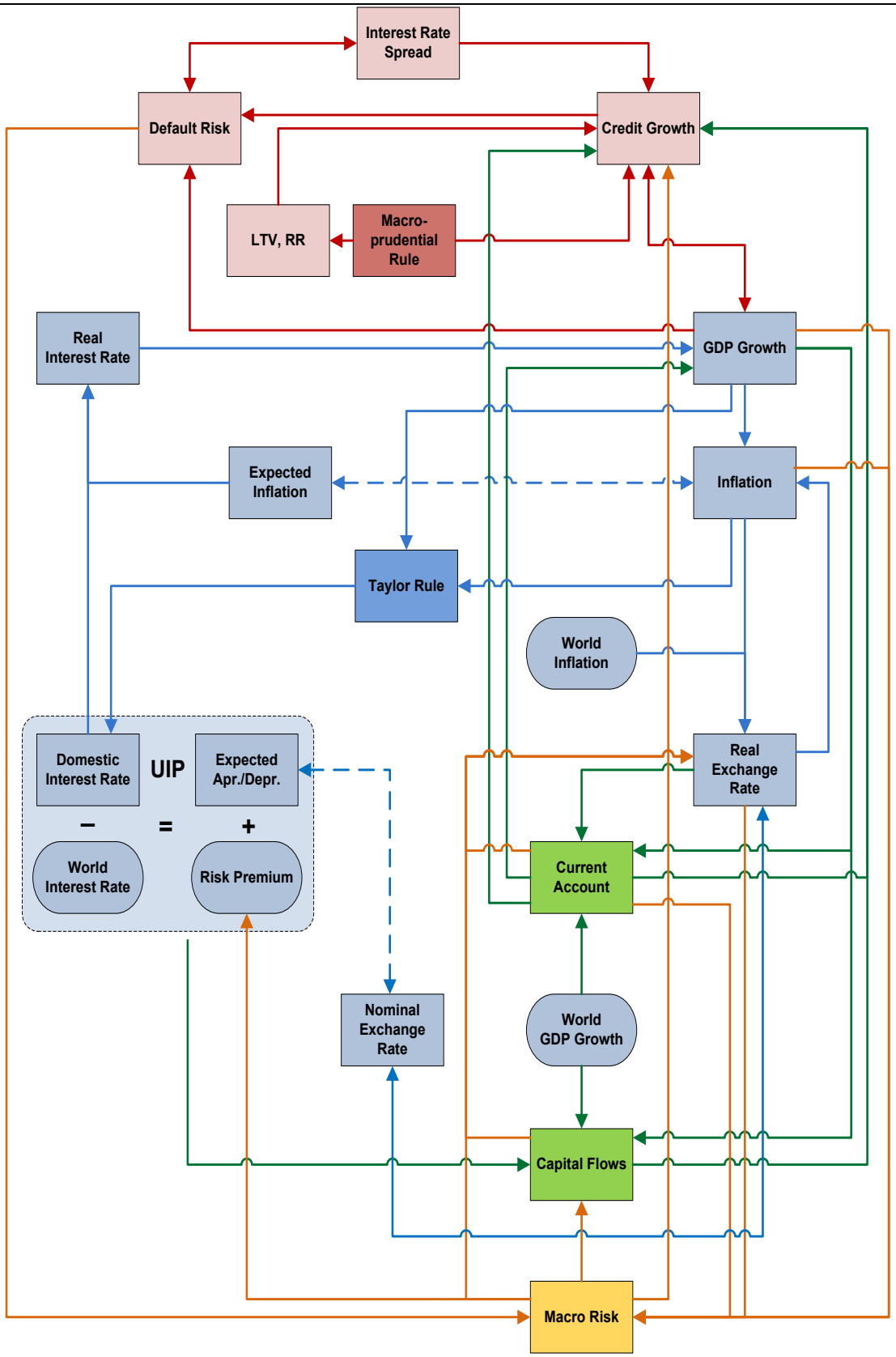
Regarding capital flows, Unsal (2011) states that the challenge to policymakers, concerning the influx of capital flows, is preventing the domestic economy from overheating with implications for inflation, as well as mitigating the risks associated with the impact on financial stability, which would be undermined as credit and financing became more accessible. Monetary policy could be utilised to overcome the effect on inflation; however, macroprudential policy is required to mitigate the impact on financial stability. According to Capistrán et al (2011), emerging economies face the very real threat of a capital flow reversal.

Juhro and Goeltom (2012) state that, in response to capital flow dynamics, amidst inflationary pressures, Bank Indonesia should implement unconventional policy using multiple instruments. The framework applied is a flexible ITF, where the overriding objective is the inflation target. However, a flexible ITF is more flexible than its standard counterpart. The central bank is focused not only on achieving the inflation target but also takes into account a number of other considerations, including financial sector stability, the dynamics of capital flows as well as the exchange rate. With such a policy perspective, the achievement of macroeconomic stability is not only related to monetary stability (price stability) but also to financial system stability.

The importance of balance between the current account and capital flows is highlighted by Ghosh et al (2008), who focus on five cases: (i) conditions where capital inflows respond to the CA financing requirement; (ii) conditions where capital inflows are merely due to higher yields; (iii) conditions where pressures emerge in the balance of payments due to a current account surplus; (iv) conditions where the current account surplus is offset by capital outflows; and (v) pre-crisis and crisis conditions (that transpire due to a current account deficit and/or capital outflows that are not offset by capital inflows and/or a current account surplus). The illustrations developed by Ghosh et al (2008) reveal ideal current account and capital flow conditions, where both are found in a state of equilibrium. According to Lee et al (2008), based on a macroeconomic balance approach, there is a certain level of exchange rate in line with CA norms, known as the equilibrium real exchange rate.

In general, macroeconomic models utilised by countries adhering to an inflation targeting framework tend to institute monetary policy based on the Taylor rule. The basic version stipulates that a central bank only responds to changes in the inflation gap and output gap. Another version specifies that in addition to responding to both

Structure of Bank Indonesia's core model (ARIMBI) Graph 3.3



the aforementioned gaps, a central bank also responds to exchange rate dynamics, marked by the inclusion of a variable for the exchange rate in the Taylor rule. Despite its inclusion in the Taylor rule, the exchange rate is not a policy instrument. In that context, monetary policy is implemented solely through the Taylor rule. As stated by Taylor (2001), there are several research papers dedicated to the inclusion of the exchange rate in the monetary policy rule, including Ball (1999), Svensson (2000) and Taylor (1999).

To support implementation of a flexible ITF, Bank Indonesia developed several macroeconomic models for use in its Forecasting and Policy Analysis System (FPAS). The core model used to make forecast and policy simulations is known as ARIMBI. Besides ARIMBI, there are a number of supporting satellite models, namely SOFIE (short-term forecast of GDP components and inflation by category), MODBI (medium-term forecast of macroeconomic variables), BIMA (short-term forecast of balance of payments) and ISMA (short-term forecast of sectoral GDP). In addition, near-term forecasts of GDP, inflation and exchange rates are also provided based on assessments and anecdotal information.

In the following section, we use equations from the ARIMBI model to explain Bank Indonesia's flexible ITF. Originally, ARIMBI was a standard small open-economy New Keynesian model, consisting of four main equations, namely IS – output gap, inflation – New Keynesian Phillips Curve (NKPC), Uncovered Interest Parity (UIP) and the Taylor rule. When the flexible ITF was introduced, we modified the model to incorporate financial accelerators, as well as procyclicality between the real and financial sectors and the risk-taking channel. We further enriched the model by including the ability to capture the dynamics of the current account and capital flows. In addition, the policy mix of Bank Indonesia is also modelled, including its monetary policy (Taylor rule and optimal exchange rate) and macroprudential policy (LTV rule and RR rule). The structure of the model is presented in Graph 3.3, with further elaboration provided in Appendix 2.

