Central Bank and Time Inconsistency

Cep Jandi Anwar, Ph.D

Media Sains Indonesia

Central Bank and Time Inconsistency

Cep Jandi Anwar, Ph.D

Publisher

CV. MEDIA SAINS INDONESIA
Melong Asih Regency B40 - Cijerah
Kota Bandung - Jawa Barat
www.penerbit.medsan.co.id

Central Bank and Time Inconsistency

Cep Jandi Anwar, Ph.D

Cover Designer:
Rintho Rante Rerung

Layout Editor:
Cep Jandi Anwar

Proofreader :
Rintho Rante Rerung

Book Size :
viii, 183 pg, Size: 14,8 x 23 cm

ISBN :
978-623-6882-50-4

Published in:
December 2020

MEDIA SAINS INDONESIA
(CV. MEDIA SAINS INDONESIA)
Melong Asih Regency B40 - Cijerah
Kota Bandung - Jawa Barat
www.penerbit.medsan.co.id

Preface

This book is composed of three empirical studies on the effect of central bank independence in developing countries. The first empirical study investigates the relationship between CBI and inflation in developing countries. After estimating a panel regression model, using pooled least square on the assumption of coefficient homogeneity; the result reveals that there is no significant negative relationship between CBI and inflation. The poolability of the panel is checked by applying the Chow test and Roy-Zellner test. The results show that the model is not poolable. Furthermore, by performing a panel heterogeneity model with pooled mean group (PMG) estimator and show that there exists a reverse relationship between CBI and inflation.

The second study presents the responses to financial asset prices, consumption and investment in relation to CBI shocks in developing countries. The financial asset prices are divided into three categories: exchange rate, stock index and bond yield. The analysis is based on a panel Vector Autoregressive (Panel VAR) estimation. By applying poolability tests, heterogeneity across the countries in our sample is identified. One possible solution to this problem is to apply a mean-group estimation to the panel VAR. Additionally, the sample countries are divided to make the sub-group poolable.

The last empirical study examines whether CBI and macroprudential policy can contribute to enhancing financial stability in terms of credit per GDP. This study proposes a new index concerning macro-

prudential policy for 20 developing economies over the period 2000 to 2017. This study shows that the effect of CBI and macroprudential policy on credit per GDP depends on the non-linearity of the CBI degree. The more independent the central bank, the more stable its financial system, with a stronger effect when CBI is below its trend. When the sample is separated into two groups based on the poolability test, the result reveals that countries with a higher average CBI index maintain better financial stability.

Contents

List of Tables

List of Figures

Chapter 1

Introduction

There is a growing consensus among policymakers and economic researchers that monetary policy instruments are the most effective tools for controlling inflation because of their influence on aggregate demand to achieve price stability. According to Phillips (1958), there is a short-run trade-off between inflation and unemployment; thus, stabilising inflation has a direct effect on unemployment. However, central banks are constrained from having an effective monetary policy due to the dynamic time-inconsistency problem. The latter arise due to pressure from the government or politicians on the central bank to stimulate economic activity, which may have negative consequences for price stability.

Kydland and Prescott (1977) stressed the importance of the relationship between rational expectation and time inconsistency in monetary policy. They stated that monetary policymakers face a trade-off between inflation and unemployment while choosing the optimal monetary policy action in each period, and public behaviour under rational expectation is represented by Phillips curve. Since policymakers might lack credibility if they fail to convince the public that the inflation target will be achieved in the next period having missed their forecast in the past. Then if the actual inflation outturn is higher than expected it leads to lower real wage, which increases labour demand and thus, reduces unemployment. However, if the central bank is more concerned about inflation stabilization, then it will end up with lower inflation but at the cost of higher unemployment.

The time-inconsistency problem arises as a consequence of monetary policy that is no longer optimal in response to the original plan (Kydland and Prescott, 1977; Barro and Gordon, 1983; Rogoff, 1985). The time-inconsistency problem generates inflation bias, which occurs when a government interferes with a central bank's operation. In this situation, if the central bank knows a public inflation expectation, it tends to create inflation surprise, increasing seigniorage and raises employment levels. Consequently, the central bank may lose credibility is which render its role in managing inflation challenging. Therefore, delegating monetary policy to an independent central bank is anticipated to promote the economic agent's trust in future macroeconomic stability. An independent central bank is believed to be better positioned to eliminate the time-inconsistency problem of monetary policy (Rogoff, 1985; Bernanke, 2010).

Central bank independence (hereafter, CBI) signifies that the central bank is free from political interference to pursue a monetary policy goal focused on inflation control (Berger et al., 2001). CBI can be classified into three aspects; personnel, financial and policy independence. Personnel independence refers to the fact that the government has restricted its influence over the central bank's boards. Neumann (1991) argues that the public might view the government's influence as encouraging the central bank to pursue the kinds of policies that are in the government's interests. Financial independence is related to the bank's ability to determine its budget so that it cannot be forced into printing money to finance budget deficits (Sargent and Wallace, 1981; Eijffinger et al., 1998). Finally, policy independence reflects the central bank's freedom to set and implement its monetary policy without any political interference.

An independent central bank that has a mandate to control the monetary policy has two keys dimensions of independence: goal independence and instrument independence (Fischer, 1995). Goal independence implies that the central bank has the ability to set the goal of monetary policy without the direct impact of the fiscal authority. Goal independence evaluates the role of central banks in determining the main goal of their monetary policy. Instrument independence means that the central bank has the freedom to adjust its monetary policy tools in achieving monetary policy goals without any interference from the government (Walsh, 2010). An independent central bank may have only goal independence, only instrument independence, or has both. For example, Banco central do Brazil has only instrument independence. Banco central de Chile only has goal independence. While, central bank of Indonesia has both goal independence and instrument independence.

According to Cukierman (1998), the reasons why countries strive to increase their level of CBI is to achieve low and stable inflation. First, the failure of international institutions designed to maintain low and stable inflation for example, the Bretton Wood System and European Monetary System (EMS), has led some countries to find an alternative institution. Second, the experience of the highly autonomy Bundesbank has revealed that an independent central bank can be an effective institution to deliver low and stable inflation. Third, based on the Maastricht Treaty, which created by the European Economic Community (EEC), countries that are members of this community have to increase the autonomy of the central bank as a prerequisite for membership of the European Monetary Union (EMU), with low and stable inflation being the main objective of this community. Fourth, in some Latin American countries, having successfully stabilised inflation, the policymakers are looking for an instrument that can reduce the likelihood of high and persistent inflation. Fifth, the improvement of the

Chapter 2

Theoretical Review on Central Bank Independence

2.1 CBI and Inflation

The theoretical view of CBI is related to time inconsistency in monetary policy based on the original paper of Kydland and Prescott (1977), Barro and Gordon (1983) and Rogoff (1985). Kydland and Prescott (1977) analyse the benefit of carrying out plans based on rules versus discretion. Barro and Gordon (1983) introduce inflation bias. They argue that policymakers have planned their objectives to reach a zero inflation rate, high growth, and employment. Policymaker had the incentive to trigger inflation surprises in order to bring about an increase in output and greater employment opportunities. Since Barro and Gordon (1983) assumed that the public is aware of policymaker's objective, then the expected inflation will equal to actual inflation. Inflation bias occurs under the discretionary monetary policy, where the government controls the central bank. Within this condition, if the central bank knows the public expectation, then it will have the ability to create inflation surprises to increase seigniorage income and achieve high employment and output. This result will affect people's trust in the central bank and will set a higher expectation in the following period. As inflation is a function of expected inflation, it will consequently be higher than it should have been. In the end, the central bank will find it challenging to manage inflation.

Barro and Gordon (1983) analysed inflation under discretionary monetary policy using the Lucas-Island supply function

$$y_t = y_n + a(\pi_t - \pi_t^e) + \varepsilon_t \tag{2.1}$$

where y_t is output; y_n is the natural rate of output; π_t is inflation; π_t^e is expected inflation; and ε_t is a real shock.

In this model, the output is a function of labour and capital (Cobb Douglas model). If actual inflation is greater than expected inflation, it leads to a real wage drop, as the expected real wage is lower than before, and the firm will absorb more labour. On the other hand, when expected inflation is higher than actual inflation, then real wage will rise, and the firm will reduce its number of employees.

Social loss function will be minimised by the central bank under the discretionary policy:

$$L = \frac{1}{2}\pi_t^2 + \frac{\lambda}{2}(y_t - y_n - k_t)^2 \tag{2.2}$$

where λ is society's preference for output, and k is constant. Under the discretionary monetary policy, on stabilising output and price, the output will be set by the monetary authority around $y_n + k$, while inflation will fluctuate around zero.

A simple relationship between inflation and the actual policy instrument adopted by policymaker gives:

$$\pi_t = \Delta m_t + v_t \tag{2.3}$$

where Δm is the growth rate of money supply (first difference of the log nominal supply of money), and v denotes the velocity shock. In setting Δm, this model assumes that expected inflation is given, supply shock (ε_t) is observable by the central bank but not velocity shock (ν_t), and also ε_t and ν_t are uncorrelated.

Firms use expected inflation to determine the wage. Meanwhile, the private agent has to carry out to the nominal wage contract before the central bank sets the nominal money supply growth rate. Under the discretionary policy, the central bank cares about output and attempts to decrease output variation through inflation. The central bank has the ability to make actual inflation different from the private agent's expectation.

By substituting Equations (2.1) and (2.3) into central bank loss function Equation (2.2), the effect of discretionary policy on inflation rate can be achieved, then take the first-order condition with respect to money growth:

$$\begin{aligned} V &= \frac{1}{2}\lambda\big[a(\Delta m + v - \pi)^2 + e - k\big]^2 + \frac{1}{2}(\Delta m + v)^2 \qquad (2.4)\\ 0 &= \lambda\big[a(\Delta m - \pi) + e - k\big] + (\Delta m)^2 \\ \Delta m &= \frac{a^2\lambda\pi_t^e + a\lambda(k-e)}{(1+a)^2\lambda} \end{aligned}$$

Equation (2.4) shows that aggregate supply shock occurs since the central bank wants to minimise output variability (λ) around its target, which results in high inflation. There is a trade-off between inflation and output variability. The private sector uses this model as their expectation, and thereafter, the optimal policy depends on private agents' expected inflation. The expected inflation is generated from observing the aggregate supply shock (ε) as follows:

$$\pi^2 = E[\Delta m] = \frac{a^2\lambda\pi^e + a\lambda k}{1 + a^2\lambda} \tag{2.5}$$

where $\pi^e = a\lambda k > 0$, substitute this into Equation (2.3) and use Equation (2.4) to get equilibrium rate of inflation under the discretionary policy:

$$\pi^d = \Delta m + v = a\lambda k - \left(\frac{a\lambda}{1 + a^2\lambda}\right)e + v \tag{2.6}$$

Equation (2.6) shows that positive inflation rate equals to $a\lambda k$. Inflation bias is determined by the effect of money supply on output (a), the weight which the central bank puts on an output objective (λ), and distortion (k). When private agents are able to fully anticipate this rate, it has no effect on output. If monetary policy is delegated to an independent and conservative central bank, the central bank puts weight on inflation, meaning that it will be:

$$\pi^d(\delta) = \Delta m + v = \frac{a\lambda k}{1 + \delta}a\lambda k - \left(\frac{a\lambda}{1 + \delta + a^2\lambda}\right)e + v \tag{2.7}$$

The equation above implies that inflation bias will be lower since $1+\delta > 1$ *or* $\delta > 0$ and this tends to reduce the loss function. However, the coefficient of aggregate supply shock (ε) is also lower, implying the central bank does not respond sufficiently to it. If it is more concerned with inflation than output stabilisation, inflation bias will be lower. However, this will also reduce output stabilisation. Thus, many researchers argue that lower average inflation can be reached by delegating monetary policy to a conservative and independent central bank. However, this is at the cost of lower output stabilisation. Thus, the trade-off between lower average inflation and higher output variability is expected to occur.

Rogoff (1985) proposed the solution for time-inconsistency problem by delegated monetary policy to an independent and conservative central bank which is more inflation averse than the government. A conservative and independent central bank would be able to reduce the average inflation, although the variability of output would increase. A conservative central bank can lower inflation bias caused by time-inconsistency monetary policy, but the central bank is less concerned in stabilising the output. Rogoff (1985) stated that there are two options to achieve price stability. The first is by a mandate to the government, and the second is by delegating monetary policy to a conservative central bank to achieve price stability.

If price stability is achieved by the government, society's loss function will be minimised:

$$\min\ L = b(y_t - y^*)^2 + (\pi_t - \pi^*)^2 \tag{2.8}$$

subject to

$$\text{Phillips curve} : y_t - y^p = (\pi_t - \pi^e) + \varepsilon_t \tag{2.9}$$

Assuming that $\pi^* = 0$ and $y^p = 0$. The loss function will become

$$L_G = b(y_t - y^*)^2 + \pi_t^2 \tag{2.10}$$

By substituting the constraint function to the objective function, and carrying out optimisation, the optimal inflation rate is obtained

$$L_G = b(a(\pi_t - \pi^e) + \varepsilon_t - y^*)^2 + \pi_t^2 \tag{2.11}$$

The first-order condition with respect to π_t is

$$\frac{\partial L_G}{\partial \pi_t} = 2ab[a(\pi_t - \pi^e) + \varepsilon_t - y^*] + 2\pi_t = 0 \tag{2.12}$$

$$2a^2b\pi_t - 2a^2b\pi^e + 2ab\varepsilon_t - 2aby^* + 2\pi_t = 0 \tag{2.13}$$

$$\pi_t(1 + a^2b) - a^2b\pi^e + ab\varepsilon_t - aby^* = 0 \tag{2.14}$$

Since inflation expectation is formed before the government takes the policy, the equation becomes:

$$\pi_t^e = E_{t-1}(\pi_t) = aby^* \tag{2.15}$$

Then the inflation and output are:

$$\pi_t^{**} = aby^* - \frac{ab}{1+a^2b}\varepsilon_t \tag{2.16}$$

$$y_t^{**} = \frac{1}{1+a^2b}\varepsilon_t \tag{2.17}$$

The author conclude that if the monetary policy mandate is given to the government:

1. There will be inflation bias, since $\pi_t^e > 0$

2. The higher the preference for output stabilisation (b), the higher inflation will be, which is

$$\frac{\partial E_{t-1}(\pi_t)}{\partial b} = ay^* > 0, \text{ and } \frac{\partial var\ \pi_t^{**}}{\partial b} > 0 \tag{2.18}$$

3. Delegating monetary policy mandate to the government which is pro-growth will not increase average output, since $y^p = 0$, so that $E\left(y^{**}\right) = 0$, $\frac{\partial E(y^{**})}{\partial b} = 0$, but will only reduce output volatility, where $\frac{\partial vary_t^{**}}{\partial b} < 0$.

Rogoff (1985) argues that in order to achieve price stability in the sense of low inflation, one must choose a conservative central bank that is more inflation averse. If monetary policy is delegated to a conservative central bank, the rate of inflation and output will be:

$$\pi_t^{**} = a\hat{b}y^* - \frac{a\hat{b}}{1 + a^2\hat{b}}\varepsilon_t \tag{2.19}$$

$$y_t^{**} = \frac{1}{1 + a^2\hat{b}}\varepsilon_t \tag{2.20}$$

where $\hat{b}$ is a conservative central bank preference for output stabilisation, the value of $\hat{b}$ is lower than the government's choice to stabilise output (b). A more conservative central bank is inflation-averse, while the government is more pro-growth, so $0 < \hat{b} < b$. Thus, delegating monetary policy to a conservative central bank will lead to a lower inflation rate than if the government mandated the monetary policy.

King (1997) illustrates the trade-off between rules and discretion in a simple and standard model. The output is described by the reduced form of the supply function

$$y = y^* + b(\pi - \hat{\pi}) + \varepsilon \tag{2.21}$$

where $\hat{\pi}$ is the private sector's expected rate of inflation, and the $b > 0$, shock ε is white noise with zero mean and variance σ^2. The output is denoted by y, and potential output is denoted by y^*. The inflation rate is denoted by π. If a constant velocity of circulation is assumed, and the previous period's price level to unity is normalized, the money stock, m, is given by

$$m = \pi + y \tag{2.22}$$

The representative agent's preferences are given by a loss function defined over quadratic terms in inflation and output. The desired level of inflation is zero, and the target level of output, ky^*, exceeds the natural rate of output.

$$L = aE\pi^2 + E(y - ky^*)^2 \tag{2.23}$$

where $a > 0$, $k > 1$, and $E(\cdot)$ is the expectation operator.