Block 1: The real sector and monetary policy

There are four main equations, namely IS – output gap, inflation – NKPC, the Taylor rule and Uncovered Interest Parity (UIP). The four equations represent a macroeconomy or real sector. The output gap represents the size of the disparity between real GDP and its potential level. The credit growth gap is added to this equation to reinforce the correlation between the macroeconomy and the financial block. Meanwhile the second equation shows that CPI inflation is determined by its expected value, output gap and real exchange rate gap. The Taylor rule is determined by its long-term trend, inflation gap and output gap. The UIP equation shows that it holds when the interest rate differential is the same as the summation of expected nominal exchange rate depreciation/appreciation and risk premium.

Block 2: The financial block and macroprudential policy

There are three equations in the financial block, namely the credit growth gap equation, the interest rate spread gap equation and the default risk gap equation. Three additional equations were included because when an economy experiences a boom/bust episode, real credit growth increases/decreases, accompanied by an increase/decrease in default risk. Meanwhile, the inclusion of the interest rate spread gap equation is required to capture the dynamics of lending rates, given that the core equations do not include the lending rate as a variable. There are two

macroprudential tools in the model, namely the LTV and RR ratios, which are modelled together. In the macro model, the macroprudential instrument mechanism of the RR resembles the LTV. The current LTV regulation has a direct effect on mortgages and automotive loans, and ultimately influences total credit. The reserve requirement affects total credit through its impact on loanable funds. In the model, both macroprudential tools respond to total credit.

Block 3: The external block and exchange rate policy

There are three equations in the external block, namely the current account (CA) gap equation, the capital flow (CF) gap equation, and several equations representing the rest of the world. As mentioned previously, the CA gap is the difference between the CA to GDP ratio and CA norms. Meanwhile, the CF gap is the difference between the CF to GDP ratio and the optimum level of CF. The rest-of-the-world equations consist of world IS – output gap, world inflation – NKPC and the world Taylor rule. It is a simple model of the global economy and a representation of what central banks do in response to shocks of world inflation and GDP. Bank Indonesia's exchange rate policy is basically a combination of responses to current economic conditions and a drift towards gradually bringing the economy to its internal and external balance. If there are no other shocks in the near term (about one to two years ahead), the path of the short-term fundamental exchange rate will be the same as path of the medium-term fundamental exchange rate. The path resembles the concept of permanent equilibrium exchange rate (PEER), in which there are responses to both temporary and permanent shocks.

Block 4: Macro risk and the risk-taking channel

In order to capture the role of risk perception in the model, we endogenise variables of risk, using the International Country Risk Guide (ICRG) index as a proxy. The risk is called macro risk to represent risk at the macro level. A higher output gap would induce lower macro risk, while a higher inflation gap would raise macro risk. On the other hand, real exchange rate depreciation would raise macro risk in a similar way to a deteriorating current account. In the financial sector, higher default risk would escalate macro risk. The determinants of macro risk are basically composed of macroeconomic and financial variables. Furthermore, macro risk influences other variables in the model. Its impact affects not only real exchange rate depreciation/appreciation but also the credit growth gap (or risk-taking channel), default risk gap, risk premium and capital flow gap.

3.2.2. Policy simulation

In this policy simulation, some external shocks are simulated, namely a shock to world GDP, world interest rate, the current account and capital flows. We differentiate two scenarios in the simulations as follows: (i) Bank Indonesia only uses monetary policy in response to the shocks (indicated by the broken red line); and (ii) Bank Indonesia utilises both monetary and macroprudential policy (indicated by the solid dark blue line).

a) A decline in world GDP

The slowdown in world GDP growth in 2010–13 had a significant impact on the domestic economy. Using the model, we simulate a shock in the form of a 1% drop in the world output gap, accompanied by declines in both world inflation and the

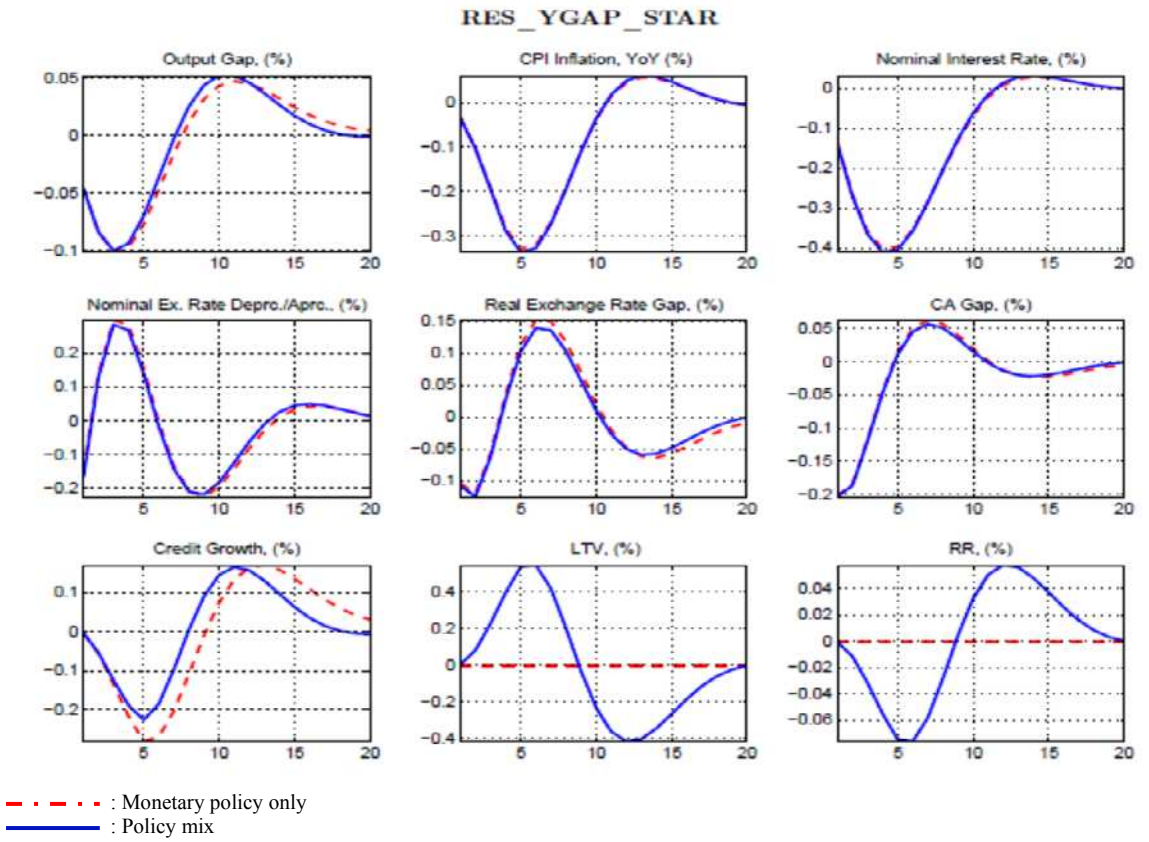
world nominal interest rate. Such a shock would precipitate a decrease in the output gap (economic growth) of Indonesia by around 0.10%, followed by a lower rate of inflation, prompting Bank Indonesia to lower its policy rate based on the standard Taylor-type rule mechanism.

A decrease in the world output gap would have a 0.20% impact on the current account deficit due to a larger decline in exports (stemming from the decrease in the world output gap and rupiah real exchange rate appreciation) than imports (because of the decrease in the output gap of Indonesia). Meanwhile, a falling output gap and current account as well as escalating default risk would trigger a limited increase in macro risk and also impact the nominal and real exchange rates as well as other variables.

A more pronounced decline in the world nominal interest rate (in response to a drop in world output gap) compared to the BI rate, coupled with the inherent lag associated with reducing the BI rate, would trigger capital inflows to the domestic economy, thereby increasing the capital flow (CF) gap by around 0.18%. Consequently, the rupiah would appreciate at the onset of the shock but subsequently depreciate as the falling world output gap starts to influence macroeconomic variables, for instance, through domestic economic moderation, a current account deficit and BI rate reductions.

IRF – World output gap shock

Graph 3.4



A decline in the output gap would subsequently lead to slower real credit growth due to procyclicality and the presence of a financial accelerator, which could also be attributable to a wider interest rate spread caused by higher default risk, in line with

economic moderation. Real credit growth would also be suppressed slightly due to declining liquidity as a result of the ensuing balance of payments (BOP) deficit. In response, Bank Indonesia would need to raise the LTV ratio and lower the RR to maintain financial stability.

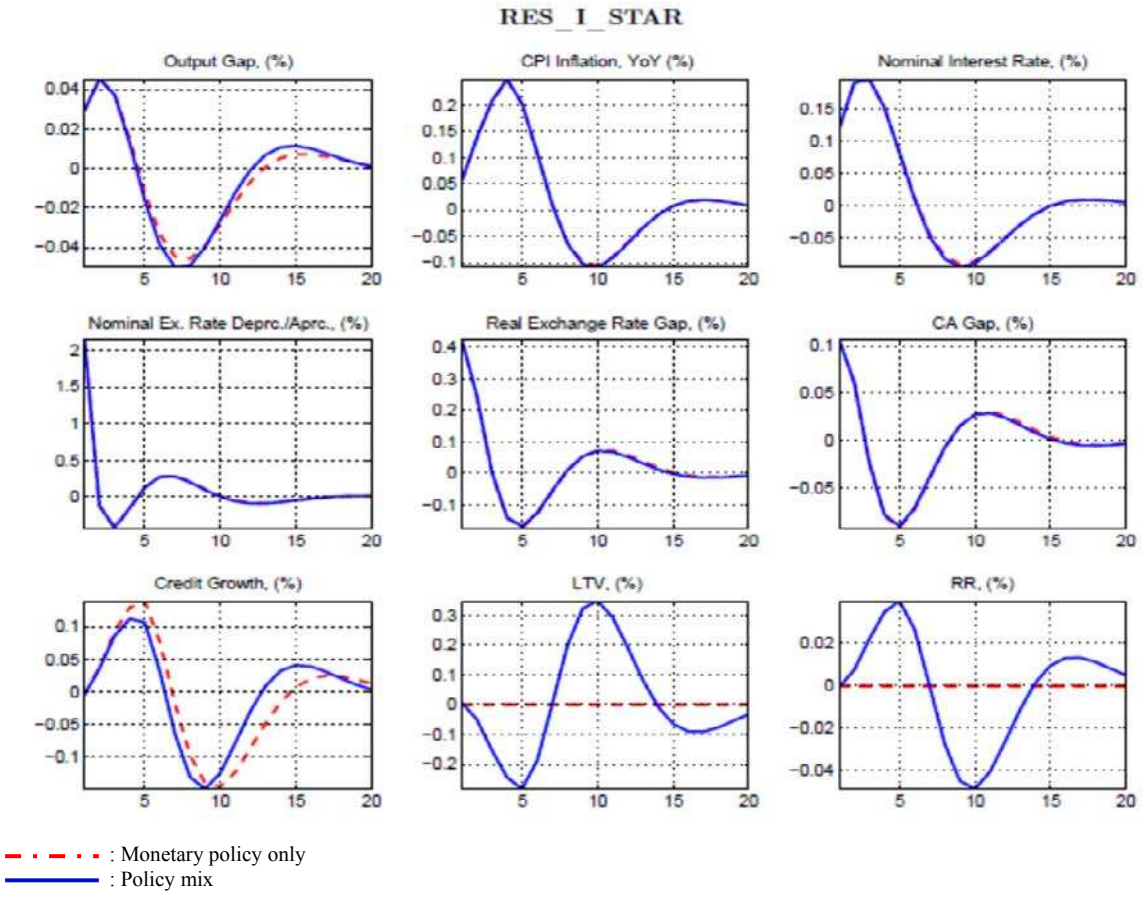
It can be observed from the simulation that the integration of monetary and macroprudential policy is superior in terms of slowing the pace of credit growth, as compared with using just one of the policies. It is unnecessary to lower the policy rate dramatically to boost the economy, or even to aggressively raise LTV or lower RR in order to spur credit growth. Implementing the two policies simultaneously necessitates only moderate shifts.

b) World interest rate increase

Normalisation of the Fed's monetary policy stance would compel other central banks to raise their own policy rates. Using the model, we simulated a shock in the form of a 1% increase in the world interest rate. The shock would induce a decline in the world output gap and lower world inflation. The shock would also spur an outflow of capital from Indonesia and cause the rupiah to depreciate, both in nominal and real terms. Nominal rupiah depreciation would bring higher CPI inflation and prompt the central bank to raise its policy rate. On the other hand, real exchange rate depreciation would close the CA gap and subsequently boost the output gap. Furthermore, real credit growth would increase in the first quarter as the output gap increased, causing Bank