Monetary policy reaction function is:

$$m = \lambda_1 + \lambda_2 \varepsilon \tag{2.24}$$

The inflation target is denoted by π^*, while inflation and output are indicated as a function of private-sector expectation, the shock, the model parameter, and the policy reaction function, which itself comprises the inflation target and a response to the shock. In general:

$$y = y^* + b(\pi^* - \hat{\pi}) + \beta\varepsilon \tag{2.25}$$

$$\pi = \pi^* + \left(\frac{\beta - 1}{b}\right)\varepsilon \tag{2.26}$$

where $\beta = 1 + \{b(\lambda_2 - 1)\}\{1 + b\}$.

The first best monetary policy reaction function is the state-contingent rule. The optimal output is reached by minimising the expected loss L, subject to rational expectations in the private sector.

$$y_0 = y^* + \frac{a}{a + b^2}\varepsilon \tag{2.27}$$

$$\pi_0 = -\frac{a}{a + b^2}\varepsilon \tag{2.28}$$

The optimal value of loss function can be achieved by putting zero in inflation target and there is no inflation bias.

$$L_0 = z^2 + \frac{1}{1 + \theta}\sigma^2 \tag{2.29}$$

where $z = (h - 1)y^*$, $\theta = b^2/a$. The left-hand side of the loss function shows that output equals y^* rather than ky^* on average, and the right-hand side shows the loss from shocks. The value of L_0 is a benchmark against which other policy reaction functions may be judged.

If a state-contingent rule is not credible, then the optimal policy rule is determined with the contingent rule, except that λ_2 is constrained to zero.

$$y_R = y^* + \frac{1}{1 + b}\varepsilon \tag{2.30}$$

Chapter 3

Empirical Literature on Central Bank Independence

3.1 CBI and Inflation

The first empirical study to investigate the relationship between CBI and inflation was Grilli et al. (1991). They used their own CBI index to examine the effect of CBI on inflation in 18 OECD countries from 1950 to 1989, and found a significant negative relationship between these variables. However, when the sample periods were divided into four decades, they still proved that there exists a negative relationship between CBI and inflation. Cukierman et al. (1992) measured the legal CBI index for 72 countries and divided the sample into developing and developed countries for the period between 1950 and 1989. They found a negative relationship between legal CBI and inflation only for advanced economies, but not for developing economies.

Jonsson (1995) studied 18 countries from 1961 to 1989 to examine the effect of CBI on inflation. He employed a pooled least square to test the assumption of exogeneity in his study. Using Cukierman et al.'s (1992) CBI index, he found a negative relationship between CBI and inflation. After the period was separated into three different decades, CBI became the most critical aspect in reducing inflation during a high inflation period (1972-1979). Ahsan et al. (2008) constructed an index of central bank independence and governance (CBIG) in the Asia Pacific for 36 countries for the period 1991 to 2005 and examined its effects on inflation. By using pooled least square and applying a dummy variable for the Asian financial crisis of 1997, they concluded that there was a strong negative correlation between CBIG and inflation, particularly in the post-crisis period, since CBIG improved in their sample countries after the Asian financial crisis. But after separating the sample countries into low income and high-income countries, the result showed that CBIG was not efficient to reduce inflation for low-income economies.

Bogoev et al. (2012) employed fixed effect panel data for 17 transition countries in Central and Eastern Europe from 1990 to 2009. They used Cukierman et al.'s (1992) index for legal CBI and found that CBI was an essential factor behind disinflation after controlling for the effect of some macroeconomic and institutional variables. Bodea and Hicks (2015) expanded Cukierman et al.'s (1992) index of CBI for 78 countries from 1973 to 2008. They used this information to conclude that CBI is linked to lower inflation and is also dependent on the country's level of democracy. This study shows that countries that have undergone central bank reform have a higher degree of independence, and thus have lower inflation compared to countries that have not experienced such a reform.

Some empirical studies show that the negative effect of CBI on inflation exists only when high inflation countries are removed from the sample. King and Ma (2001) found various results of the impact of CBI on inflation in advanced, middle and low-income economies. By including the degree of tax centralisation and using panel data for 42 countries for the period 1965 to 1990, they found a positive relationship between CBI and inflation for all of the countries in their sample. However, after excluding sample countries with inflation of over 20%, they found that the relationship between CBI and inflation had a negative sign. Temple (1998), used Cukierman et al.'s (1992) legal index to investigate the effect of CBI on inflation. By including high inflation countries in his sample of OECD and developing economies, the reverse relationship disappeared. However, when the outlier countries were removed from his regression, a strong correlation between CBI and inflation was found at a 1% level of significance. He concluded that the existence of a reverse relationship between CBI and inflation profoundly influenced the presence of high inflation economies.

However, some research has concluded that in fact, there exists no such negative relationship between CBI and inflation. Campillo and Miron (1997) examined the relationship between CBI and average inflation for 49 countries from 1973 to 1994. Without any control variable in their model, they found no significant effect of CBI on inflation. Even after omitting high inflation countries (exceeded 50% inflation), the result was still inconsistent with the theory. Daunfeldt and De Luna (2008) looked at the data from 1975 to 2000 from 29 OECD countries and applied a non-parametric regression method to compare the long-term inflation data with an increase in the CBI index. They claimed that there is no correlation between CBI and inflation. They stated that price stability might have been achieved by an exchange rate agreement rather than central bank reforms. In their study, Jácome and Vázquez (2008) explored the effect of CBI on inflation in 24 Latin American and Caribbean countries from 1985 to 2002. By using an instrumental variable method with panel data, they uncovered a negative relationship between CBI and inflation. More recently, Posso and Tawadros (2013) estimated the effect of CBI on inflation for the periods 1987 to 1991 and 2002 to 2006 for 96 countries. They suggest that CBI has no significant impact on inflation, and claim that CBI is not an important aspect in lowering inflation.

Some recent studies have also failed to find a negative relationship between CBI and inflation. Dumiter et al. (2015) analysed the relationship between CBI and inflation for developed and developing countries in a different group from 2005 to 2014. Using a pooled least square and two-stage least square panel data model, they did not find a significant negative effect of CBI on inflation for either group. The lack of a relationship between those variables was due to the quality and quantity of the data, the time period, and the econometrical tools. Agoba et al. (2017) investigated the role of the financial system and quality of political institutions on the effectiveness of CBI in reducing inflation. They applied a 2SLS instrumental variable estimator for a sample of 48 African countries during the period 1970 to 2012. They introduced inflation targeting as an additional explanatory variable, using interaction terms between financial development and institutional quality, and comparing the relative effectiveness of banking sector development. However, they failed to find a negative relationship between CBI and inflation in African countries because those countries lacked high-level financial systems and political institutions.

3.2 CBI and Financial Asset Prices

The effect of monetary policy on financial asset prices has become one of the most interesting research in macroeconomic policy since the last two decades. Rigobon and Sack (2004) estimated the response of financial asset prices to changes in monetary policy in the US using daily data from January 3, 1994, to November 26, 2001. They performed identification by means of the heteroskedasticity method which relies on examining changes in the co-movement of interest rates and financial asset prices when the variance of one of the shocks in the system is recognised as shifting. As a result, the response of financial asset prices to the interest rate can be measured. They claimed that stock index has a significant negative reaction to monetary policy. However, the increase in the short-term interest rate has a positive and significant effect on the Eurodollar rate and bond yield.

Changes in monetary policy could be caused by changes central bank governor, thereby influencing on financial asset prices has been investigated by Kuttner and Posen (2010). They assessed the impact of changing the governor of the central bank on exchange rate and bond yield in 15 industrialised countries covering the years 1974 to 2006. To calculate the volatility of the exchange rate and bond yield, they used bootstrapped critical values instead of those derived from the normal distribution, seeing as they found that changes to the exchange rate and bond yield are not distributed normally and both skewed and leptokurtotic. They suggest that central bank appointments should change the markets through their effect on expected inflation and the interest rate. Their findings revealed that the exchange rate has a statistically significant response to the announcement of a new governor. However, they failed to establish a consistently significant response with respect to bond yield to the announcement of a new governor. One probable reason regarding that failure is due to the limited availability of daily bond yield data.

Moser and Dreher (2010) examined the effect of changing the governor of the central bank on the foreign exchange market, domestic stock market and sovereign bond spreads based on a data set for 20 emerging countries over the period 1992 to 2006. They suggest that financial markets react positively to a new central bank governor of the central bank, such changes convey new information on the subject of future monetary policy. As inflation bias is determined by the degree of CBI, the public's perception of inflation expectation will be affected. Consequently, asset price should change to the extent of their sensitivity to inflation. Their results show that changing the governor of the central bank has a negative effect on the financial market. The reasons why investors respond negatively is because the new governor of the central bank apparently suffers from a systemic credibility problem.

The effect of CBI on stock market return has been analysed by Forch and Sunde (2012). Using monthly observations from 1988 to 2007 in 27 emerging economies, they calculate stock market returns as the percentage month-to-month change in the price stock market index obtained from Morgan Stanley Capital International (MSCI) emerging market index. Additionally, they use the legal CBI index constructed by Cukierman et al. (1992). Their first investigation examined the impact of CBI on stock market returns applying the non-parametric test of equality of stock market returns prior to and after changes in CBI. Their results reveal that changes in CBI have a positive relationship with stock market returns over one month after the changes. However, they determine that CBI has no significant effect on stock market returns for the periods of three, six and 12 months after the CBI changes. Their second analysis uses fixed effect panel data estimation. They find a positive and significant effect of CBI on stock market returns, which implies that CBI appears to be beneficial concerning market performance. Papadamou et al. (2017) investigated the effect of CBI on stock market volatility. In their study, they use annual data for the period 1998 to 2005 and sample 29 developed and developing countries using panel data estimation. They divided stock market volatility into conditional stock market volatility that is obtained from the standard deviation of quarterly stock index and historical stock market volatility which can be measured using GARCH based stock return volatility. Using pooled OLS and the Prais-Winsten method with PCSEs, they confirm the positive and significant effect of CBI on both conditional and historical stock market volatility. This implies that a greater level of CBI can increase stock market volatility, which means that a high level of CBI can contribute to financial instability. They argue that there is a trade-off between price stability and financial stability and moreover, that the monetary authorities prefer price stability.

Bodea and Hicks (2014) examined the effect of the CBI index on 10-year domestic bond yield for a sample of 78 OECD and non-OECD countries during the period 1974 to 2007. They used Cukierman et al.'s (1992) index for CBI, as they were able to recognise the central bank's reforms for every country. They argue that a higher degree of legal CBI index is a signal to attract investors seeing as CBI is granted via regular legislation and the risk of independence comes from implicit or explicit threats to amend the law. Using fixed effect estimation for panel data since the fixed effects control time-invariant country specifics, while the time trend helps control the overtime increase of bonds. They determined that CBI has a negative relationship with 10-year bond rates in non-OECD countries, but CBI has no significant effect on 10-year bond rates for full sample countries. They argue that non-OECD countries may expect lower bond yield from greater CBI, when compared to other economies and moreover, that CBI can act as a separating signal.

Eichler and Littke (2018) investigated the effect of CBI on exchange rate volatility using panel data for 62 economies from 1998 to 2010. They reported that a conservative and independent central bank will reduce the public's uncertainty about the central bank's policy objective, thus reduce the volatility of inflation expectation. Consequently, agents are easier to estimate the long-run equilibrium value of the exchange rate and to assess the degree of exchange rate valuation in the short-run. They also revealed that exchange rate volatility depends on price flexibility in the goods market, central bank preferences for price stability and the interest rate sensitivity related to money demand. They established strong empirical evidence that an increase in independent central banks decreases exchange rate volatility. They argued that more conservative and independent central banks produce lower uncertainty concerning inflation expectation, thus creating a pronounced stabilising effect on exchange rate volatility.

The relationship between asset price and consumption and invest-

Chapter 4

Data and Econometric Methodology

4.1 CBI and Inflation

4.1.1 Data

The panel data used in this study covers 37 developing countries[1] determined by data availability[2]. Our dataset consists of seven variables: inflation, CBI, output gap, openness, fiscal deficit, US inflation and the unemployment rate in the period from 1972 to 2016. Inflation is defined as the percentage change in the consumer price index over the corresponding period from the previous year, and is provided by International Financial Statistics from the IMF.

For the measure of CBI, the author follow the CBI index constructed by Cukierman et al. (1992). This index is based on a legal aspect of independence. The index is between 0 and 1, with higher values denoting greater CBI for the legal index. The data for the CBI index

[1] The classification of developing countries based on IMF's World Economic Outlook

[2] List of countries is in Table A.1 in Appendix A

is a legal variable aggregate weighted taken from Garriga's (2016) data set.

The output gap is measured as the difference between the actual output (y) and the potential output (y*). The Hodrick-Prescott-filter is employed to compute the potential output (Hodrick and Prescott, 1997) since it is the most commonly accepted methodology for doing so. The gap is then calculated as the percentage deviation of output from its potential.

Following Catao and Terrones (2005), this chapter includes trade openness, calculated by the sum of export and import as a share of GDP. The author collected the data for trade openness from the IFS database. This chapter includes trade openness because several studies have found that openness has a significant effect on inflation (Terra, 1998; Jácome and Vázquez, 2008).

Another control variable is the fiscal deficit. The fiscal deficit is measured as the difference between government revenue and government expenditure, as a percentage of GDP following the approach of Bodea and Hicks (2015), Griffin (2011) and Bogoev et al. (2012). A negative sign denotes a deficit. The data is provided by the IFS.

US inflation is also included because the United States is the largest trading partner for developing countries. Given that around 50% of US trade is with developing countries, inflation in the US can spread to developing countries.

The unemployment rate is added, calculated as the percentage of those who are unemployment out of the total labour force. The data come from the World Economic Indicator from the World Bank database. Since data on the unemployment rate are only available from 1991 to 2016, the author follow the model of Kitov and Kitov (2011), who used Okun's law to predict the unemployment rate from 1972 to 1990.

4.1.2 Econometric Methodology

This study investigates the relationship between CBI and inflation. The author follows Cukierman et al. (1992); Eijffinger et al. (1998) models:

$$INF_{it} = \beta_0 + \beta_1 CBI_{it} + \varepsilon_{it} \tag{4.1}$$

The author extends the model by adding control variables. The first model is:

$$INF_{it} = \beta_0 + \beta_1 CBI_{it} + \beta_2 GAP_{it} + \beta_3 OPEN_{it} + \beta_4 FD_{it} + \varepsilon_{it} \tag{4.2}$$

In addition, by following Crowder (1996) that domestic inflation can be influenced by other countries inflation as an external shock. This chapter adds United States inflation since the United States is the large economy thus given its most influential role for small open economies (Cheung and Yuen, 2002). Therefore, the author extends Equation (4.2) to include United States inflation in order to examine their influence on inflation. Thus, the second model follows:

$$\begin{aligned} INF_{it} = {} & \beta_0 + \beta_1 CBI_{it} + \beta_2 GAP_{it} + \beta_3 OPEN_{it} + \beta_4 FD_{it} \\ & + \beta_5 USINF_t + \varepsilon_{it} \end{aligned} \tag{4.3}$$

The unemployment rate is one of the possible influence on inflation. A higher unemployment rate might increase the incentive for the government to drive economic expansion; as a result, increase the time-consistent inflation rate (Walsh, 1995). Phillips (1958) reported the negative relationship between inflation and unemployment rate. He described the trade-off between inflation and unemployment then become known as the Phillips curve. After the unemployment rate is added on Equation (4.2), our third model as:

$$\begin{aligned} INF_{it} = \beta_0 + \beta_1 CBI_{it} + \beta_2 GAP_{it} + \beta_3 OPEN_{it} + \beta_4 FD_{it} \\ + \beta_5 UNP_{it} + \varepsilon_{it} \end{aligned} \tag{4.4}$$

In the fourth model, both US inflation and unemployment rate are added on our basic model in Equation (4.2). Then model 4 is:

$$\begin{aligned} INF_{it} = \beta_0 + \beta_1 CBI_{it} + \beta_2 GAP_{it} + \beta_3 OPEN_{it} + \beta_4 FD_{it} \\ + \beta_5 USINF_t + \beta_6 UNP_{it} + \varepsilon_{it} \end{aligned} \tag{4.5}$$

where INF is inflation, CBI is legal CBI index, GAP is output gap, $OPEN$ is openness trade, FD is a fiscal deficit, $USINF$ is US inflation, and UNP is the unemployment rate. GAP $OPEN$, FD, $USINF$, and UNP are control variables. $i = 1,2,\ldots,N$ sections and $t=1,2,\ldots,T$ time periods.

4.1.3 Panel unit root tests

In this study, the stationary properties for all variables will be checked using some different panel unit root tests. Levin et al. (2002) introduced the LLC test for panel data which allow individual intercepts and time trends, and heterogenous autocorrelation for the error terms. The main model in Levin et al. (2002) is:

$$\Delta y_{it} = \delta y_{it-1} + \sum_{L=1}^{p_i} \theta_{iL} \Delta y_{it-L} + \alpha_{mi} d_{mt} + \varepsilon_{it}, \quad m = 1, 2, 3 \tag{4.6}$$

The null hypothesis is

$$H_0 : \delta = 0 \quad \text{against} \quad H_1 : \delta \neq 0 \tag{4.7}$$

LLC test is based on a three-step procedure. The first step is applying ADF regressions for every individual cross-section, and obtain two orthogonalized residuals. Then estimating the ratio of long-run to the short-run standard deviation for each cross-section is conducted in the second step. The final step is to regress the pooled estimation.

$$\tilde{e}^*_{i,t} = \delta \tilde{v}^*_{it-1} + \tilde{\varepsilon}^*_{it}, \tag{4.8}$$

Breitung (2005) shows that bias adjustment in Levin et al. (2002) the test may cause severe power loss. Then he proposed a test which does not require bias correction. The test contains three steps: the first is to obtain standardised residuals, $\tilde{e}_{i,t} = \frac{\hat{e}_{i,t}}{\hat{\sigma}_{\epsilon,i}}$; $\tilde{v}_{i,t-1} = \frac{\hat{v}_{i,t-1}}{\hat{\sigma}_{\epsilon,i}}$, thus $\tilde{e}_{i,t}$ and $\tilde{v}_{i,t-1}$; excluding the deterministic terms, the regression of $\Delta y_{i,t}$ and $y_{i,t-1}$ on $\Delta y_{i,t-L}$; $L = 1, 2, ..., p_i$ are performed. The second step is to transform $\tilde{e}_{i,t}$ and $\tilde{v}_{i,t-1}$ using forward orthogonalisation to obtain $\tilde{e}^*_{i,t}$ and $\tilde{v}^*_{i,t-1}$. The final step is to gain a test statistic for $H_0 : \rho = 0$ by following pooled regression of $\tilde{e}^*_{i,t}$ and $\tilde{v}^*_{i,t-1}$;

$$e^*_{i,t} = \rho v^*_{it-1} + \varepsilon^*_{it}, \tag{4.9}$$

Breitung (2005) shows that under the null hypothesis, t-statistic follows an asymptotic standard normal distribution.

The IPS tests constructed by Im et al. (2003) will be employed. Im et al. (2003) developed a panel unit root testing for dynamic heterogeneous panels under cross-sectional independence assumption. The model heterogeneous T periods and N cross-sections with errors in serially correlated is:

$$\Delta Y_{it} = \alpha_i + \beta_i Y_{i,t-1} + \sum_{j=1}^{p_i} \rho_{i,j} \Delta Y_{i,t-j} + \varepsilon_{i,t} \tag{4.10}$$

where Δ is the first different, $i = 1, \cdots, N$ and $t = 1, \cdots, T$. ε_{it} is identical and independently distributed.

The null hypothesis that contains a unit root is

$\mathrm{H}_0 : \beta_i = 0$ for all $i = 1, \cdots, N$

The alternative hypothesis of stationary is

$\mathrm{H}_1 : \beta_i < 0$ for all $i = N_1 + 1, \cdots, N$, with $0 < N_1 < N$.

The t-statistic of IPS test is:

$$Z_{IPS} = \frac{\sqrt{N}\left(\bar{t}_{NT} - N^{-1}\sum_{i=1}^{N} E\left[\tilde{t}_{Ti}\right]\right)}{\sqrt{N^{-1}\sum_{i=1}^{N} Var\left[\tilde{t}_{Ti}\right]}} \Longrightarrow N(0,1) \tag{4.11}$$

where N denotes the number of cross-section units, β_i is autoregressive root, $E\left[\tilde{t}_{Ti}\right]$and $Var\left[\tilde{t}_{Ti}\right]$ are the moment of mean and variance attained from Im et al. (2003) simulation and $\bar{t}_{NT}$ denotes the average computed ADF statistic defined as follow

$$\bar{t}_{NT} = \frac{1}{N}\sum_{i=1}^{N} t_{iTi} \tag{4.12}$$

4.1.4 Pooled Least Square and Fixed Effect Estimation

A. Pooled Least Square Estimation

Assume that a panel data of N cross-section units and T observation time series. Following Asteriou and Hall (2016) simple linear model with one explanatory variable:

$$Y_{it} = \alpha + \beta X_{it} + u_{it} \tag{4.13}$$

where Y and X have both i and t for i= *1,2,...,*N sections and t=*1,2,...,*T time periods. $u_{it} \sim N(0, \sigma^2)$ *for all i and t.* X_{it} is assumed to be uncorrelated with u_{it}. Pooled least square model is assuming that all the coefficients in the model are the same across cross-sectional and time series observations.

B. Fixed Effect Estimation

In the pooled least square estimation in Equation (4.13), the disturbance term u_{it} capture the unobservable heterogeneity which consists of unobservable specific effect and remainders disturbance.

$$u_{it} = \mu_i + \nu_{it} \tag{4.14}$$

where μ_i denotes the unobservable country-specific effect and ν_{it} represents the remainder disturbance. The country-specific effect such as cultural, political, and institutional factors which are not constant over time are not included in the model. For one-way error component model, Baltagi (2008) reveals that these unobservable country-specific effects can be accounted into the model. The equation for the fixed effect is given:

$$y_{it} = \alpha + \beta x_{it} + \mu_i + \nu_{it} \tag{4.15}$$

For each country observation i, averaging equation

$$\bar{y}_{it} = \alpha + \beta \bar{x}_{it} + \mu_i + \bar{\nu}_{it} \tag{4.16}$$

Then subtracting Equation (4.15) from Equation (4.16) gives:

$$y_{it} - \bar{y}_{it} = \beta(x_{it} - \bar{x}_{it}) + (\nu_{it} - \bar{\nu}_{it}) \tag{4.17}$$

Note that the unobservable country-specific effect,μ_i, has disappeared. The transformation process in Equation (4.17) is known by within transformation.

4.1.5 Diagnostic test for POLS and Fixed Effect

A. Poolability Test

This chapter applies poolability test to check whether the parameter of our equation varies from one country to the other. Pooled least square model represents a behavioural equation with the same parameters over time and across groups. On the other hand, the unrestricted model has the same behavioural but different parameters across time and across groups (Baltagi, 2008). The restricted model for each group is:

$$y_{it} = Z_i \delta_i + u_i \quad i = 1, 2, ..., N \tag{4.18}$$

where $y_i^{'} = (y_{i1}, ..., y_{iT})$, $Z_i = [\iota T, X_i]$ and X_i is T x K. $\delta_i^{'}$ is 1 x $(K{+}1)$, and u_i is (T x 1). $\delta_i^{'}$ is vary for every individual equation.

The restricted model is given by:

$$y = Z\delta + u \tag{4.19}$$

where $Z^{'} = (Z_1^{'}, Z_2^{'}, ..., Z_N^{'})$, $u^{'} = (u_1^{'}, u_2^{'}, ..., u_N^{'})$.

The null hypothesis is the poolability test is

$$H_0 : \delta_i = \delta \quad \text{against} \quad H_1 : \delta_i \neq \delta \tag{4.20}$$

Chow Test

Chow (1960) constructed a poolability test under the assumption that $u \sim N(0, \sigma^2 I_{NT})$ by using the F-test to test the hypothesis.

$$F_{Chow} = \frac{(RRSS - URSS)}{URSS} \frac{(N-1)}{(NT - N - K)} \tag{4.21}$$

RRSS is the restricted residual sum of the square of pooled least square, URSS denotes the unrestricted residuals sum of the square of all individual regressions. Under the H_0, the statistic of F_{obs} is distributed as F with $N-1, N(T-1)-K$ degree of freedom.

Roy Zellner Test

Roy-Zellner test is a generalisation of the Chow test for the N linear regression case, under the assumption of heteroskedastic variances (Roy, 1957; Zellner, 1962). The F statistic of Roy Zellner test can be achieved as

$$F_{RZ} = \frac{(ess_c - (ess_1 + ess_2 + ... + ess_N)}{(ess_1 + ess_2 + ... + ess_N)} \frac{(N-1)(K+1)}{N(T-K+1)} \tag{4.22}$$

where ess_c denotes the error sum of square the pooled regression, and $ess_1 + ess_2 + ... + ess_N$ are the error sum of square from the N separate time series regressions.

In this test, all regressions are transformed to have homoskedastic variances. The null hypothesis is $H_0 : \delta_i = \delta$ for every $i = 1, 2, ..., N$.

B. Test for The Presence of Fixed Effect

The fixed effect model in Equation (4.17) will yield bias estimates because the individual effect dummies are omitted by OLS estimation. Baltagi (2008) demonstrates how the joint significance of these dummies can be checked by applying an F-test. The author tests the hypothesis that the individual effects assuming there is no time effect. The null hypothesis is $H_0 : \mu_i = 0$ for every $i = 1, 2, ..., N-1$.

In this case:

$$F_{1-way} = \frac{(RRSS - URSS)/(N-1)}{URSS/(NT-N-K)} \overset{H0}{\sim} F_{N-1,N(T-1)-K} \tag{4.23}$$

RRSS is the restricted residual sum of the square of pooled least square, URSS denotes the unrestricted residuals sum of the square of the LSDV regressions. Under the H_0, the statistic of F_{obs} is distributed as F with $N-1, N(T-1)-K$ degree of freedom.

4.1.6 Heterogeneous Panel Data Estimation

In the case that pooled least square estimator is not poolable because the assumption of homogeneity is not held. This chapter, therefore, adopts mean group estimator developed by Pesaran and Smith (1995) and pooled mean group estimator constructed by Pesaran et al. (1999). MG estimator assumes that the short-run and long-run coefficients are different across countries. Pesaran and Smith (1995) start the model with a simple heterogeneous dynamic model:

$$y_{it} = \lambda_i y_{i,t-1} + \beta_i^{'} \mathbf{x}_{it} + \varepsilon_{it}, \qquad i = 1, 2, ..., N, \quad t = 1, 2, ..., T, \tag{4.24}$$

where coefficients λ_i and β_i varying across groups according to the random coefficient model:

$$H_a : \lambda_i = \lambda + \eta_{1i}, \quad \beta_i = \beta + \eta_{2i}, \tag{4.25}$$

Assume that η_{1i} and η_{2i} have zero mean and constant covariances. It is also assume that higher-order moments of η_{1i} and η_{2i} and their cross moments exist and are finite. The short-run coefficients are β_i and λ_i, they are gained from the standard formulation of the random coefficient model. While, the long-run effects, $\theta_i = \beta_i/(1-\lambda_i)$, and the mean lags, $\psi_i = \lambda_i/(1-\lambda_i)$, vary randomly across groups:

$$H_b : \psi_i = \psi + \zeta_{1i}, \quad \theta_i = \theta + \zeta_{2i}, \tag{4.26}$$

ζ_{1i} and ζ_{2i} are assumed to have zero mean and constant covariances. The mean group estimator of $\mathbf{x}$ on y can be obtained from the average short-run coefficient or the average of long-run equilibrium:

$$\hat{\beta}_{MG} = N^{-1} \sum_{i=1}^{N} \beta_i \tag{4.27}$$

where $\hat{\beta}_i$ is the OLS estimator of β_i.

Pesaran et al. (1999) developed the pooled mean group estimation which incorporates both long-run and short-run effects by adopting an Autoregressive Distributive Lag structure (ARDL), and estimating ARDL method as an Error Correction Model. PMG estimator allows the intercepts, short-run coefficients, and error variances vary for every cross-sections, but the constraint of long-run coefficients are the same. Pesaran et al. (1999) showed that the effect of explanatory variable on the dependent variables can be tracked by taking sufficient lags in ARDL structure to solve the spurious regression. Meanwhile, the error correction model integrates the short-run dynamics and the long-run equilibrium without losing information of the long-run. PMG model is based on ARDL $(p, q, q, ..., q)$ model,

$$y_{it} = \sum_{j=1}^{p} \lambda_{ij} y_{i,t-j} + \sum_{j=0}^{q} \delta_{ij}^{'} \mathbf{x}_{i,t-j} + \mu_i + \varepsilon_{it} \tag{4.28}$$

where $\mathbf{x}_{it}$ $(kx1)$ is the vector of exogenous variables for group i. μ_i represents the fixed effects; λ_{ij} are the scalar which are the coefficients of the lagged dependent variables, and δ_{ij} are $(kx1)$ coefficient vectors. In PMG model T must be large in order to estimate the model for every cross-section. By re-parametrization, the equation become:

$$\Delta y_{it} = \phi i y_{i,t-1} + \beta_i^{'} \mathbf{x}_{it} + \sum_{j=1}^{p-1} \lambda_{ij}^{*} \Delta y_{i,t-j} + \sum_{j=0}^{q-1} \delta_{ij}^{*} \Delta \mathbf{x}_{i,t-j} + \mu_i + \varepsilon_{it} \tag{4.29}$$

for $i = 1, 2, ..., N$, and $t = 1, 2, ..., T$, where

$$\phi_i = \left(\sum_{j=1}^{p} \lambda_{ij}^{*} \lambda_{ij} - 1 \right) = -\left(1 - \sum_{j=1}^{p} \lambda_{ij}^{*} \lambda_{ij} \right), \quad \beta_i = \sum_{j=0}^{q} \delta_{ij},$$

$$\lambda_{ij} = - \sum_{m=j+1}^{p} \lambda_{im}, \quad \delta_{ij} = - \sum_{m=j+1}^{q} \delta_{im} \tag{4.30}$$

The error correction parametrization can be written as:

$$\Delta y_{it} = \phi i \mathbf{y}_{i,t-1} + \mathbf{x}_i \beta_i + \sum_{j=1}^{p-1} \lambda_{ij}^* \Delta y_{i,-j} + \sum_{j=0}^{q-1} \Delta \mathbf{x}_{i,-j} \delta_{ij}^* + \mu_i \iota + \varepsilon_i \tag{4.31}$$

$i = 1, 2, ..., N$, where $\mathbf{y}_i = (y_{i1}, ..., y_{iT})'$ is a $Tx1$ vector of the observations on the dependent variable of the i th group, $\mathbf{X}_i = (x_{i1}, ..., x_{iT})'$ is a $Tx1$ matrix of observations on the regressors that vary both across groups and time veriods. $\iota = (1, ..., 1)'$ is a $Tx1$ vector of 1s, $\mathbf{y}_{i,-j}$ and $\mathbf{X}_{i,-j}$ are j period lagged values of y_i and X_i, and $\Delta\mathbf{y}_i = \mathbf{y}_i - \mathbf{y}_{i-1}$, $\Delta\mathbf{X}_i = \mathbf{X}_i - \mathbf{X}_{i-1}$, $\Delta\mathbf{y}_{i,-j}$ and $\Delta\mathbf{X}_{i,-j}$ are j period lagged values of $\Delta\mathbf{y}_i$ and $\Delta\mathbf{X}_i$, and $\varepsilon_i = (\varepsilon_{i1}, ..., \varepsilon_{iT})'$.

This chapter also employ the Hausman test to check the long-run homogeneity hypothesis of pooled mean group estimator. The null hypothesis in this test is pooled mean group estimator is consistent and more efficient than mean group estimator (Pesaran et al., 1999). If the null hypothesis is rejected, then it cannot be assumed the same long-run coefficients for all panels and the restriction imposed by pooled mean group estimator is not valid. In other words, mean group estimator is preferred.