IRF – World interest rate shock

Graph 3.5

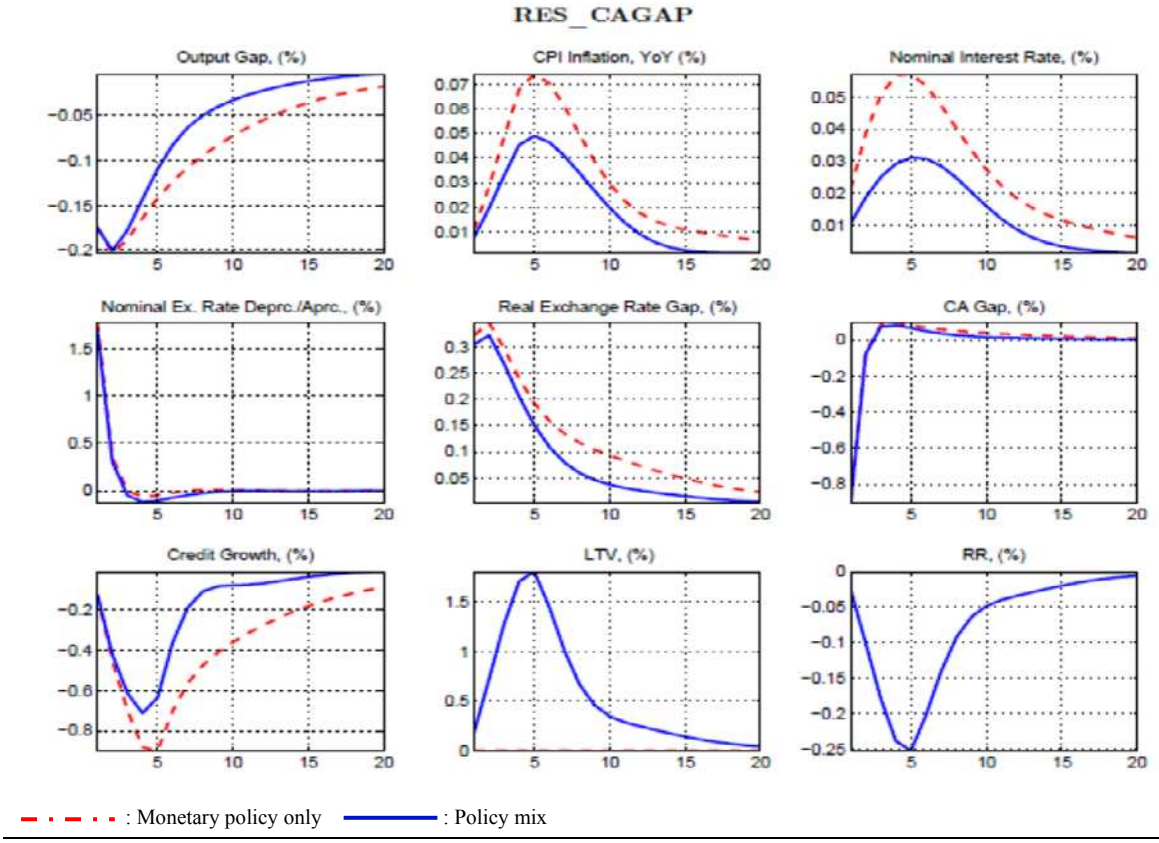


Indonesia to lower the LTV ratio and raise the RR. Here we see that Bank Indonesia responds to the world interest rate shock with an appropriate policy mix. Accordingly, monetary policy is directed towards stabilising domestic inflation, while macroprudential policy would be used to control credit growth. The simulations show that using a policy mix would lessen fluctuations amongst economic and financial variables.

c) Widening current account deficit

Bank Indonesia faces the challenge of a large current account (CA) deficit, peaking at more than 4% of GDP in the previous period. A 1% drop in the CA gap (widening CA deficit) would undermine economic growth as the current account (CA) represents net exports, which is a component of GDP. Weaker net exports would clearly undermine GDP and the shock would also slow real credit growth, appearing as an impact of the decline in the CA gap on liquidity and as a result of a lower output gap. Ultimately, a decline in real credit growth would prompt Bank Indonesia to raise the LTV ratio and lower the RR ratio. Meanwhile, mounting macro risk due to the shock would cause the rupiah to depreciate and contribute to higher inflation, prompting Bank Indonesia to raise its policy rate. That combination of outcomes would also precipitate capital outflows. The impact of a drop in the CA gap would demand vigilance, with the balance of payments experiencing reinforcing pressures from both the current account and capital account. A depreciating rupiah constitutes an optimal response to restore the external sector because it would support current account adjustments. The simulations show that it would be better for Bank Indonesia to respond to the multitude of challenges through an appropriate policy mix.

IRF – Current account gap shock — Graph 3.6

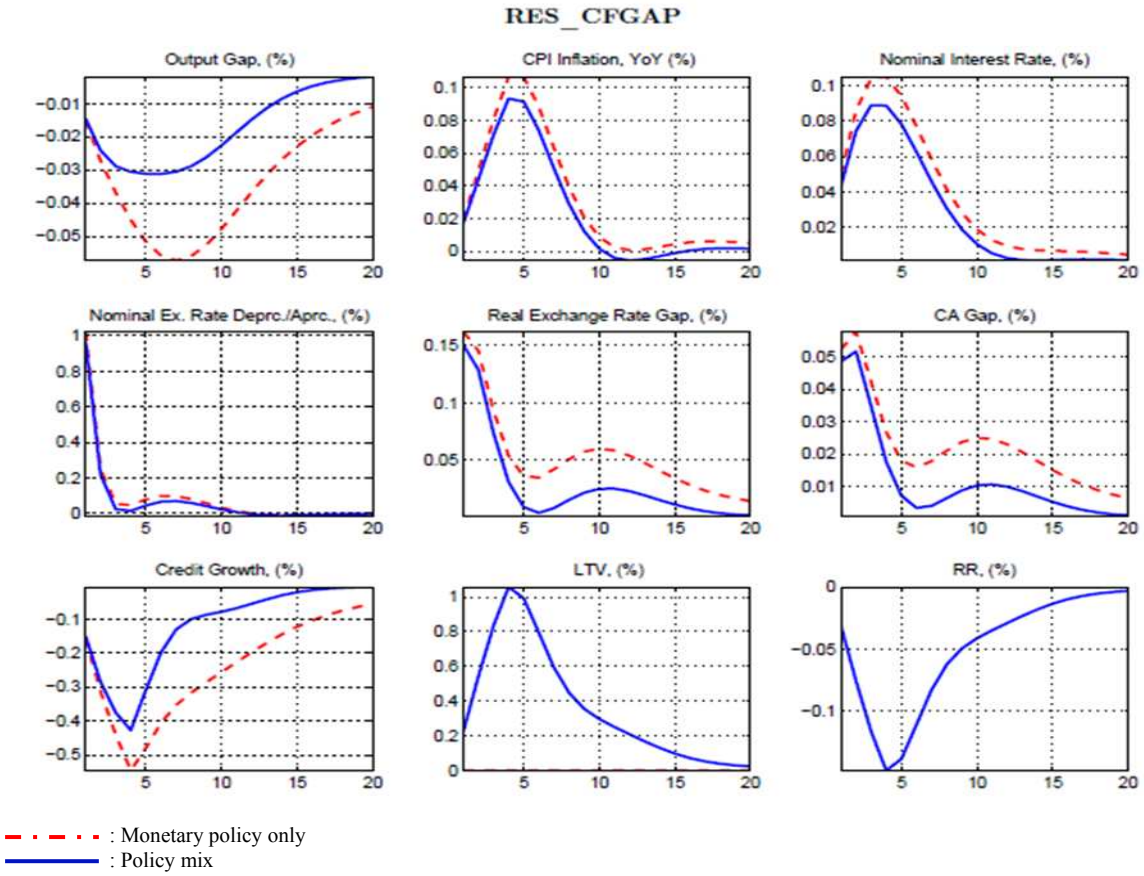


d) Capital outflow

The risk of a sudden reversal following large capital inflows seems to be a serious threat, as experienced by Indonesia due to the 1997–98 crisis. A shock in the form of a 1% drop in the capital flow (CF) gap would reduce real credit growth, following a decline in liquidity flowing into the domestic economy. A substantial deceleration in real credit growth would reduce the output gap due to the presence of a financial accelerator, thus triggering a further decline in real credit growth. Subsequently, the fall in real credit growth would prompt Bank Indonesia to raise the LTV ratio and lower the reserve requirement (RR). The drop in the CF gap would eventually cause the rupiah to depreciate, both in nominal and real terms, inducing higher domestic inflation and compelling the central bank to raise its policy rate. The simulations show that a policy mix is more optimal than monetary policy alone when managing monetary and financial stability.

IRF – Capital flow gap shock

Graph 3.7



4. Conclusion

As the Indonesian economy is becoming progressively more integrated with the world economy, the impact of global shocks on the domestic economy are becoming increasingly pronounced. The influx of capital to the domestic economy, which

triggers excessive liquidity and exacerbates the risk of sudden reversal, poses a serious threat to the Indonesian economy, especially in terms of financial stability. Recent crisis episodes have indicated that monetary policy alone is insufficient to maintain macroeconomic stability; it needs to be accompanied by macroprudential policy. Against the backdrop of a dynamic global environment, the multitude of challenges confronting the Indonesian economy demand a policy mix response utilising multiple instruments. To that end, a flexible ITF is considered more suitable than the standard ITF in terms of managing monetary and financial stability in Indonesia as well as dealing with the dynamics of the financial and external sectors. Using the framework, Bank Indonesia could mitigate the impact of external shocks and simultaneously maintain both monetary and financial stability.