4.2 CBI and Financial Asset Prices

4.2.1 Data

For the measure of CBI, this chapter follows the CBI index constructed by Cukierman et al. (1992). This index is based on the legal aspect of independence. The index is between 0 and 1, with higher values denoting greater CBI for the legal index. The data relating to the CBI index is legal variable aggregate weighted obtained from Garriga's

(2016) data set.

The role of financial asset prices is represented by the exchange rate, stock index and bond yield. This chapter uses the exchange rate and stock index in terms of logarithm natural. Exchange rate is the bilateral currency of each country's sample against the U.S. dollar (USD). The data are retrieved from the International Financial Statistics (IFS) of the International Monetary Fund (IMF). The stock index is local market indices measured in local currency, which obtain from Bloomberg. This chapter uses the government securities interest rate as a proxy for government bond yield, whereby data are retrieved from the IFS of the IMF.

This chapter uses household consumption and investment following Claessens and Kose (2017). The reason why this chapter uses total consumption and investment is because consumption is the largest share of output, while investment is the most volatile component of output (Beaudry et al., 2015). Household consumption data is the private consumption expenditure. The data are retrieved from the IFS of the IMF. Investment is measured as gross fixed capital formation and it is taken from the IFS of the IMF. Consumption and investment are in terms of logarithm natural.

4.2.2 Panel Vector Autoregressive

The primary goal of this study is to observe the impact of CBI shock on financial asset prices in developing countries. To solve this problem, this chapter applies a panel VAR proposed by Canova and Ciccarelli (2013). In the panel VAR model, all variables are considered as endogenous and interdependent but a cross-sectional dimension is included in the representation. Let, Y_t as the stacked model of y_{it}, the vector of G variables for each unit i=1,...,N, i.e., $Y_t = (y'_{1t}, y'_{2t}, ..., y'_{Nt})'$ where i is generic and indicate countries. Then, a panel VAR is:

$$y_{it} = A_{0i}(t) + A_i(\ell)Y_{t-1} + u_{it} \quad i = 1, ..., N \;\; t = 1, ..., T \tag{4.32}$$

where $A(\ell)$ is a polynomial in the lag operator and iid, A_0t is the deterministic components, u_{it} is a $G \times 1$ vector of random disturbances. Equation (4.32) may include constants, seasonal dummies and deterministic polynomial in time.

A typical variation of Equation (4.32) allows the G variables in Y_t to be linear function of a set of predetermined or exogenous variables, W_t. Then Equation (4.32) can be written as:

$$y_{it} = A_{0i}(t) + A_i(\ell)Y_{1t-1} + F_i(\ell)W_t + u_{it} \tag{4.33}$$

where $u_t = [u_{1t}, u_{2t}, ..., u_{Nt}]' \sim iid(0, \sum)$, $F_{i,j}$ are $G \times M$ matrices for each lag $j = 1, ..., q$, and W_t is a $M \times 1$ vector of predetermined or exogenous variables, common to all unit i.

A panel VAR has three characteristic features. First, lags of all endogenous variables of all units enter the model for unit i, it is known by dynamic interdependencies. Second, u_{it} is generally correlated across i, it is called static interdependencies. The third characteristic is cross-section heterogeneity where the intercept, the slope, and the variance of the shocks u_{1it} may be unit specific.

In carrying out a panel VAR model, the optimal lag has to be obtained through the lag selection criteria. The optimal lag is needed in order to find more efficient and unbiased results. The selection of lag lengths to the panel VAR is very crucial step to choose the optimal lag lengths that allow the panel VAR model to reflect a sufficiently rich dynamic structure in the model. The lag lengths in the panel VAR model is selected based on the Akaike Information Criteria (AIC).

A. Model 1: CBI, Exchange Rate, Consumption and Investment

Our Panel VAR model to analyse the interaction among CBI, exchange rate, consumption and investment includes four endogenous variables: exchange rate (ER), CBI, household's consumption (Cons), and investment (Inv). Turning now to the full panel VAR case, in our model G=4, thus our Panel VAR models are:

$$ER_{it} = \alpha_{1,i} + \sum_{j=1}^{k} a_{1,j} ER_{i,t-j} + \sum_{j=1}^{k} b_{1,j} CBI_{i,t-j} + \sum_{j=1}^{k} c_{1,j} Cons_{i,t-j} + \sum_{j=1}^{k} d_{1,j} Inv_{i,t-j} + u_{1,it} \tag{4.34a}$$

$$CBI_{it} = \alpha_{2,i} + \sum_{j=1}^{k} a_{2,j} ER_{i,t-j} + \sum_{j=1}^{k} b_{2,j} CBI_{i,t-j} + \sum_{j=1}^{k} c_{2,j} Cons_{i,t-j} + \sum_{j=1}^{k} d_{2,j} Inv_{i,t-j} + u_{2,it} \tag{4.34b}$$

$$Cons_{it} = \alpha_{3,i} + \sum_{j=1}^{k} a_{3,j} ER_{i,t-j} + \sum_{j=1}^{k} b_{3,j} CBI_{i,t-j} + \sum_{j=1}^{k} c_{3,j} Cons_{i,t-j} + \sum_{j=1}^{k} d_{3,j} Inv_{i,t-j} + u_{3,it} \tag{4.34c}$$

$$Inv_{it} = \alpha_{4,i} + \sum_{j=1}^{k} a_{4,j} ER_{i,t-j} + \sum_{j=1}^{k} b_{4,j} CBI_{i,t-j} + \sum_{j=1}^{k} c_{4,j} Cons_{i,t-j} + \sum_{j=1}^{k} d_{4,j} Inv_{i,t-j} + u_{4,it} \tag{4.34d}$$

B. Model 2: CBI, Stock Index, Consumption and Investment

Our Panel VAR model to analyse the interaction among CBI, stock exchange, consumption and investment include four endogenous variables: stock index (Stock), CBI, household's consumption (Cons), and investment (Inv). Turning now to the full panel VAR case, in our model G=4, thus our Panel VAR models are:

$$Stock_{it} = \alpha_{1,i} + \sum_{j=1}^{k} a_{1,j} Stock_{i,t-j} + \sum_{j=1}^{k} b_{1,j} CBI_{i,t-j} + \sum_{j=1}^{k} c_{1,j} Cons_{i,t-j} + \sum_{j=1}^{k} d_{1,j} Inv_{i,t-j} + u_{1,it} \tag{4.35a}$$

$$CBI_{it} = \alpha_{2,i} + \sum_{j=1}^{k} a_{2,j} Stock_{i,t-j} + \sum_{j=1}^{k} b_{2,j} CBI_{i,t-j} + \sum_{j=1}^{k} c_{2,j} Cons_{i,t-j} + \sum_{j=1}^{k} d_{2,j} Inv_{i,t-j} + u_{2,it} \tag{4.35b}$$

$$Cons_{it} = \alpha_{3,i} + \sum_{j=1}^{k} a_{3,j} Stock_{i,t-j} + \sum_{j=1}^{k} b_{3,j} CBI_{i,t-j} + \sum_{j=1}^{k} c_{3,j} Cons_{i,t-j} + \sum_{j=1}^{k} d_{3,j} Inv_{i,t-j} + u_{3,it} \tag{4.35c}$$

$$Inv_{it} = \alpha_{4,i} + \sum_{j=1}^{k} a_{4,j} Stock_{i,t-j} + \sum_{j=1}^{k} b_{4,j} CBI_{i,t-j} + \sum_{j=1}^{k} c_{4,j} Cons_{i,t-j} + \sum_{j=1}^{k} d_{4,j} Inv_{i,t-j} + u_{4,it} \tag{4.35d}$$

C. Model 3: CBI, Bond Yield, Consumption and Investment

Our Panel VAR model to analyse the interaction among CBI, bond yield, consumption and investment include four endogenous variables:

bond yield (Bond), CBI, household's consumption (Cons), and investment (Inv). Turning now to the full panel VAR case, in our model G=4, thus our Panel VAR models are:

$$Bond_{it} = \alpha_{1,i} + \sum_{j=1}^{k} a_{1,j} Bond_{i,t-j} + \sum_{j=1}^{k} b_{1,j} CBI_{i,t-j} + \sum_{j=1}^{k} c_{1,j} Cons_{i,t-j} + \sum_{j=1}^{k} d_{1,j} Inv_{i,t-j} + u_{1,it} \tag{4.36a}$$

$$CBI_{it} = \alpha_{2,i} + \sum_{j=1}^{k} a_{2,j} Bond_{i,t-j} + \sum_{j=1}^{k} b_{2,j} CBI_{i,t-j} + \sum_{j=1}^{k} c_{2,j} Cons_{i,t-j} + \sum_{j=1}^{k} d_{2,j} Inv_{i,t-j} + u_{2,it} \tag{4.36b}$$

$$Cons_{it} = \alpha_{3,i} + \sum_{j=1}^{k} a_{3,j} Bond_{i,t-j} + \sum_{j=1}^{k} b_{3,j} CBI_{i,t-j} + \sum_{j=1}^{k} c_{3,j} Cons_{i,t-j} + \sum_{j=1}^{k} d_{3,j} Inv_{i,t-j} + u_{3,it} \tag{4.36c}$$

$$Inv_{it} = \alpha_{4,i} + \sum_{j=1}^{k} a_{4,j} Bond_{i,t-j} + \sum_{j=1}^{k} b_{4,j} CBI_{i,t-j} + \sum_{j=1}^{k} c_{4,j} Cons_{i,t-j} + \sum_{j=1}^{k} d_{4,j} Inv_{i,t-j} + u_{4,it} \tag{4.36d}$$

D. Model 4: CBI, Exchange Rate, Stock Index, Bond Yield, Consumption and Investment

Our Panel VAR model to analyse the interaction among CBI, financial asset prices, consumption and investment include six endogenous variables: exchange rate (ER), stock index (Stock), bond yield (Bond), CBI, household's consumption (Cons), and investment (Inv). Turning now to the full panel VAR case, in our model G=6, thus our Panel

VAR models are:

$$
\begin{aligned}
ER_{it} = \alpha_{1,i} &+ \sum_{j=1}^{k} a_{1,j} ER_{i,t-j} + \sum_{j=1}^{k} b_{1,j} Stock_{i,t-j} + \sum_{j=1}^{k} c_{1,j} Bond_{i,t-j} \\
&+ \sum_{j=1}^{k} d_{1,j} CBI_{i,t-j} + \sum_{j=1}^{k} e_{1,j} Cons_{i,t-j} + \sum_{j=1}^{k} f_{1,j} Inv_{i,t-j} + u_{1,it}
\end{aligned} \tag{4.37a}
$$

$$
\begin{aligned}
Stock_{it} = \alpha_{2,i} &+ \sum_{j=1}^{k} a_{2,j} ER_{i,t-j} + \sum_{j=1}^{k} b_{2,j} Stock_{i,t-j} + \sum_{j=1}^{k} c_{2,j} Bond_{i,t-j} \\
&+ \sum_{j=1}^{k} d_{2,j} CBI_{i,t-j} + \sum_{j=1}^{k} e_{2,j} Cons_{i,t-j} + \sum_{j=1}^{k} f_{2,j} Inv_{i,t-j} + u_{1,it}
\end{aligned} \tag{4.37b}
$$

$$
\begin{aligned}
Bond_{it} = \alpha_{3,i} &+ \sum_{j=1}^{k} a_{3,j} ER_{i,t-j} + \sum_{j=1}^{k} b_{3,j} Stock_{i,t-j} + \sum_{j=1}^{k} c_{3,j} Bond_{i,t-j} \\
&+ \sum_{j=1}^{k} d_{3,j} CBI_{i,t-j} + \sum_{j=1}^{k} e_{3,j} Cons_{i,t-j} + \sum_{j=1}^{k} f_{3,j} Inv_{i,t-j} + u_{1,it}
\end{aligned} \tag{4.37c}
$$

$$
\begin{aligned}
CBI_{it} = \alpha_{4,i} &+ \sum_{j=1}^{k} a_{4,j} ER_{i,t-j} + \sum_{j=1}^{k} b_{4,j} Stock_{i,t-j} + \sum_{j=1}^{k} c_{4,j} Bond_{i,t-j} \\
&+ \sum_{j=1}^{k} d_{4,j} CBI_{i,t-j} + \sum_{j=1}^{k} e_{4,j} Cons_{i,t-j} + \sum_{j=1}^{k} f_{4,j} Inv_{i,t-j} + u_{1,it}
\end{aligned} \tag{4.37d}
$$

$$
\begin{aligned}
Cons_{it} = \alpha_{5,i} &+ \sum_{j=1}^{k} a_{5,j} ER_{i,t-j} + \sum_{j=1}^{k} b_{5,j} Stock_{i,t-j} + \sum_{j=1}^{k} c_{5,j} Bond_{i,t-j} \\
&+ \sum_{j=1}^{k} d_{5,j} CBI_{i,t-j} + \sum_{j=1}^{k} e_{5,j} Cons_{i,t-j} + \sum_{j=1}^{k} f_{5,j} Inv_{i,t-j} + u_{1,it}
\end{aligned} \tag{4.37e}
$$

$$Inv_{it} = \alpha_{6,i} + \sum_{j=1}^{k} a_{6,j} ER_{i,t-j} + \sum_{j=1}^{k} b_{6,j} Stock_{i,t-j} + \sum_{j=1}^{k} c_{6,j} Bond_{i,t-j} + \sum_{j=1}^{k} d_{6,j} CBI_{i,t-j} + \sum_{j=1}^{k} e_{6,j} Cons_{i,t-j} + \sum_{j=1}^{k} f_{6,j} Inv_{i,t-j} + u_{1,it} \tag{4.37f}$$

4.2.3 Poolability tests

This chapter applies poolability test to check whether the coefficients in models 1 to 4 homogeneous across the cross-section by applying the Chow and Roy-Zellner tests[3].

4.3 CBI and Financial Stability

4.3.1 Construction of a Macroprudential Policy Index

To document the importance of macroprudential policy, this chapter uses the index developed by Cerutti et al. (2017), who examine the GMPI index. In their study, 12 macroprudential policy instruments: loan-to-value ratio caps (LTV_CAP), debt to income ratio (DTI), dynamic loan loss provisioning (DP), general countercyclical capital buffer or requirement (CTC), leverage ratio (LEV), capital surcharges on SIFIs (SIFI), limits on interbank exposure (INFER), concentration limits (CONC), limits on foreign currency loans (FC), countercyclical reserve requirement (RR_REV), limits on domestic currency loans (CG) and levy or tax on financial institutions (TAX) are measured for every country. For each instrument, they assign 1 if it is implemented and 0 otherwise. The GMPI index is the sum of the score for all 12 tools. There are, however, several disadvantages in just aggregating all

[3] The poolability tests have been explained in detail in Chapter 4 Subsection 4.1.5.

Chapter 5

Effects of Central Bank Independence

5.1 CBI and Inflation

Central bank independence has an essential role in achieving macroeconomic stability, particularly in influencing the level of inflation. CBI is a solution to inflation bias due to time-inconsistency in monetary policy (Kydland and Prescott, 1977; Barro and Gordon, 1983; Rogoff, 1985). The hypothesis that a higher degree of CBI is negatively related to inflation has been proven by Alesina and Summers (1993), Grilli et al. (1991), Jonsson (1995), Brumm (2002), Ahsan et al. (2008), Acemoglu et al. (2008), and Maslowska (2011). This previous empirical research on the relationship between CBI and inflation focuses on advanced countries, specifically the Organisation for Economic Co-operation and Development (OECD) countries. According to Agoba et al. (2017), the existence of a negative effect of CBI on inflation in developed countries is due to them having financial systems and institutional of high quality.

Cukierman et al. (1992) examine the relationship between CBI and inflation in developed and developing countries. Their results show that the negative relationship only exists in developed countries, and fail to find the same result for developing countries. The main characteristics of developing countries include an unstable political situation, a hyperinflation period, and strong political interference in central bank matters; some developing countries also experience disinflation. According to Cukierman et al. (1992); Arnone et al. (2009) and Klomp and De Haan (2010), the concept of CBI in developing countries differs from that in industrial nations. For example, the law and actual practice in the central banks in developed and developing countries are different. Developing countries have a lower-level rule of law rather than developed countries, there might be a difference between the institutional arrangement and its adherence to the law. Campillo and Miron (1997) argue that in terms of pursuing price stability, CBI requires strong political support.