This paper finds that the integration of monetary and macroprudential policy provides better results in terms of mitigating excessive macroeconomic (output) and financial sector (credit) fluctuations, as compared with any single policy instrument. By modelling the financial block, the model is better able to capture Indonesian economic dynamics in both the real sector and financial sector, including procyclicality and the presence of a financial accelerator.

More comprehensive external sector modelling provides increasingly accurate analysis of several issues that occur in Indonesia's external sector. External sector dynamics, namely shocks affecting the exchange rate, current account and capital flows, have a significant impact on macroeconomic stability in Indonesia. The model has proved itself useful in helping Bank Indonesia to formulate an appropriate policy mix to mitigate the adverse effects of external shocks.

References

Agung, J (2010): "Integrating monetary and macroprudential policy: towards a new paradigm of monetary policy in Indonesia after the global crisis", *Bank Indonesia Working Paper*, no WP/07/2010.

Altunbas, Y, L Gambacorta and D Marques-Ibanez (2009): "An empirical assessment of the risk-taking channel", Paper presented on the BIS-ECB Workshop on Monetary Policy and Financial Stability, Basel, September.

Angelini, P, S Neri and F Panetta (2011): "Monetary and macroprudential policies", *Bank of Italy Working Papers*, no 801, March.

Ball, L (1999): "Policy rules for open economies", in J Taylor (ed), *Monetary Policy Rules*, University of Chicago Press.

Bank Indonesia (2011): *Strengthening Monetary Policy Framework in Indonesia: Flexible Inflation Targeting Framework*, October.

Beau, D, L Clerc and B Mojon (2011): "Macro-prudential policy and the conduct of monetary policy", *Bank of France Working Paper*, January.

Bernanke, B, M Gertler and S Gilchrist (1996): "The financial accelerator and the flight to quality", *The Review of Economics and Statistics*, vol 78, no 1, February.

Borio, C, C Furfine and P Lowe (2001): "Procyclicality of the financial system and financial stability: issues and policy options", *BIS Papers*, no 1.

Borio, C (2003): "Towards a macroprudential framework for financial supervision and regulation?", *BIS Working Papers*, no 128, December.

Borio, C and H Zhu (2008): "Capital regulation, risk-taking, and monetary policy: a missing link in the transmission mechanism?", *BIS Working Papers*, no 268, December.

Capistrán, C, G Cuadra and M Ramos-Francia (2011): "Policy response to external shocks: lessons from the crisis", *Bank of Mexico Working Papers*, no 2011-14, December.

Cúrdia, V and M Woodford (2009): "Credit spreads and monetary policy", *NBER Working Paper Series*. no 15289, August.

De Nicolò, G, G Dell'Ariccia, L Laeven and F Valencia (2010): "Monetary policy and bank risk taking", *IMF Staff Position Note*, SPN/10/09, July.

Galati, G and R Moessner (2011): "Macroprudential policy – a literature review", *BIS Working Papers*, no 337, February.

Gerali, A, S Neri, L Sessa and F-M Signoretti (2010): "Credit and banking in a DSGE model of the euro area", *Bank of Italy Working Papers*, no 740, January.

Gertler, M and P Karadi (2011): "A model of unconventional monetary policy", *Journal of Monetary Economics*, vol 58.

Ghosh, A, M Goretti, B Joshi, U Ramakrishnan, A Thomas and J Zalduendo (2008): "Capital inflows and balance of payments pressures—tailoring policy responses in emerging market economies", *IMF Policy Discussion Paper*, no PDP/08/2, June.

Harmanta, Tarsidin, M Bathaluddin and Idham (2013): "ARIMBI with macroprudential policy", Revised Edition (not published), *Bank Indonesia Working Paper*, no WP/1/2013, October.

Harmanta, Tarsidin, Idham and A Rachmanto (2015): "ARIMBI 2015", (not published). *Bank Indonesia Research Paper*, no LHP/1/DKEM/2015, June.

Issing, O (2003): "Monetary and financial stability – is there a trade-off?", speech at the BIS Annual Conference on Monetary Stability, Financial Stability and the Business Cycle, Basel.

Juhro, S (2014): "The linkages between monetary and financial stability: some policy perspectives", *Bank Indonesia Occasional Paper*, March 2014.

——— (2015): "The role of the central bank in promoting sustainable growth: perspectives on the implementation of flexible ITF in Indonesia", Paper presented in the CCBS/BoE-Columbia University Joint Seminar on Inflation Targeting, New York, April.

Juhro, S and M Goeltom (2015): "Monetary policy regime in Indonesia", in A Kohsaka (ed), *Macro-Financial Linkages in the Pacific Region*, Routledge.

Lee, J, G Milesi-Ferretti, J Ostry, A Prati and L Ricci (2008): "Exchange rate assessments: CGER methodologies", *IMF Occasional Paper*, no 261.

Peñaloza, D (2011): "In the quest of macroprudential policy tools", *Bank of Mexico Working Paper*, March.

Siregar, R (2011): "The concepts of equilibrium exchange rate: a survey of literature", *SEACEN Staff Paper*, no 81, April.

Svensson, L (1998): "Open-economy inflation targeting", *Journal of International Economics*, no 50, November.

Taylor, J (2001): "The role of the exchange rate in monetary-policy rules", *American Economic Review*, vol 91, no 2, May.

Unsal, D (2011): "Capital flows and financial stability: monetary policy and macroprudential responses", *IMF Working Paper*, no WP/11/189, August.

Wimanda, R, Tarsidin, T Winarno and Idham (2013): "ARIMBI with extended external sector", (not published). *Bank Indonesia Working Paper*, no WP/2/2013, December.

Appendix 1

Macroprudential measures in Indonesia

Period of 2010–15 Table A1

Period	Measures
July 2010	Minimum holding period on BI bills, one-month holding period.
July 2010	Introduce non-tradable rupiah term deposits for banks.
Nov 2010	Increase the primary rupiah reserve requirement from 5% to 8%, effective from June 2011.
Jan 2011	Reinstate limits on short-term offshore borrowing by banks • Maximum of 30% of capital; • Effective end of January 2011 with a three-month transition period.
March 2011	Increase the FX reserve requirements on banks from 1% of FX deposits to 5%, effective from March 2011.
March 2011	Impose the LDR-based reserve requirement.
Jan 2011	Lengthen (from weekly to monthly) auctions and offer longer maturity (three, six and nine months) for BI bills.
May 2011	Introduce a six-month holding period for BI bills.
June 2011	Increase the FX reserve requirement from 5% to 8%.
Sept 2011	Mandatory reporting of foreign exchange originating from export earnings.
March 2012	Loan-to-value (LTV) ratio for the property sector (max 70%)
Dec 2012	Mandatory reporting of foreign exchange originating from export earnings. • Adjustment of the deadline for receipt; • Limiting the difference between the report and the value based on the declaration of exported goods
Sept 2013	• LTV for second property 60%; • LTV for third property 50%.
Sept 2013	Secondary reserve requirement raised from 2.5%: • to 3% from 1 to October 31, 2013. • to 3.5% of from November 1 to December 1, 2013 • to 4% from December 2, 2013.
Sept 2013	Adjustments of LDR-based reserve requirement • The upper limit of the LDR-based RR was reduced from 100% to 92%; • The lower limit remained at 78%; • Disincentives imposed on banks with an LDR ratio above 92% and CAR of less than 14% • Disincentives is also imposed on banks that have LDR less than 78%
June 2015	LTV ratio for property sector: • LTV for first property 80%; • LTV for second property 70%; • LTV for third property 60%. Down payments (DP) for automobiles (min 25%), for commercial vehicles (min 20%) and for motorcycles (min 20%).
June 2015	Adjustments to LDR-based reserve requirement: • Redefinition: to include bank securities in the calculation. LDR to be renamed to Loan-to-Funding Ratio (LFR); • Commencing August 2015, the upper limit of LFR permitted at 94% if the bank fulfils an NPL ratio < 5%.