Having considered this evidence in developing countries, this study focuses on the analysis of the effect of CBI on inflation among developing countries. In most developing countries, high inflation remains one of the leading challenges to macroeconomic management and requires policy intervention. Moreover, among developing countries, a few have also experienced hyperinflation that has lasted for decades. To address this problem, many of these countries have had to reform their central bank legislation and change the central bank's objective to achieve low inflation. These reforms have been expected to create a higher level of independence to efficiently manage inflation. Dimakou (2015) evaluated the central bank reform in 77 countries (23 developed and 54 developing countries) based on the geo-economic group, from the 1990s to the beginning of the 2000s. It was found that institutional change in central banks had increased the level of independence. Some countries had also implemented an inflation targeting framework, in which an inflation target had been set as the nominal anchor and regularly communicated to the public.

Alesina and Summers (1993) examined the relationship between CBI and inflation in 16 developed countries for the period 1955-1988. Using a simple plot to capture inflation and CBI, they found a negative correlation between CBI and inflation. Their result is in line with the theoretical view that CBI creates lower inflation. Figure 5.1 and Figure 5.2 display the bivariate relationship between average CBI rate and average inflation for 15 high inflation economies and 22 moderate inflation economies during the period between 1972 and 2016. Some countries such as Peru, Argentina, and Nicaragua had high average inflation and a high average CBI. On the other hand, some countries with lower average inflation experienced a lower CBI index, for example, Thailand, Morocco and Pakistan. However, from this picture, it is difficult to draw conclusions regarding the existence of a negative relationship between CBI and inflation in developing countries.

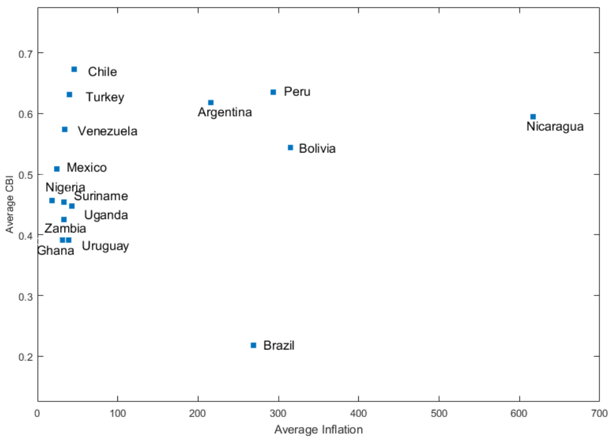


Figure 5.1: Average CBI and Average Inflation in High Inflation Countries

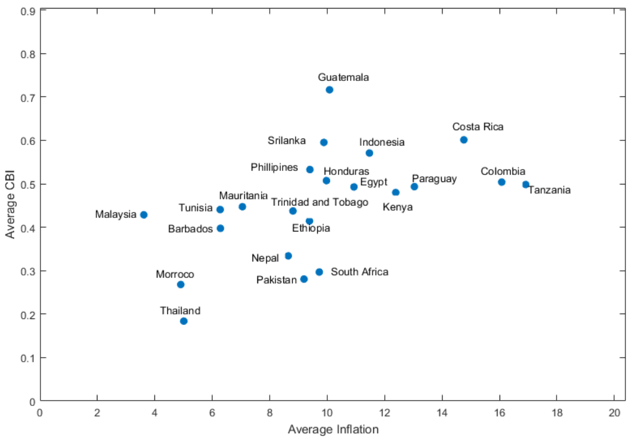


Figure 5.2: Average CBI and Average Inflation in Moderate Inflation Countries

The relationship between CBI and inflation varies widely in developing countries, reflecting differences in the institutional structure of the central banks and policy responses, and heterogeneity in the macroeconomic structures. This study analyses the effect of CBI on inflation in 37 developing countries over the period 1972 to 2016 using panel data estimation. First, the author perform pooled least square and fixed effect estimations for four models. Second, the author check a homogeneity assumption for the pooled least square estimation, applying Chow and Roy-Zellner tests. Third, the author employ panel heterogeneous estimators, mean group (MG) and pool mean group (PMG) regressions.

The result confirms the presence of heterogeneity parameters across cross-sections in the relationship between CBI and inflation. The results of the Chow and Roy-Zellner tests reject the homogeneous assumption for the coefficients in the pooled least square estimation. This study employs the Hausman test to check the long-run homogeneity restriction across the country for the MG and PMG estimators. The test shows that the PMG estimator is more consistent and efficient in our models. According to the PMG estimation, the result shows that in the long-run, CBI has a negative effect on inflation with coefficients ranging from -4.2971 to -33.987. This finding is robust, since the sample is divided into two groups, moderate and high inflation countries; the negative relationship between those variables still exists. Regarding the structural break test, our result shows that 20 countries experienced a break before their degree of CBI improved and 17 countries experienced a break after their CBI changed. This structural break finding is in line with the causality test result, which shows that there is bidirectional causality between CBI and inflation. This implies that the causality can run from CBI to inflation and from inflation to CBI.

This section examines the effect of CBI and other control variables on inflation of four models in three different groups by performing PMG and MG estimations for 37 developing economies during the period 1972 to 2016.

To choose the optimal lags for each variable in the long-run and the short-run, Akaike Info Criterion (AIC) is applied. The ARDL (1,1,1,1,1) is preferred in this model based on AIC results. The Hausman test is performed to test for the long-run homogeneity of the coefficient of all of the independent variables, with the null hypothesis as homogeneity in the long-run coefficient. If the null hypothesis is rejected, that means that the MG estimator is preferred to the PMG estimator. On the other hand, the PMG estimator is more consistent and efficient if the null hypothesis can not be rejected.

The error correction term is statistically significant and has a negative sign, so there exists a long-run relationship between inflation and its essential determinants. This negative and significant coefficient implies that in response to a shock, inflation adjust to the long-run equilibrium, the explanatory variables in the model bring about a correction in the opposite direction. In the PMG estimator, the coefficients of ECT are in the range -0.4840 to -0.4983 and significant at 1%. This implies that the disequilibrium in the short-run will be corrected annually by between 48.40% and 49.83% and a long-run equilibrium exists after around 2 years for the PMG estimator. On the other hand, for the MG estimator, the coefficients of ECT are between -0.6909 and -0.7311 and significant at 1%. The ECT coefficients of the MG estimator are higher than those for the PMG estimator. This implies that a long-run equilibrium exists earlier for the MG estimator, at around 1.36 to 1.44 years.

The PMG parameter constrains the long-run parameters such that they are the same across the country. The author tests the null hypothesis of homogeneity and the validity of the long-run homogeneity restriction across the country. If the null hypothesis is not rejected, that implies that the long-run parameter is homogeneous. As a result, the PMG estimator is consistent. The MG estimator is always consistent; however, under the homogeneity condition, it is inefficient. The Hausman statistic value for model 1 is 4.22 (p-value is 0.3376). The author also find that the p-values are 0.7833, 0.8236, and 0.9596 for model 2, model 3, and model 4, respectively. These results show that the null hypothesis is not rejected, which indicates that the PMG is consistent and more efficient than the MG estimator for the four different models. These Hausman test results imply that in the long-run, the relationship between inflation and the explanatory variables is the same across the countries.

The long-run parameter estimates can be explained as follows. The result shows a statistically significant negative long-run relationship between CBI and inflation with coefficients ranging from -4.2971 to -33.987 for the four models. This finding is supported by the theoretical view of CBI[1], whereby delegating monetary policy to an independent central bank will reduce inflation. Our finding is supported by Grilli et al. (1991), Cukierman et al. (1992), Jonsson (1995), Brumm (2002), Ahsan et al. (2008), Acemoglu et al. (2008) and Maslowska (2011), who

[1] Kydland and Prescott (1977); Barro and Gordon (1983); Rogoff (1985)

cal deficit and inflation is negative and significant. The more negative the fiscal deficit, the higher the inflation. This can be caused by the limited access of developing economies to external finance sources due to low government credibility. Thus they sometimes rely on seigniorage revenue to finance the deficit. After adding US inflation and unemployment rate, the author still find a negative and significant relationship between CBI and inflation. Regarding the short-run effect, CBI, trade openness, and fiscal deficit, they have an insignificant influence on inflation. Only the output gap has a significant effect on inflation, with a positive sign. This positive sign may be attributed to the dominance of demand shocks in developing countries.

5.2 CBI and Financial Asset Prices

The previous study reveals that CBI succeeds to reduce inflation in developing countries. Seeing as the objective of central bank independence is solely price stability, various countries which opted for the independent central bank have enjoyed low and stable inflation. However, after 2007, the financial crisis changed the central bank's concern, which is the apparent increase in financial instability (Bernanke and Gertler, 1999). Associated with financial instability, Shiratsuka (2001), argue that financial instability is closely interconnected with asset price fluctuation. He cited Japan's experience as an example, since the 1980's asset price bubble played a crucial part in economic fluctuation even though the inflation rate remained stable in that period. In addition, the low interest rate was exacerbating the asset price bubble resulting in financial instability and a prolonged recession. Borio et al. (1994) reported the fluctuation in financial asset prices in various developed countries since the early 1980s has been the role of financial instability.

The role of CBI to affect financial asset prices can be explained as follow: central bank reform (change in the degree of CBI) will alter the public's expectation of inflation. Then, if the public perception of inflation change, the asset price should also change due to the sensitivity related to inflation. This means that financial asset prices contain information pertaining to future inflation. Smets (1997) explained two key reasons concerning the relationship between financial asset prices and expected inflation. First, aggregate demand change is directly due to a change in asset price, whilst second, financial asset prices depend on future return expectation, such as future economic activity, inflation and monetary policy. These changes highlight the importance of investigating the relationship between CBI and financial asset prices. Claessens and Kose (2017) categorise asset price into equity prices, house prices, exchange rate, and interest rate. Seeing as house price is a non-tradeable product, the author therefore only focus on three other assets. A few papers have focused on central bank reform over the financial asset prices. Kuttner and Posen (2010) and Moser and Dreher (2010) documented the changes of central bank's governor and their relationship to the financial asset prices. Eichler and Littke (2018) examined the effect of CBI on exchange rate volatility. Forch and Sunde (2012) and Papadamou et al. (2017) investigated the relationship between CBI and stock index volatility, whilst Bodea and Hicks (2014) analysed the effect of CBI on bond yield. This study also examines the impact of three different financial asset prices on private consumption and investment. Finally, this study examines the effect of CBI on consumption and investment via the exchange rate, stock index and bond yield.

It is vital for central banks to examine the effect of asset price fluctuation related to two of the central bank's objectives: price and financial stability. Bernanke and Gertler (1999) stated that price stability and financial stability are complementary, which implies that by stabilising price, the central bank may stabilise financial asset prices. Low and stable inflation provide the central bank with room to react to the financial crisis. Certain studies, such as Stock and Watson (1999), Goodhart and Hofmann (2000) and Bordo and Jeanne (2002) agreed that financial asset prices can predict future movement in the CPI. Cecchetti et al. (2000) state that development of financial asset prices have a significant impact on inflation and economic activity. The literature on financial asset prices and monetary policy tends to focus on three arguments: the first is that the change in price level (inflation) can be measured by the asset price changing; second, financial asset prices forecast inflation and third, there are structural links between asset price and consumption and investment (Gilchrist and Leahy, 2002).

Economic theory suggests that asset price has a direct effect on consumption and investment for the reason that it is forward-looking. In this study, the relationship between financial asset prices and real activity focus on consumption and investment. Tobin's q theory explains the influence of financial asset prices on household consumption and saving decisions via wealth and substitution channels. Public consumption decisions are based on current and future income, as well as current financial and physical assets. Changes in financial asset prices can affect current consumption because of changes in household financial and real wealth. Thus, changes in consumption allocation can influence household saving behaviour.

Furthermore, this study compares which asset price has greater sensitivity due to CBI changing. Our results show that the shock of CBI on exchange rate appreciation is delayed. In fact, it takes roughly a year for CBI to appreciate the exchange rate. Stock index will rise in two quarters after the shock of CBI, though after period three the effect becomes negative. Finally, this study establishes that CBI has a significant role in reducing bond yield in all periods. Therefore, this study can concludes that the greatest effect of CBI on financial asset prices is on bond yield. In this paper, financial asset prices have an essential role in monetary policy transmission, to the extent that change in CBI affects the exchange rate, stock index and bond yield, thereby influencing private consumption and investment. Greater CBI produces lower private consumption for all three channels. CBI needs three quarters to increase investment via the exchange rate and stock index, but CBI directly increases investment via the bond yield channel.

5.2.1 CBI, Exchange Rate, Consumption and Investment

This section analyses the interaction between CBI, exchange rate, consumption and investment in various sub-samples: full sample, group 1, group 2 and group 3. The results show how these relationships are influenced by a diversity of factors such as heterogeneity of economic sectors, degree of CBI, inflation, exchange rate regime and capital mobility (Lane, 2001).

Figure 5.3 reveals the impulse response of the exchange rate to the shock of CBI in three different groups samples and the average for the full sample. Interestingly, the response to the shock varies in each group. From the graph, it is apparent that a one-unit shock in CBI negatively affects the exchange rate in the first group. However, the positive effect is shown for groups two, three and also for the full sample countries, even though after a certain period the effect is negative. The magnitude of the maximum impact of one percentage point change in the degree of CBI on the exchange rate varies between -0.2% and 0.4%. The maximum impact is achieved at period 2 for the full sample, group 1 and group 3; however, for group 2 is in period 8.

This section discusses various economic features of developing countries to determine the main factors that can describe the different results among groups. First, the exchange rate classification measured by Reinhart and Rogoff (2004) which is presented in Table B.1 row 5 in the Appendix is applied. A higher number means a more flexible exchange rate arrangement. The three groups have different degrees of exchange rate flexibility. Group 1 has the lowest exchange rate flexibility; the average group members in group 1 are applying de facto crawling peg. Group 2 has moderate exchange rate flexibility; a number of countries are using the crawling band exchange rate arrangement. Group 3 is the highest degree; certain countries adopt the manage floating exchange rate. Theoretically, the peg exchange rate arrangement may result in exchange rate puzzling (Kim and Lim, 2016). In the 1990s, most developing countries applied the peg exchange rate system to limit speculation, provide a stable system for traders and investors, and prevent market adjustments when a currency undervalued. However, this system creates an unreal exchange rate or exchange rate manipulation. Therefore, there is a gap between the official and unofficial exchange rate. Independent central banks commonly followed by changing the exchange rate system from the peg to the floating exchange rate system. In the short-run, the exchange rate will adjust to the market value. Therefore, the exchange rate will be depreciated as it is undervalued. However, in the long-run, central bank reforms could lower the exchange rate depreciation. This implies that under CBI, monetary policy is predictable, generating lower exchange rate uncertainty. This finding is relevant with Cermeño et al. (2010), who concluded that central bank reforms are associated with reduced exchange rate uncertainty and lower average depreciation in the long-run.

According to Mundell (1963), the link between monetary policy and the exchange rate is based on perfect capital mobility. When capital mobility is highly controlled, the increase in CBI degree may not effect capital flows and the exchange rate. Table B.1 row 6 in the Appendix describes the capital control restriction developed by Fernández et al. (2016). This results establishes that the degree of capital control restrictions are different for the three subgroups, resulting in different monetary transmission effects on the exchange rate. The results for group 1, which is the lowest capital control restriction, are compatible with theoretical expectations that higher CBI leads to lower inflation expectation and hence, will appreciate the exchange rate. The "overshooting" theory developed by Dornbusch (1976) predicts that in the long-run, the exchange rate should initially overshoot to respond to monetary policy shock. Thus, an overshooting exchange rate occurred in this group. Previous empirical results support this finding, for instance, Kim and Roubini (2000), Faust and Rogers (2003) and BjÃžrnland (2009), who ascertained an appreciation exchange rate to monetary policy shocks. In contrast, the exchange rate puzzle is demonstrated by group 2, where monetary policy shock affects exchange rate depreciation. In this group, capital mobility restriction is high. The previous result presented by Grilli and Roubini (1995) strengthen this finding. According to Kim and Lim (2016), exchange rate puzzle occurs in countries with strong restricted capital mobility. Hence, the change in monetary policy may not influence the exchange rate. The result for group 3 and the full sample group add the existence of the "delayed overshooting" puzzle previously documented by Eichenbaum and Evans (1995) and Scholl and Uhlig (2008). Group 3 has moderate capital mobility restriction. Eichenbaum and Evans (1995) found that the exchange rate overshoots is the long-run effect of monetary policy shock, though it occurs one to three years after the shocks. These delays can be caused by "forward discount bias" puzzle, conditional on monetary policy shocks.