Appendix 2

Bank Indonesia's Core Model (ARIMBI)

Block 1: The real sector and monetary policy

There are four main equations, namely IS – output gap, inflation – NKPC, the Taylor rule and Uncovered Interest Parity (UIP). The four equations represent a macroeconomy or real sector.

IS – Output gap

$$\hat{y}_t = \beta_1 \hat{y}_{t-1} + \beta_2 \hat{y}_{t+1} - \beta_3 \hat{r}_t + \beta_6 \widehat{dcr}_t + \beta_7 \widehat{ca}_t + e_t^{\hat{y}} \quad \text{A2.1}$$

The output gap ($\hat{y}$) represents the size of the disparity between real GDP and its potential level. It is determined by the output gap in the previous period, its value in the next period, real interest rate gap ($\hat{r}$), credit growth gap ($\widehat{dcr}$) and current account (CA) gap ($\widehat{ca}$). The credit growth gap ($\widehat{dcr}$) is added to reinforce the correlation between the macroeconomy and the financial block. The addition of this variable is necessary considering that the dynamics of real credit volume growth (that subsequently affect the output gap) cannot be fully represented by real interest rate gap ($\hat{r}$). Other factors also influence real credit volume growth. Therefore, it would be more appropriate to directly input the impact of real credit volume growth into the output gap equation. On the other hand, investment not only stems from or is financed through credit but also through direct investment, the magnitude of which is determined by the real interest rate gap. Meanwhile, the CA gap represents the level of exports and imports, which is modelled in detail in the external sector. A positive CA gap increases the output gap.

Inflation – NKPC

$$\pi_t^{CPI} = w^{adm}\pi_t^{adm} + (1 - w^{adm})\pi_t^{net} + e_t^{\pi^{CPI}} \quad \text{A2.2}$$

$$\pi_t^{net} = \lambda_1 \pi_{t-1}^{net} + (1 - \lambda_1) E_t \pi_{t+1}^{net} + \lambda_3 \hat{y}_t + \lambda_4 \hat{z}_t + e_t^{\pi^{net}} \quad \text{A2.3}$$

The first equation represents CPI inflation and its components, while the second is NKPC. The CPI inflation (π^{CPI}) is formed by two components, ie administered price inflation (π^{adm}) and core inflation (π^{net}), including volatile food inflation. The NKPC shows that inflation is determined by its value in the previous period, its expected value, output gap ($\hat{y}$), and real exchange rate gap ($\hat{z}$). We can see that it is a forward-looking specification of inflation and shows the significance of inflation expectation. Meanwhile, the output gap represents the level of inflation pressure in which a higher output gap indicates more intense inflationary pressures. The variable of the real exchange rate gap represents sources of inflation from abroad, ie exchange rate pass-through to inflation from imported goods.

Monetary policy – Taylor rule

$$i_t = \gamma_1 i_{t-1} + (1 - \gamma_1)(\bar{\imath}_t + \gamma_2 \hat{\pi}_t^{CPI} + \gamma_3 \hat{y}_t) + e_t^i \quad \text{A2.4}$$

The Taylor rule is determined by value of the policy rate in the previous period, its long-term trend ($\bar{\imath}$), inflation gap ($\hat{\pi}^{CPI}$) and output gap ($\hat{y}$). It is a standard Taylor rule. Bank Indonesia responds to the inflation gap (deviation of inflation expectation from

its target) and output gap. There is no real exchange rate variable in the equation, in line with ITF, where the exchange rate is free-floating in nature.

Uncovered interest parity

$$i_t - i_t^* = E_t DS_t + prem_t \quad \text{A2.5}$$

The UIP equation shows that it holds when the interest rate differential ($i - i^*$) is the same as the summation of expected nominal exchange rate depreciation/appreciation (EDS) and risk premium ($prem$). The expected nominal exchange rate appreciation/depreciation is calculated by comparing the expected nominal exchange rate level (S^e) and the actual current nominal exchange rate level (S). The expected nominal exchange rate level is calculated based on the exchange rate level in the period t + 1 and t – 1, with the addition of a drift that is twice the nominal exchange rate appreciation/depreciation trend. Meanwhile, risk premium represents the amount of premium asked by investors to invest in domestic assets.

Block 2: The financial block and macroprudential policy

There are three equations in the financial block, namely the credit growth gap equation, the interest rate spread gap equation and the default risk gap equation. Three additional equations were included because when an economy experiences a boom/bust episode, real credit growth increases/decreases, accompanied by an increase/decrease in default risk. Meanwhile, inclusion of the interest rate spread gap equation is required to capture the dynamics of lending rates, considering that the core equations does not include lending rate as its variable. The equations refer to Peñaloza (2011), with some modification.

Credit growth gap

$$\widehat{dcr}_t = \delta_1 \widehat{dcr}_{t-1} + (1-\delta_1)\left(-\delta_2 \hat{r}_t - \delta_3 \widehat{spread}_t + \delta_4 \hat{y}_t + \delta_5 \widehat{ltv}_t - \delta_6 \widehat{rr}_t + \delta_7 \widehat{ca}_{t-1} + \delta_8 \widehat{cf}_t - \delta_9 \hat{\Upsilon}_t\right) + e_t^{dcr} \quad \text{A2.6}$$

The credit growth gap ($\widehat{dcr}$) indicates the size of disparity between real credit volume growth and potential real credit volume growth. The credit growth gap is determined by the credit growth gap in the previous period as well as by the real interest rate gap ($\hat{r}$), the interest rate spread gap ($\widehat{spread}$) and output gap ($\hat{y}$). A wider real interest rate gap implies a correspondingly narrower credit growth gap, and a wider spread gap leads to a narrower credit growth gap. On the other hand, a larger output gap will exacerbate the credit growth gap. Meanwhile, a narrow credit growth gap is also the result of macroprudential variables, in this instance LTV and RR. Moreover, a wider LTV gap ($\widehat{ltv}$) will broaden the credit growth gap. Conversely, a wider RR gap reduces loanable funds and thereby narrows the credit growth gap. Escalating default risk will also precipitate a narrower credit growth gap as banks opt to hold their credit allocation. However, considering that default risk is already implicitly represented by spread (which indicates that higher lending rates tend to escalate default risk) and output gap (which denotes that a larger output gap leads to lower default risk), default risk no longer appears in the credit growth gap equation.

A balance of payments (BOP) surplus/deficit is added to the credit growth gap equation, represented by the total of the CA gap and CF gap. The inclusion of the BOP variables intends to capture the impact of more/less liquidity in the economy stemming from the external sector. The combination of the variables, CA gap and CF gap, in the credit growth gap equation can be expressed as a single variable, namely

the BOP surplus/deficit. However, in order to accommodate differences between the characteristics of the current account and capital flows with regards to their impact on liquidity, a lag is applied to the CA gap, while the CF gap has no lag.

Interest rate spread gap

$$\widehat{spread}_t = \nu_1 \widehat{spread}_{t-1} + (1-\nu_1)\nu_2 \widehat{def}_t + e_t^{spread} \quad \text{A2.7}$$

The interest rate spread gap equation ($\widehat{spread}$) shows that the gap between the lending rate and deposit rate is not only determined by the spread gap in the previous period but also by the default risk gap ($\widehat{def}$) faced by the banks. In addition to the range of variables previously mentioned, the interest rate spread gap is also affected by the bank market structure. This, for instance, is observable based on the fact that the wide spread in Indonesia, amongst others, is attributable to monopolistic competition in terms of market structure. However, considering that the bank market structure has remained relatively unchanged in the near term (one to two years), the variable of bank market structure is omitted from the model.