Figure 5.3: Impulse Response Function of Exchange Rate to CBI Shock

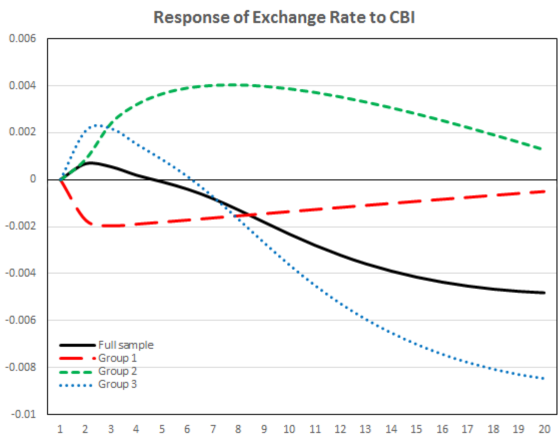
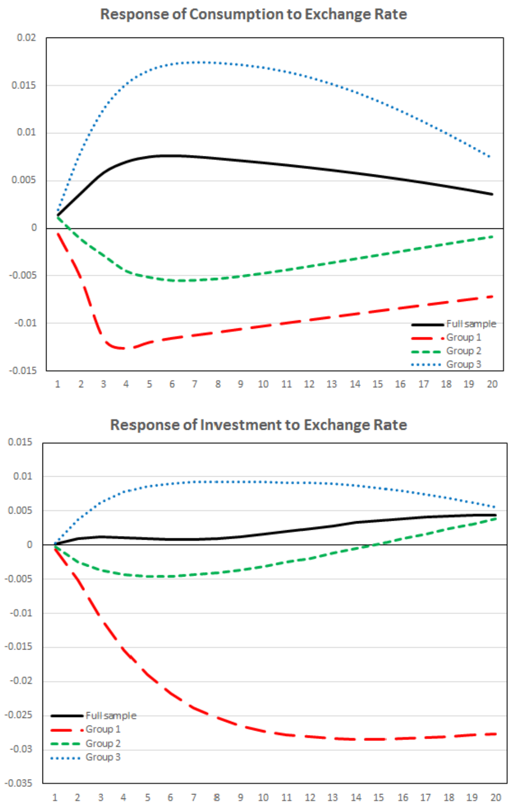


Figure 5.4: Impulse Response Function of Consumption and Investment to Exchange Rate Shock



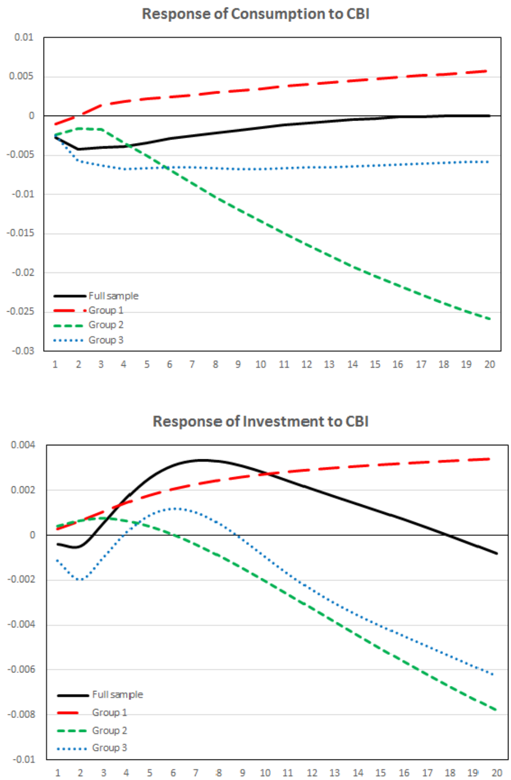
The left side of Figure 5.4 shows the impulse responses of consumption to a one positive unit shock in the exchange rate. The effects of the exchange rate on consumption are positive in the full sample and group 3. This suggests that currency depreciation generates higher consumption which supports the international real business cycle model which predicts the positive relationship between domestic consumption and the depreciation exchange rate. The depreciation exchange rate generates less expensive exports, while imports are more expensive. Based on competitiveness, foreign demand for exports goods and services will increase and domestic demand for imports will decrease; thus, shifting consumption to domestic goods and services. As the net external demand increases, the increases in aggregate demand will have a positive effect on output and create jobs. Increasing income and employment generates increased consumption. Past empirical studies such as Kandil (2015), found that the depreciation exchange rate initiates increased consumption growth in developing countries, due to increases in the domestic prices of import goods and services. Conversely, for groups 1 and 2, consumption increases due to the appreciation exchange rate. Appreciation of the exchange rate decreases the cost of tradables and nontradables goods and, therefore, increases consumption growth. The combined effect will depend on the elasticity of consumers' substitution between tradables and non-tradables (Kandil and Mirzaie, 2006). This result confirms the Backus-Smith puzzle of a negative relationship between exchange rate and consumption (Backus and Smith, 1993). According to Kollmann (2012), the consumption-real exchange rate anomaly might be due to the underdevelopment of international financial markets. Additional empirical evidence such as Devereux et al. (2012), determined a negative relationship between exchange rate and consumption.

The right side of Figure 5.4 illustrates the impulse responses of the investment to a one-unit shock in the exchange rate depreciation can create an increase in investment as the marginal profit from an additional unit of capital is likely to increase as future foreign sales rise for group 3 and the average all countries. Conversely, for groups 1 and 2, the appreciation exchange rate leads to higher investment. Depreciation produces higher price for imported capital, whilst inputs can reduce profits and, in turn, lower investment. The overall impact of the exchange rate changes on investment hinges on which of these forces dominates (Landon and Smith, 2009). Depreciation of the exchange rate boosts investment, reducing the cost of investment in domestic countries. Increases in investment are also consistent with higher demand for goods and services because competition increases. This indicates the more dominant supply-side effect via the increase of competitiveness channel, particularly in the tradable sector.

Currency depreciation also has a positive implication for investment by means of relative wage channels. Depreciation reduces domestic's wages and production costs compared to those of its foreign counterparts. Therefore, it increases the overall rate of return on foreign investment in the domestic country. Previous studies, such as Blonigen (1997), argue that foreign exchange rate depreciation will lead to enhanced foreign direct investment (FDI) into the foreign economy. This result is also in lines with the Mundell-Fleming model for open economies which describes that the depreciation of domestic currency generates greater investment, seeing that it produces cheaper domestic goods and thus, more competitive in international markets. The principal factor related to a company's investment decisions are price competitiveness (Brito et al., 2018). In contrast, appreciation of domestic currency should stimulate investment for countries that depend on imported capital goods, as foreign capital goods are cheaper (Alejandro, 1963). Specific studies show that currency depreciations (appreciations) are associated with a contraction (expansion) in investment (Landon and Smith, 2009; Goldberg, 1993; Campa and Goldberg, 2005). Furthermore, there is also extensive theoretical literature looking at how linkages between exchange rate and output can depend on exchange rate regimes (Uribe, 1997; Mendoza and Uribe, 1997).

The different effect of the exchange rate on consumption and investment might be caused by average level of inflation. Regarding Table B.1 row 3 in Appendix B; Group 1 comprises a low average inflation rate, group 2 has a moderate inflation rate and group 3 consists of a high inflation rate, while the average for all countries is close to the average of group 3. For low and moderate inflation rate, the appreciation (depreciation) exchange rate leads to higher (lower) consumption and investment. The positive effect is higher for the low inflation group. Conversely, in countries with high inflation, depreciation (appreciation) causes higher (lower) consumption and investment.

Figure 5.5: Impulse Response Function of Consumption and Investment to CBI Shock



Finally, the direct link from CBI to consumption and investment in Figure 5.5 is determined. The reaction of consumption due to changes in CBI is negative in the first quarter for all groups. Only after a lag of approximately 3 quarters for group 1 does the impact become positive, though for the other groups the response is negative until period

20. CBI has a positive effect on consumption only in countries with low inflation, given that a greater degree of CBI gives central banks freedom to set monetary policy, for instance lowering interest rates and increasing the money supply. Thus, these expansionary monetary policies create higher consumption. In contrast, in group 2 and group 3, which have high inflation rates, the central bank focuses more on lowering price by setting contractionary monetary policy such as, tight money policy. Tightening the supply of money lowers private consumption. Generally, the average for all countries sample is that higher CBI creates lower consumption, seeing as regularly, they have high inflation and the target of the central bank is to reduce prices.

The reason for different consumption responses to CBI is the sensitivity of imported goods (Carriere-Swallow et al., 2017). One major problem in developing countries is high inflation owing to lack of supply. One possible solution is importing goods to lower the price because price in foreign countries is lower than domestically. For group 1, greater CBI causes an appreciation of the exchange rate, making imported goods cheaper. Hence households can consume more. In contrast, CBI affects the depreciation exchange rate in group 2, group 3 and in the full sample. This depreciation generates more expensive imported goods, therefore, reducing consumption.

Figure 5.5 also presents the investment responses to CBI shock in various groups. The result shows that the positive effect of CBI on investment, seeing that increasing the degree of CBI as a signal to combat inflation, display good governance institution and consequently, will attract investment. For group 2 and group 3, the responses become negative after 6 and 8 quarters. Here, the central bank could focus on reducing inflation by raising the interest rate and thus, discouraging investment. In group one, increasing the degree of CBI is also a signal for the implementation of structural economic reforms (Lavezzolo, 2006). This will create good opportunities for investors and moreover, promote investment.

Chapter 6

Conclusion

The main idea of this thesis was to investigate the heterogeneity effect of CBI on inflation, financial asset prices and credit per GDP in developing countries.

The relationship between CBI and inflation has created a controversial debate in the empirical literature. It is generally admitted that CBI is an essential factor inflation stabilisation. Nevertheless, empirical evidence in this field indicates differing and inconclusive results. The first study investigated the effect of CBI on inflation in a panel of 37 developing economies for the period 1972 to 2016. The study applies poolability tests to check the homogeneity assumption in the panel models. The Chow and Roy-Zellner tests proved that the homogeneity assumption in the models does not hold; as a consequence, our models consist of heterogeneous parameters across countries. This study employed a panel heterogeneity model (MG and PMG estimations) to verify the short-run and long-run effect of CBI on inflation. The results confirmed that there is a negative and significant relationship between CBI and inflation. After splitting the sample into two groups based on the rate of inflation to create high and moderate inflation groups. The result provides evidence that CBI reduces inflation in both groups.

The second empirical study provided an empirical analysis of CBI, consumption and investment via three different financial asset prices: exchange rate, stock index and bond yield. In this study, the panel VAR proposed by Canova and Ciccarelli (2013) was applied to four different models. The author verified the poolability assumption of the panel VAR by performing Chow and Roy-Zellner poolability tests. The result found heterogeneity in the sample; therefore, an MG estimation for the panel VAR was applied by running individual VAR for each country and averaging the coefficients. The author also split the sample into two and three groups such that our subsamples were poolable. The first model studied the responses of the exchange rate, consumption and investment due to a shock to CBI. Our results show that after a central bank reform shock, it takes five quarters for the exchange rate to begin to appreciate. A shock of one percentage point to the degree of CBI leads to a fall in consumption but increases investment. Moreover, a shock of one standard deviation of the exchange rate leads to increased consumption and investment. The sample is the split into three groups to make the subsamples poolable. The results for each of the three groups differ. This shows how results can be influenced by different factors, such as: heterogeneity of economic sectors, degree of CBI, inflation, exchange rate regime and capital mobility.

The second model examined the interrelationship between CBI, stock index, consumption and investment. The MG estimation for the panel VAR shows that a shock of one standard deviation relating to CBI causes the stock index to respond positively until period two; then the response gradually returns to the initial value in period three. A shock of one standard deviation related to the degree of CBI reduces private consumption. However, after the CBI shock, it takes three quarters before the investment starts to rise. Furthermore, the responses of consumption and investment to a stock index shock are positive. Model three analysed the effect of CBI on bond yield, the effect of bond yield on consumption and investment, and the effect of CBI

Chapter 7

Policy Recommendations

The findings of this study provide a basis for some sound policy recommendations. Based on the first empirical study, developing countries have the challenge of considering CBI an essential factor in reducing inflation. However, for some central banks, the legal independence index is low. These include Thailand (0.1839), Brazil (0.2174), Morocco (0.2680), Pakistan (0.2806) and Nepal (0.3341). Most developing countries still need to reform their central bank legislation in order to deliver the price stability objective. Some central banks' laws and statutes need further revision because their Acts are considerably out of date. For example, according to Garriga (2016), Banco Central do Brazil is still guided by the 1988 Act, which grants it a low degree of CBI.

The findings from the second empirical study show that policymakers in developing countries need to pay more attention to improve their credibility in the international financial market in order to attract capital; a higher degree of CBI reflects more transparency and credibility, thus attracting more investment. However, the effect of CBI on attracting capital depends on global financial factors, such as capital restriction. Lower capital restriction reduces capital costs, in-

Bibliography

Acemoglu, D., Johnson, S., Querubín, P., and Robinson, J. A. (2008). When does policy reform work? the case of central bank independence. *Brookings Papers on Economic Activity*, pages 351–417.

Agoba, A. M., Abor, J., Osei, K. A., and Sa-Aadu, J. (2017). Central bank independence and inflation in africa: The role of financial systems and institutional quality. *Central Bank Review*, 17(4):131 – 146.

Ahsan, A., Skully, M. T., and Wickramanayake, J. (2008). Does central bank independence and governance matter in asia pacific? *Paolo Baffi Centre Research Paper*, (2008-27).

Akinci, O. and Olmstead-Rumsey, J. (2018). How effective are macroprudential policies? an empirical investigation. *Journal of Financial Intermediation*, 33:33–57.

Alejandro, C. F. D. (1963). A note on the impact of devaluation and the redistributive effect. *Journal of Political Economy*, 71(6):577–580.

Alesina, A. (1988). Macroeconomics and politics. *NBER macroeconomics annual*, 3:13–52.

Alesina, A. and Summers, L. H. (1993). Central bank independence and macroeconomic performance: Some comparative evidence. *Journal of Money, Credit and Banking*, 25(2):151–162.

Alfaro, L. (2005). Inflation, openness, and exchange-rate regimes: The quest for short-term commitment. *Journal of Development Economics*, 77(1):229 – 249.

Amin, F. and Annamalah, S. (2013). An evaluation of malaysian capital controls. *Journal of Economic Studies*, 40(4):549–571.

Andriani, Y., Gai, P., et al. (2013). The effect of central bank independence on price stability: The case of indonesia. *Bulletin of Monetary Economics and Banking*, 15(4):1–24.

Arnone, M., Laurens, B. J., Segalotto, J.-F., and Sommer, M. (2009). Central bank autonomy: lessons from global trends. *IMF Staff Papers*, 56(2):263–296.

Ashra, S. (2002). Inflation and openness: a study of selected developing economies. *Indian Council for Research on International Economic Relations. Working Paper*, 84.

Assenmacher-Wesche, K., Gerlach, S., et al. (2008). *Financial structure and the impact of monetary policy on asset prices*. Swiss National Bank.

Asteriou, D. and Hall, S. G. (2016). *Applied Econometrics*. Palgrave Macmillan Ltd., New York.

Backus, D. K. and Smith, G. W. (1993). Consumption and real exchange rates in dynamic economies with non-traded goods. *Journal of International Economics*, 35(3):297 – 316.

Bade, R. and Parkin, M. (1988). *Central bank laws and monetary policy*. Department of Economics, University of Western Ontario London, ON.

Bahadir, B. and Valev, N. (2006). Credit expansions and financial crises: The roles of household and firm credit. *SSRN Electronic Journal*.

Ball, L. (1999). Efficient rules for monetary policy. *International finance*, 2(1):63–83.

Ball, L. and Mankiw, N. G. (1994). Asymmetric price adjustment and economic fluctuations. *The Economic Journal*, 104(423):247–261.