Default risk gap

$$\widehat{def}_t = \theta_1 \widehat{def}_{t-1} + (1-\theta_1)\left(\theta_2 \widehat{spread}_t + \theta_3 \widehat{dcr}_{t-1} - \theta_4 \hat{y}_t + \theta_5 \hat{\Upsilon}_t\right) + e_t^{def} \quad \text{A2.8}$$

The default risk gap equation ($\widehat{def}$) indicates that the default risk gap is determined by the default risk gap in the previous period, the interest rate spread gap ($\widehat{spread}$), credit growth gap ($\widehat{dcr}$) in the previous period and the output gap ($\hat{y}$). A wider spread gap leads to greater pressures on the cost of capital faced by the customer, which will clearly intensify default risk. Meanwhile, a higher credit growth gap increases the likelihood of default. Conversely, a larger output gap ameliorates business conditions and eases default risk as the economy experiences robust growth. Gross non-performing loans (NPL) data are used as a proxy for default risk gap, which reveals the level of risk faced by the bank (and the requested premium).

Macroprudential rule

Macroprudential policy can constitute a separate policy, in other words macroprudential policy and monetary policy are independent. Notwithstanding, macroprudential policy can be incorporated into monetary policy, explicitly using the augmented Taylor rule or implicitly through variables in the Taylor rule. Interaction between macroprudential policy and monetary policy must be modelled accurately, considering that the effect of such interaction can be complementary, neutral/independent or indeed conflicting. In this case, modelling macroprudential policy and monetary policy falls under the auspices of Bank Indonesia.

There are two macroprudential tools in the model, namely the LTV ratio and the reserve requirement (RR), which are modelled together. In the macro model, the macroprudential instrument mechanism of the RR resembles the LTV. The current LTV regulation has a direct effect on mortgages and automotive loans, and ultimately influences total credit. The reserve requirement affects total credit through its impact on loanable funds. In the model, both macroprudential tools respond to total credit.

LTV rule

LTV policy intends to limit the provision of credit/financing by banks when an economy is experiencing boom conditions and, conversely, expand the allocation of credit/financing when an economy is in recession. Limits are placed on credit

availability, where banks are only permitted to extend credit up to the specified LTV ratio, and, on the other hand, households and the corporate sector are only allowed to borrow up to the prevailing LTV ratio. Thus, LTV ratio intends to control the pace of credit growth. If the credit growth gap widens, LTV will need to be lowered in order to curb credit growth. To this end, an LTV rule is required as follows:

$$\widehat{ltv}_t = \mu_1 \widehat{ltv}_{t-1} + (1-\mu_1)\left(-\mu_2 \widehat{dcr4}_t\right) + e_t^{ltv} \quad \text{A2.9}$$

RR rule

The reserve requirement ratio (RR) is fundamentally designed to manage the amount of loanable funds. This can be achieved, for example, by raising/lowering the reserve requirement at times when the economy is facing excess/insufficient liquidity. The reserve requirement is countercyclical in nature and helps control procyclicality in the financial sector, thereby avoiding excessive credit growth. The dynamic reserve requirement refers to the following rule:

$$\widehat{rr}_t = \kappa_1 \widehat{rr}_{t-1} + (1-\kappa_1)\kappa_2 \widehat{dcr4}_t + e_t^{rr} \quad \text{A2.10}$$

Block 3: The external block and exchange rate policy

There are three equations in the external block, namely the current account (CA) gap equation, the capital flow (CF) gap equation and several equations representing the rest of the world. As mentioned previously, the CA gap is the difference between the CA to GDP ratio and CA norms. Meanwhile, the CF gap is the difference between the CF to GDP ratio and the optimum level of CF. CA norms are calculated by regressing the variable CA to GDP ratio against the fundamental variables of an economy, applying the Macroeconomic Balance Approach cited by Lee et al. (2008). In contrast, an approach to calculate the optimal level of capital flows is yet to be determined. There are only depictions of an optimal CF to GDP ratio in relation to the CA to GDP ratio, as quoted by Ghosh et al (2008).

Current account gap

$$\widehat{ca}_t = \vartheta_1 \widehat{ca}_{t-1} + (1-\vartheta_1)(\vartheta_2 \hat{z}_t - \vartheta_3 \hat{y}_t + \vartheta_4 \hat{y}_t^*) + e_t^{\widehat{ca}} \quad \text{A2.11}$$

The equation of the current account gap ($\widehat{ca}$) shows the size of the gap between the CA to GDP ratio and CA norms. This variable is influenced by the previous current account gap, real exchange rate gap ($\hat{z}$), output gap ($\hat{y}$) and global output gap ($\hat{y}^*$). As the real exchange rate gap increases (depreciates), the current account gap also increases, while a higher output gap will result in a lower current account gap (considering its impact on higher imports). On the other hand, a larger global output gap (representing external/foreign demand) will exacerbate the current account gap (considering its impact on higher exports).

Capital flow gap

$$\widehat{cf}_t = \phi_1 \widehat{cf}_{t-1} + (1-\phi_1)\left(\phi_3(i_t - i_t^* - (\phi_2 EDS_{t-1} + (1-\phi_2)EDS_t) - prem_t) + \phi_4 \hat{y}_t - \phi_5 \hat{y}_t^* - \phi_6 \hat{\Upsilon}_t\right) + e_t^{\widehat{cf}} \quad \text{A2.12}$$

The capital flow gap equation ($\widehat{cf}$) indicates the magnitude of the gap between the CF to GDP ratio and the optimum level of CF. This variable is driven by the previous capital flow gap, uncovered interest rate parity (UIP), output gap ($\hat{y}$) and global output gap ($\hat{y}^*$). A higher domestic nominal interest rate will attract capital flows (increasing the capital flow gap), while a higher global nominal interest rate will trigger foreign

capital outflows (reducing the capital flow gap), and higher expected exchange rate depreciation will also lead to foreign capital outflows (reducing the capital flow gap). Conversely, a greater level of risk in Indonesia will prompt foreign capital outflows (lowering the capital flow gap). In this case, it is assumed that UIP will not hold because of a lag in the formation of expected nominal exchange rate appreciation/depreciation.

An increase in the output gap represents improvements in the economy of Indonesia and will attract foreign capital (increasing the capital flow gap). Meanwhile, a larger global output gap denotes improvements in the global economy, thereby diverting foreign capital from Indonesia (reducing the capital flow gap). Considering the Indonesian economy is affected by improvements in the global economy, the impact on capital flows is sometimes mixed, depending on the most dominant factor.

It should be emphasised here that the CA gap and CF gap were brought back to their optimal path (where the gap is zero) through appreciation/depreciation of the nominal and real exchange rates and adjustments to other influencing variables. Furthermore, there is no policy to control capital flow in this model. The CF gap equation shows that capital moves freely depending on its determinants. However, some shocks can be added to the model to capture the impact of BI regulations on capital movements.