Baltagi, B. (2008). *Econometric analysis of panel data*. John Wiley & Sons.

Barro, R. and Gordon, D. (1983). Rules, discretion and reputation in a model of monetary policy. *Journal of Monetary Economics*, 12(1):101–121.

Beaudry, P., Moura, A., and Portier, F. (2015). Reexamining the cyclical behavior of the relative price of investment. *Economics Letters*, 135:108–111.

Berger, H., De Haan, J., and Eijffinger, S. C. (2001). Central bank independence: an update of theory and evidence. *Journal of Economic surveys*, 15(1):3–40.

Berger, W. and Kißmer, F. (2013). Central bank independence and financial stability: A tale of perfect harmony? *European Journal of Political Economy*, 31:109–118.

Bernanke, B. S. (2010). Central bank independence, transparency, and accountability. In *Speech at the Institute for Monetary and Economic Studies International Conference, Bank of Japan, Tokyo, Japan, May*, volume 25.

Bernanke, B. S. and Gertler, M. (1995). Inside the Black Box: The Credit Channel of Monetary Policy Transmission. *Journal of Economic Perspectives*, 9(4):27–48.

Bernanke, B. S. and Gertler, M. (1999). Monetary policy and asset price volatility. *Economic Review*, (Q IV):17–51.

Berument, H., Inamlik, A., and Olgun, H. (2008). Inflation and growth: Positive or negative relationship? *Journal of Applied Sciences*, 8(2):192–204.

BjÃžrnland, H. C. (2009). Monetary policy and exchange rate overshooting: Dornbusch was right after all. *Journal of International Economics*, 79(1):64 – 77.

Blonigen, B. A. (1997). Firm-specific assets and the link between exchange rates and foreign direct investment. *The American Economic Review*, 87(3):447–465.

Bodart, V. and Reding, P. (1999). Exchange rate regime, volatility and international correlations on bond and stock markets. *Journal of International Money and Finance*, 18(1):133 – 151.

Bodea, C. and Hicks, R. (2014). International finance and central bank independence: Institutional diffusion and the flow and cost of capital. *The Journal of Politics*, 77(1):268–284.

Bodea, C. and Hicks, R. (2015). Price stability and central bank independence: Discipline, credibility, and democratic institutions. *International Organization*, 69(1):35–61.

Bogoev, J., Petrevski, G., and Sergi, B. S. (2012). Investigating the Link Between Central Bank Independence and Inflation in Central and Eastern Europe. *Eastern European Economics*, 50(4):78–96.

Bordo, M. D. and Jeanne, O. (2002). Monetary policy and asset prices: does benign neglect make sense? *International Finance*, 5(2):139–164.

Borio, C., Lowe, P., et al. (2002). Assessing the risk of banking crises. *BIS Quarterly Review*, 7(1):43–54.

Borio, C. E., Kennedy, N., and Prowse, S. D. (1994). *Exploring aggregate asset price fluctuations across countries: measurement, determinants and monetary policy implications.* Number 40. Bank for International Settlements, Monetary and Economic Dept.

Borio, C. E. and Lowe, P. W. (2002). Asset prices, financial and monetary stability: exploring the nexus.

Breitung, J. (2005). *The Local Power of Some Unit Root Tests for Panel Data.* Humboldt-Universitet zu Berlin, Wirtschaftswissenschaftliche Fakultet.

Brito, S., Magud, M. N. E., and Sosa, M. S. (2018). *Real Exchange Rates, Economic Complexity, and Investment.* International Monetary Fund.

Brumm, H. J. (2000). Inflation and central bank independence: Conventional wisdom redux. *Journal of Money, Credit and Banking*, 32(4):807–819.

Brumm, H. J. (2002). Inflation and central bank independence revisited. *Economics Letters*, 77(2):205 – 209.

Bruno, V. and Shin, H. S. (2014). Cross-border banking and global liquidity. *The Review of Economic Studies*, 82(2):535–564.

Campa, J. M. and Goldberg, L. S. (2005). Exchange Rate Pass-Through into Import Prices. *The Review of Economics and Statistics*, 87(4):679–690.

Campillo, M. and Miron, J. (1997). Why does inflation differ across countries? In *Reducing Inflation: Motivation and Strategy*, pages 335–362. National Bureau of Economic Research, Inc.

Canova, F. and Ciccarelli, M. (2013). Panel vector autoregressive models: A survey. *Advances in Econometrics*, 31.

Canuto, O., Dos Santos, P. F. P., and de Sá Porto, P. C. (2012). Macroeconomics and sovereign risk ratings. *Journal of International Commerce, Economics and Policy*, 3(02):1250011.

Caprio, G. and Klingebiel, D. (1999). *Bank insolvencies: cross-country experience*. The World Bank.

Carriere-Swallow, M. Y., Gruss, B., Magud, M. N. E., and Valencia, M. F. (2017). *Monetary policy credibility and exchange rate pass-through*. International Monetary Fund.

Catao, L. A. and Terrones, M. E. (2005). Fiscal deficits and inflation. *Journal of Monetary Economics*, 52(3):529 – 554.

Cecchetti, S. G., Genberg, H., Lipsky, J., and Wadhwani, S. (2000). *Asset prices and central bank policy*. Centre for Economic Policy Research.

Cermeño, R., Grier, R., and Grier, K. (2010). Elections, exchange rates and reform in latin america. *Journal of Development Economics*, 92(2):166–174.

Cerutti, E., Claessens, S., and Laeven, L. (2017). The use and effectiveness of macroprudential policies: New evidence. *Journal of Financial Stability*, 28:203 – 224.

Cheung, Y.-W. and Yuen, J. (2002). Effects of u.s. inflation on hong kong and singapore. *Journal of Comparative Economics*, 30(3):603 – 619.

Chow, G. C. (1960). Tests of equality between sets of coefficients in two linear regressions. *Econometrica: Journal of the Econometric Society*, pages 591–605.

Cihak, M. (2007). Central banks and financial stability: A survey. *SSRN Electronic Journal.*

Cihak, M. (2010). Price stability, financial stability, and central bank independence. In *Oesterreichische Nationalbank, Central Banking after the Crisis, 38th Economic Conference.*

Claessens, S. and Kose, M. A. (2017). *Asset prices and macroeconomic outcomes: a survey.* The World Bank.

Copelman, M. et al. (1996). *The role of credit in post-stabilization consumption booms.* Number 569. Board of Governors of the Federal Reserve System.

Cottarelli, C., Dell'Ariccia, G., and Vladkova-Hollar, I. (2005). Early birds, late risers, and sleeping beauties: Bank credit growth to the private sector in central and eastern europe and in the balkans. *Journal of banking & Finance*, 29(1):83–104.

Crowder, W. J. (1996). The international convergence of inflation rates during fixed and floating exchange rate regimes. *Journal of International Money and Finance*, 15(4):551 – 575.

Cukierman, A. (1992). *Central bank strategy, credibility, and independence: Theory and evidence.* MIT press.

Cukierman, A. (1998). The economics of central banking. In *Contemporary Economic Issues*, pages 37–82. Springer.

Cukierman, A., Webb, S. B., and Neyapti, B. (1992). Measuring the independence of central banks and its effect on policy outcomes. *The World Bank Economic Review*, 6(3):353–398.

Daunfeldt, S.-O. and De Luna, X. (2008). Central bank independence and price stability: evidence from oecd-countries. *Oxford Economic Papers*, 60(3):410–422.

Davis, E. and Stone, M. R. (2004). Corporate financial structure and financial stability. *Journal of Financial Stability*, 1(1):65 – 91.

de Haan, J. and Kooi, W. J. (2000). Does central bank independence really matter?: New evidence for developing countries using a new indicator. *Journal of Banking and Finance*, 24(4):643 – 664.

Debelle, G. and Fischer, S. (1994). How independent should a central bank be? *Conference Series ; [Proceedings]*, 38:195–225.

Dell'Ariccia, G., Igan, D., Laeven, L., and Tong, H. (2016). Credit booms and macrofinancial stability. *Economic Policy*, 31(86):299–355.

Dell'Ariccia, G., Igan, D., Laeven, L., Tong, H., Bakker, B., and Vandenbussche, J. (2012). Policies for macrofinancial stability: How to deal with credit booms. *IMF Staff discussion note*, 7.

Dellas, H. and Tavlas, G. (2013). Exchange rate regimes and asset prices. *Journal of International Money and Finance*, 38:85 – 94. 30th Anniversary of the Journal of International Money and Finance.

Demirguc Kunt, A. and Detragiache, E. (1997). *The determinants of banking crises-evidence from developing and developed countries*, volume 106. World Bank Publications.

den Haan, W. J. (2000). The comovement between output and prices. *Journal of Monetary Economics*, 46(1):3 – 30.

Detragiache, E. and Kenichi, U. (2004). Does financial sector development help economic growth and welfare. *IMF Stability Report May.*

Devereux, M. B., Smith, G. W., and Yetman, J. (2012). Consumption and real exchange rates in professional forecasts. *Journal of International Economics*, 86(1):33 – 42.

Dimakou, O. (2015). Bureaucratic corruption and the dynamic interaction between monetary and fiscal policy. *European Journal of Political Economy*, 40:57–78.

Domac, I. and Peria, M. S. M. (2003). Banking crises and exchange rate regimes: is there a link? *Journal of International Economics*, 61(1):41–72.

Dornbusch, R. (1976). Expectations and exchange rate dynamics. *Journal of Political Economy*, 84(6):1161–1176.

Dornbusch, R., Sturzenegger, F., and Wolf, H. (1990). Extreme Inflation: Dynamics and Stabilization. *Brookings Papers on Economic Activity*, 21(2):1–84.

Doumpos, M., Gaganis, C., and Pasiouras, F. (2015). Central bank independence, financial supervision structure and bank soundness: An empirical analysis around the crisis. *Journal of banking and Finance*, 61(S1):S69–S83.

Dumiter, F., Brezeanu, P., Radu, C., and Turcas, F. (2015). Modelling central bank independence and inflation: Deus ex machina? *Studia Universitatis Vasile Goldis Arad, Economics Series*, 25(4):56–69.

ECB (2009). Ecb financial stability review june 2009–opening remarks.

Eichenbaum, M. and Evans, C. L. (1995). Some empirical evidence on the effects of shocks to monetary policy on exchange rates. *The Quarterly Journal of Economics*, 110(4):975–1009.

Eichler, S. and Littke, H. C. (2018). Central bank transparency and the volatility of exchange rates. *Journal of International Money and Finance*, 89:23 – 49.

Eijffinger, S., Schaling, E., and Hoeberichts, M. (1998). Central bank independence: A sensitivity analysis. *European Journal of Political Economy*, 14(1):73 – 88.

Ellingsen, T. and Soderstrom, U. (2001). Monetary policy and market interest rates. *American Economic Review*, 91(5):1594–1607.

Farvaque, E., Héricourt, J., and Lagadec, G. (2010). Central bank independence and ageing. *Applied Economics Letters*, 17(12):1167–1171.

Faust, J. and Rogers, J. H. (2003). Monetary policy's role in exchange rate behavior. *Journal of Monetary Economics*, 50(7):1403 – 1424.

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

Fischer, S. (1995). Central-bank independence revisited. *The American Economic Review*, 85(2):201–206.

Fischer, S., Sahay, R., and Végh, C. A. (2002). Modern hyper-and high inflations. *Journal of Economic literature*, 40(3):837–880.

Forch, T. and Sunde, U. (2012). Central bank independence and stock market returns in emerging economies. *Economics Letters*, 115(1):77–80.

Fratzscher, M., König, P. J., and Lambert, C. (2016). Credit provision and banking stability after the great financial crisis: The role of bank regulation and the quality of governance. *Journal of international money and finance*, 66:113–135.

Froyen, R. T. and Waud, R. N. (1995). Central bank independence and the output-inflation tradeoff. *Journal of Economics and Business*, 47(2):137 – 149. Central Banking at a Crossroads.

Garratt, A. and Hall, S. G. (1996). Measuring underlying economic activity. *Journal of Applied Econometrics*, 11(2):135–151.

Garriga, A. C. (2016). Central bank independence in the world: A new data set. *International Interactions*, 42(5):849–868.

Gerlach, S. and Smets, F. (1999). Output gaps and monetary policy in the emu area1the views expressed are solely our own, and not necessarily those of the bis or the ecb.1. *European Economic Review*, 43(4):801 – 812.

Gilchrist, S. and Leahy, J. (2002). Monetary policy and asset prices. *Journal of Monetary Economics*, 49(1):75–97.

Goldberg, L. S. (1993). Exchange Rates and Investment in United States Industry. *The Review of Economics and Statistics*, 75(4):575–588.

Gonzalez, A., Teräsvirta, T., van Dijk, D., and Yang, Y. (2017). Panel smooth transition regression models. Technical Report 2017:3, Uppsala University, Department of Statistics. This is a revised and updated version of the Working Paper No. 604(2005) in the Working Paper Series of Economics and Finance, Stockholm School of Economics.

Goodhart, C. and Hofmann, B. (2000). Do asset prices help to predict consumer price inflation? *The Manchester School*, 68:122–140.

Griffin, C. H. (2011). Effectiveness of central bank independence via its internal characteristics. *International Journal of Banking and Finance*, 8(2):2.

Grilli, V., Masciandaro, D., and Tabellini, G. (1991). Political and monetary institutions and public financial policies in the industrial countries. *Economic Policy*, 6(13):341–392.

Grilli, V. and Roubini, N. (1995). Liquidity and exchange rates: Puzzling evidence from the g-7 countries. Technical report, New York University, Leonard N. Stern School of Business, Department of Economics.

Hall, S. G., Zonzilos, N. G., et al. (2003). An indicator measuring underlying economic activity in greece. *Bank of Greece. Working Paper*, (4).

Hansen, H.-J. (1996). *The impact of interest rates on private consumption in Germany*. Number 1996, 03e. Discussion Paper, Economic Research Group of the Deutsche Bundesbank.

Hayo, B. and Hefeker, C. (2001). Do we really need central bank independence? a critical re-examination. *A Critical Re-Examination (March 2001). University of Basel WWZ Working Paper*, (01/03).

He, L. T. and McGarrity, J. P. (2005). A reexamination of the wealth effect and uncertainty effect. *International Advances in Economic Research*, 11(4):379–398.

Hermes, N. and Lensink, R. (2000). Financial system development in transition economies. *Journal of Banking & Finance*, 24(4):507–524.

Herrero, A. G. and Del Rio, P. (2003). Financial stability and the design of monetary policy. *communications*, 33(40.62):07–29.

Hodrick, R. J. and Prescott, E. C. (1997). Postwar us business cycles: an empirical investigation. *Journal of Money, credit, and Banking*, pages 1–16.

Hoffmaister, A. W. and Roldós, J. E. (2001). The sources of macroeconomic fluctuations in developing countries: Brazil and korea. *Journal of Macroeconomics*, 23(2):213 – 239.

Hoffmaister, A. W., Roldós, J. E., and Wickham, P. (1998). Macroeconomic fluctuations in sub-saharan africa. *Staff Papers*, 45(1):132–160.

Hoffmaister, M. A. W. and Roldós, M. J. (1997). *Are business cycles different in Asia and Latin America?* Number 97-99. International Monetary Fund.

Im, K. S., Pesaran, M., and Shin, Y. (2003). Testing for unit roots in heterogeneous panels. *Journal of Econometrics*, 115(1):53 – 74.

Ioannidis, C. and Kontonikas, A. (2008). The impact of monetary policy on stock prices. *Journal of Policy Modeling*, 30(1):33 – 53.

Issing, O. (2003). Monetary and financial stability: is there a trade-off? *BIS Papers*, 18:16–23.

Jácome, L. I. and Vázquez, F. (2008). Is there any link between legal central bank independence and inflation? evidence from latin america and the caribbean. *European Journal of Political Economy*, 24(4):788–801.

Jeanneau, S. (2014). Financial stability objectives and arrangements–what's new? *BIS Paper*, (76e).

Jonsson, G. (1995). Institutions and macroeconomic outcomes-the empirical evidence. *Swedish Economic Policy Review*, 2(1):181–212.

Jordà, Ò., Schularick, M., and Taylor, A. M. (2013). When credit bites back. *Journal of Money, Credit and Banking*, 45(s2):3–28.