Rest of the world

$$\hat{y}_t^* = \beta f_1 \hat{y}_{t-1}^* + \beta f_2 \hat{y}_{t+1}^* - \beta f_3 (r_t^* - \overline{r_t^*}) + e_t^{\hat{y}*} \quad \text{A2.13}$$

$$\pi_t^* = \lambda f_1 \pi_{t-1}^* + (1 - \lambda f_1) E_t \pi_{t+1}^* + \lambda f_3 \hat{y}_t^* + e_t^{\pi^*} \quad \text{A2.14}$$

$$i_t^* = \gamma f_1 i_{t-1}^* + \left(1 - \gamma_{f1}\right)\left(\bar{r}_t^* + \pi 4_{t+3}^* + \gamma f_2 (\pi 4_{t+4}^* - \pi_{ss}^*) + \gamma_{f3} \hat{y}_t^*\right) + e_t^{i*} \quad \text{A2.15}$$

The rest of the world equations consist of world IS – output gap, world inflation – NKPC and the world Taylor rule. It is a simple model of the world economy and a representation of what central banks do in response to shocks of world inflation and GDP. In addition, there is a residual in each equation to represent an external shock. As required, covariance shocks could be added to ensure a more appropriate magnitude of external shocks.

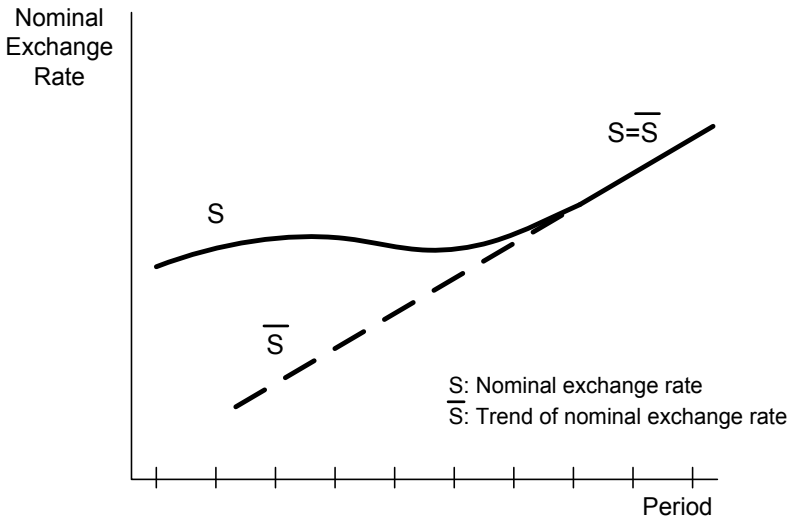
Bank Indonesia actively responds to external sector dynamics, such as through foreign exchange market intervention and capital flow management. Even though Bank Indonesia's exchange rate regime is free floating, the rupiah exchange rate is actually managed in line with economic fundamentals and to be less volatile. By intervening on the foreign exchange market, Bank Indonesia adheres to the exchange rate policy framework, which is continuously developed in line with the current issues and challenges.

The Indonesian economy is not currently at an external balance, as indicated by a current account (CA) deficit that surpassed 4.27% in second quarter of 2014. On the other hand, the Indonesian economy is nearly close to its internal balance, which is demonstrated by the low level of unemployment (around 5.7% in February 2014) as well as low and stable inflation (3.99% in August 2014, in line with the inflation target of 4.5%$\pm$ 1%). Internal and external balance cannot be achieved with rapidity, it should be achieved gradually over a sufficiently long horizon, for example five years. In the near term, however, Bank Indonesia should seek to achieve favourable economic conditions, while simultaneously pursuing the internal and external balance.

Bank Indonesia policy does not aim to achieve internal and external balance immediately but to achieve it optimally, which requires a rupiah exchange rate path that responds favourably to current economic conditions and concomitantly seeks the internal and external balance. This is not a medium-term fundamental exchange rate path (ie an exchange rate path that is consistent with the internal and external balance). If Bank Indonesia sticks to the medium-term fundamental exchange rate path; the economy would be forced to adjust drastically to the internal and external balance, which could trigger macroeconomic instability as the exchange rate is distorted from its optimal level. An optimal exchange rate level must be consistent with macroeconomic and financial variables at their fundamental value. Therefore, Bank Indonesia should maintain the rupiah exchange rate in line with short-term fundamentals, while simultaneously aiming for the medium-term fundamental exchange rate path. The optimal exchange rate path is consistent with attaining the inflation target as outlined by the flexible ITF.

Bank Indonesia's exchange rate policy is basically a combination of responding to current economic conditions while gradually shifting the economy back to its internal and external balance. If no other shocks occur in the near term (about one to two years), the short-term fundamental exchange rate path will be the same as the medium-term fundamental exchange rate path, resembling the concept of permanent equilibrium exchange rate (PEER), in which there are responses to both temporary and permanent shocks. The path is depicted in Graph A2.1, in which there are two exchange rate paths, ie nominal exchange rate trend values ($\bar{S}$, broken straight line) and Bank Indonesia's exchange rate policy path (S, solid curve line).

Path of exchange rate policy — Graph A2.1



In the ARIMBI model, dz represents short-term fundamental (real) exchange rate depreciation/appreciation, while $\overline{dz}$ represents medium-term fundamental (real) exchange rate depreciation/appreciation. Meanwhile, in nominal terms it is represented by DS and $\overline{DS}$. In the model, the exchange rate is modelled as it depreciates/appreciates over time. In the model, the nominal and real exchange rates are determined based on the uncovered interest parity (UIP) and purchasing power parity (PPP) equations as follows:

Uncovered interest parity

$$i_t - i_t^* = EDS_t + prem_t \quad \text{A2.16}$$

Purchasing power parity

$$dz_t = (DS_t + \pi_t^*) \quad - \pi_t \quad \text{A2.17}$$

where:

trend of real exchange rate depreciation/appreciation:

$$\overline{dz_t} = \overline{dzgrowth_t} + \iota_1 \hat{\Upsilon}_t - \iota_2 \left(\widehat{ca}_{t-1} + \widehat{cf}_t\right) + e_t^{\overline{dz}} \quad \text{A2.18}$$

From both the UIP and PPP equations, several determinants of nominal and real exchange rates are observed in the model, ie (i) interest rate differential (considering expected nominal exchange rate depreciation/appreciation and risk premium), (ii) terms of trade (represented by domestic and world inflation), (iii) risk (Υ), and (iv) net foreign assets represented by current account gap ($\widehat{ca}$) and capital flows gap ($\widehat{cf}$). Higher risk leads to greater exchange rate depreciation. On the other hand, larger net foreign assets would lead to exchange rate appreciation.

Block 4: Macro risk and the risk-taking channel

In the model, we endogenise variables of risk in order to capture the role of risk perception, using the International Country Risk Guide (ICRG) index as a proxy. The risk is called macro risk to represent risk at the macro level and modelled as follows:

$$\hat{\Upsilon}_t = \eta_1 \hat{\Upsilon}_{t-1} + (1 - \eta_1)\left(-\eta_2 \hat{y}_t + \eta_3 \hat{\pi}_t^{CPI} + \eta_4 \hat{z}_t - \eta_5 \widehat{ca}_t + \eta_6 \widehat{def}_t\right) + e_t^{\hat{\Upsilon}} \quad \text{A2.19}$$

From the equation, we notice that the level of macro risk in the previous period determines macro risk along with the output gap ($\hat{y}$), inflation gap ($\hat{\pi}^{CPI}$), real exchange rate gap ($\hat{z}$), current account gap ($\widehat{ca}$) and default risk gap ($\widehat{def}$). A higher output gap would induce lower macro risk, while a higher inflation gap would raise macro risk. On the other hand, real exchange rate depreciation would raise macro risk in a similar way to a deteriorating current account. In the financial sector, higher default risk would escalate macro risk.

The determinants of macro risk are basically composed of macroeconomic and financial variables. Furthermore, macro risk influences other variables in the model. Its impact not only affects real exchange rate depreciation/appreciation but also the credit growth gap (called the risk-taking channel), default risk gap, risk premium and capital flow gap.