Judd, J. P. and Trehan, B. (1995). The cyclical behavior of prices: Interpreting the evidence. *Journal of Money, Credit and Banking*, 27(3):789–797.

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):473–500.

Kandil, M. (2015). On the benefits of nominal appreciations: Contrasting evidence across developed and developing countries. *Borsa Istanbul Review*, 15(4):223 – 236.

Kandil, M. and Mirzaie, I. A. (2006). Consumption and macroeconomic policies: Theory and evidence from developing countries. *J. Int. Trade & Economic Development*, 15(4):469–491.

Kim, S. and Lim, K. (2016). Effects of Monetary Policy Shocks on Exchange Rate in Emerging Countries. Working Papers 192016, Hong Kong Institute for Monetary Research.

Kim, S. and Mehrotra, A. (2018). Effects of monetary and macroprudential policies?evidence from four inflation targeting economies. *Journal of Money, Credit and Banking*, 50(5):967–992.

Kim, S. and Roubini, N. (2000). Exchange rate anomalies in the industrial countries: A solution with a structural var approach. *Journal of Monetary Economics*, 45(3):561 – 586.

King, D. and Ma, Y. (2001). Fiscal decentralization, central bank independence, and inflation. *Economics Letters*, 72(1):95 – 98.

King, M. (1997). Changes in uk monetary policy: Rules and discretion in practice. *Journal of Monetary Economics*, 39(1):81 – 97. Rules and Discretion in Monetary Policy.

Kishor, N. K. (2007). Does consumption respond more to housing wealth than to financial market wealth? if so, why? *The Journal of Real Estate Finance and Economics*, 35(4):427–448.

Kiss, G., Nagy, M., and Vonnák, B. (2006). credit growth in central and eastern europe: trend, cycle or boom. In *conference ?Finance and Consumption Workshop: Consumption and Credit in Countries with Developing Credit Markets?, Florence*, pages 16–17.

Kitov, I. and Kitov, O. (2011). Employment, unemployment and real economic growth. *Unemployment and Real Economic Growth (July 24, 2011)*.

Klomp, J. and de Haan, J. (2009). Central bank independence and financial instability. *Journal of Financial Stability*, 5(4):321 – 338.

Klomp, J. and De Haan, J. (2010). Central bank independence and inflation revisited. *Public Choice*, 144(3-4):445–457.

Kollmann, R. (2001). The exchange rate in a dynamic-optimizing business cycle model with nominal rigidities: a quantitative investigation. *Journal of International Economics*, 55(2):243 – 262.

Kollmann, R. (2012). Limited asset market participation and the consumption-real exchange rate anomaly. *Canadian Journal of Economics/Revue canadienne d'économique*, 45(2):566–584.

Kuttner, K. N. and Posen, A. S. (2010). Do markets care who chairs the central bank? *Journal of Money, Credit and Banking*, 42(2-3):347–371.

Kydland, F. E. and Prescott, E. C. (1977). Rules rather than discretion: The inconsistency of optimal plans. *Journal of Political Economy*, 85(3):473–491.

Kydland, F. E. and Prescott, E. C. (1990). Business cycles: real facts and a monetary myth. *Quarterly Review*, 14(2):3–18.

Laeven, M. L. and Valencia, M. F. (2018). *Systemic banking crises revisited*. International Monetary Fund.

Landon, S. and Smith, C. (2009). Investment and the exchange rate: Short run and long run aggregate and sector-level estimates. *Journal of International Money and Finance*, 28(5):813–835.

Landström, M. (2013). *Determinants and Effects of Central Bank Independence Reforms*. PhD thesis, Umeå universitet.

Lane, P. R. (2001). The new open economy macroeconomics: a survey. *Journal of International Economics*, 54(2):235 – 266.

Lane, P. R. and Shambaugh, J. C. (2010). The long or short of it: determinants of foreign currency exposure in external balance sheets. *Journal of International Economics*, 80(1):33–44.

Lavezzolo, S. (2006). *Central Bank Independence in Developing Countries: A Signaling Mechanism?* Citeseer.

Lee, M., Asuncion, R. C., and Kim, J. (2016). Effectiveness of macroprudential policies in developing asia: an empirical analysis. *Emerging Markets Finance and Trade*, 52(4):923–937.

Levin, A., Lin, C.-F., and Chu, C.-S. J. (2002). Unit root tests in panel data: asymptotic and finite-sample properties. *Journal of Econometrics*, 108(1):1 – 24.

Levine, R. (1999). *Financial development and economic growth: views and agenda*. The World Bank.

Li, Y. D., Iscan, T. B., and Xu, K. (2010). The impact of monetary policy shocks on stock prices: Evidence from canada and the united states. *Journal of International Money and Finance*, 29(5):876 – 896.

Lim, C. H., Costa, A., Columba, F., Kongsamut, P., Otani, A., Saiyid, M., Wezel, T., and Wu, X. (2011). Macroprudential policy: what instruments and how to use them? lessons from country experiences. *IMF working papers*, pages 1–85.

Lin, H.-Y. (2010). Openness and inflation revisited. *International Research Journal of Finance and Economics*, 37(2010):40–47.

Loungani, P. and Sheets, N. (1997). Central bank independence, inflation, and growth in transition economies. *Journal of Money, Credit and Banking*, 29(3):381–399.

Luukkonen, R., Saikkonen, P., and Teräsvirta, T. (1988). Testing linearity against smooth transition autoregressive models. *Biometrika*, 75(3):491–499.

Masciandaro, D. and Volpicella, A. (2016). Macro prudential governance and central banks: Facts and drivers. *Journal of International Money and Finance*, 61:101–119.

Maslowska, A. A. (2011). Quest for the Best: How to Measure Central Bank Independence and Show its Relationship with Inflation. *Czech Economic Review*, 5(2):132–161.

McKinnon, R. I. and Pill, H. (1998). International overborrowing: a decomposition of credit and currency risks. *World Development*, 26(7):1267–1282.

Mendoza, E. and Uribe, M. (1997). The syndrome of exchange-rate-based stabilizations and the uncertain duration of currency pegs. *Duke University, Department of Economics, Working Papers.*

Mishkin, F. (1997). Understanding financial crises: A developing country perspective. *Annual World Bank Conference on Development Economics.*

Moser, C. and Dreher, A. (2010). Do markets care about central bank governor changes? evidence from emerging markets. *Journal of Money, Credit and Banking*, 42(8):1589–1612.

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):475–485.

Neumann, M. (1991). Precommitment by central bank independence. *Open Economies Review*, 2(2):95–112.

Papadamou, S., Sidiropoulos, M., and Spyromitros, E. (2017). Does central bank independence affect stock market volatility? *Research in International Business and Finance*, 42:855 – 864.

Parkin, M. (2014). The effects of central bank independence and inflation targeting on macroeconomic performance: Evidence from natural experiments. *Review of Economic Analysis*, 6(1):1–35.

Pastor, Jr, M. and Maxfield, S. (1999). Central bank independence and private investment in the developing world. *Economics & Politics*, 11(3):299–309.

Pesaran, M. and Smith, R. (1995). Estimating long-run relationships from dynamic heterogeneous panels. *Journal of Econometrics*, 68(1):79 – 113.

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):621–634.

Phillips, A. W. (1958). The relation between unemployment and the rate of change of money wage rates in the united kingdom, 1861-1957. *Economica*, 25(100):283–299.

Pichette, L., Tremblay, D., et al. (2003). *Are wealth effects important for Canada?* Bank of Canada Ottawa, Canada.

Polillo, S. and Guillen, M. F. (2005). Globalization pressures and the state: The worldwide spread of central bank independence. *American Journal of Sociology*, 110(6):1764–1802.

Posso, A. and Tawadros, G. B. (2013). Does greater central bank independence really lead to lower inflation? evidence from panel data. *Economic Modelling*, 33:244 – 247.

Reinhart, C. M. and Rogoff, K. S. (2004). The Modern History of Exchange Rate Arrangements: A Reinterpretation. *The Quarterly Journal of Economics*, 119(1):1–48.

Reinhart, C. M. and Rogoff, K. S. (2009). The aftermath of financial crises. *American Economic Review*, 99(2):466–72.

Rigobon, R. and Sack, B. (2004). The impact of monetary policy on asset prices. *Journal of Monetary Economics*, 51(8):1553 – 1575.

Rogoff, K. (1985). The optimal degree of commitment to an intermediate monetary target. *The Quarterly Journal of Economics*, 100(4):1169–1189.

Romer, D. (1993). Openness and inflation: Theory and evidence. *The Quarterly Journal of Economics*, 108(4):869–903.

Roy, S. N. (1957). *Some aspects of multivariate analysis.* Statistical Publishing Society, Kolkata.

Saito, A. T., Savoia, J., and Lazier, I. (2014). Determinants of private credit in oecd developed, bric's and lac countries. *American International Journal of Social Science*, 3(3).

Samargandi, N., Fidrmuc, J., and Ghosh, S. (2015). Is the relationship between financial development and economic growth monotonic? evidence from a sample of middle-income countries. *World Development*, 68:66 – 81.

Sanchez, M. (2008). The link between interest rates and exchange rates: do contractionary depreciations make a difference? *International Economic Journal*, 22(1):43–61.

Sargent, T. J. and Wallace, N. (1981). Some unpleasant monetarist arithmetic. *Quarterly Review*, (Fall).

Schnabl, G. (2008). Exchange rate volatility and growth in small open economies at the emu periphery. *Economic Systems*, 32(1):70–91.

Scholl, A. and Uhlig, H. (2008). New evidence on the puzzles: Results from agnostic identification on monetary policy and exchange rates. *Journal of International Economics*, 76(1):1–13.

Schularick, M. and Taylor, A. M. (2012). Credit Booms Gone Bust: Monetary Policy, Leverage Cycles, and Financial Crises, 1870-2008. *American Economic Review*, 102(2):1029–1061.

Shiratsuka, S. (2001). Asset prices, financial stability and monetary policy: based on japan experience of the asset price bubble. In Settlements, B. f. I., editor, *Marrying the macro- and micro-prudential dimensions of financial stability*, volume 01, pages 261–284. Bank for International Settlements.

Siokis, F. M. (2005). Policy transmission and the consumption-wealth channel. *Applied Financial Economics Letters*, 1(6):349–353.

Smets, F. (1997). Financial asset prices and monetary policy: Theory and evidence. *SSRN Electronic Journal.*

Smets, F. et al. (2014). Financial stability and monetary policy: How closely interlinked? *International Journal of Central Banking*, 10(2):263–300.

Starr-McCluer, M. (2002). Stock market wealth and consumer spending. *Economic Inquiry*, 40(1):69–79.

Stepanyan, V. and Guo, K. (2011). *Determinants of bank credit in emerging market economies.* Number 11-51. International Monetary Fund.

Stock, J. and Watson, M. (1999). Business cycle fluctuations in us macroeconomic time series. In Taylor, J. B. and Woodford, M., editors, *Handbook of Macroeconomics*, volume 1, Part A, chapter 01, pages 3–64. Elsevier, 1 edition.

Stock, J. H. and Watson, M. W. (1989). New indexes of coincident and leading economic indicators. *NBER macroeconomics annual*, 4:351–394.

Svensson, L. E. (1997). Inflation forecast targeting: Implementing and monitoring inflation targets. *European Economic Review*, 41(6):1111 – 1146.

Taylor, A. (2015). Credit, financial stability, and the macroeconomy. *Annual Review of Economics*, 7:309–339.

Temple, J. (1998). Central bank independence and inflation: good news and bad news. *Economics Letters*, 61(2):215 – 219.

Temple, J. (2002). Openness, inflation, and the phillips curve: A puzzle. *Journal of Money, Credit and Banking*, 34(2):450–468.

Terra, C. T. (1998). Openness and inflation: A new assessment. *The Quarterly Journal of Economics*, 113(2):641–648.

Tillmann, P. (2008). The conservative central banker revisited: Too conservative is more costly than too liberal. *European Journal of Political Economy*, 24(4):737 – 741. Does central bank independence still matter?

Tobin, J. (1969). A general equilibrium approach to monetary theory. *Journal of Money, Credit and Banking*, 1(1):15–29.

Triffin, R. and Grubel, H. (1962). The adjustment mechanism to differential rates of monetary expansion among the countries of the european economic community. *The Review of Economics and Statistics*, 44(4):486–491.

Ueda, K. and Valencia, F. (2014). Central bank independence and macro-prudential regulation. *Economics Letters*, 125(2):327 – 330.

Ungerer, R. (2003). The effect of the stock market on consumer spending october 1990-april 2002. *Issues in Political Economy*, 12:55–84.

Uribe, M. (1997). Exchange-rate-based inflation stabilization: The initial real effects of credible plans. *Journal of Monetary Economics*, 39(2):197 – 221.

Walsh, C. E. (1995). Is new zealand's reserve bank act of 1989 an optimal central bank contract? *Journal of Money, Credit and Banking*, 27(4):1179–1191.

Walsh, C. E. (2010). Central bank independence. In *Monetary Economics*, pages 21–26. Springer.

Zellner, A. (1962). An efficient method of estimating seemingly unrelated regressions and tests for aggregation bias. *Journal of the American statistical Association*, 57(298):348–368.

Appendices

Appendix A

Appendix to First Study

Table A.1: List of Countries

Moderate Inflation Countries	High Inflation Countries
Barbados	Argentina
Colombia	Bolivia
Egypt	Brazil
Ethiopia	Chile
Guatemala	Costarica
Honduras	Ghana
Indonesia	Mexico
Kenya	Nicaragua
Malaysia	peru
Mauritania	Suriname
Morocco	Turkey
Nepal	Uganda
Nigeria	Uruguay

Continued on next page

Table A.1 – *Continued*

Moderate Inflation Countries	**High Inflation Countries**
Pakistan	Venezuela
Paraguay	Zambia
Philippines	
South Africa	
Sri Lanka	
Tanzania	
Thailand	
Trinidad and Tobago	
Tunisia	

Appendix B

Appendix to Second Study

Table B.1: Splitting model 1

Country	CBI	Money Suply	Inflation	Exchange Rate Arrangement	Capital Control
Group 1					
Guatemala	0.7406	34.8759	13.0250	7.0000	0.0552
Morocco	0.3588	85.0877	4.2804	7.6154	0.7601
Paraguay	0.5799	32.9120	15.2093	10.2692	0.0865
Thailand	0.2200	104.7696	5.3353	9.1923	0.7365
Malaysia	0.4902	124.0735	4.7260	7.8846	0.7931
Trinidad and Tobago	0.4420	48.2702	10.1755	3.8462	0.0000
Average Group 1	**0.4719**	**71.6648**	**8.7919**	**7.6346**	**0.4052**
Group 2					
Tunisia	0.5181	54.7790	6.9880	8.0000	1.0000
Uruguay	0.5445	44.2457	29.2257	10.0000	0.0250
Pakistan	0.3192	48.2686	14.2623	7.3462	0.7228
Philippines	0.6173	57.2600	9.5637	9.1154	0.8404
Egypt	0.4901	83.8688	14.9066	5.8846	0.1504
Average Group 2	**0.4978**	**57.6844**	**14.9893**	**8.0692**	**0.5477**
Group 3					
Mexico	0.6194	35.8761	15.6881	11.0769	0.5751
Honduras	0.6002	45.5186	17.9976	6.5769	0.0000
Mauritania	0.4867	92.3699	9.6362	8.0769	0.0000
Suriname	0.4618	50.0210	50.9858	6.7692	0.0000
Argentina	0.7631	24.9493	20.2267	5.9231	0.5091
Ghana	0.4528	26.8950	30.4840	10.0000	0.5816
Kenya	0.5116	37.8868	19.4738	8.9231	0.3256
South Africa	0.3389	62.6375	11.3456	12.4615	0.6143
Turkey	0.7332	40.1662	51.4683	12.4615	0.3772
Zambia	0.4616	18.4128	44.6631	11.8462	0.0000
Bolivia	0.7067	59.0471	11.0994	6.0000	0.1633
Ethiopia	0.4254	35.8363	16.3077	7.9615	0.7572
Nicaragua	0.6964	29.4110	83.0620	4.7692	0.1400
Venezuela	0.6974	28.3389	48.5877	7.3846	0.3234
Indonesia	0.7562	42.9868	15.9173	9.2692	0.6080
Average Group 3	**0.5807**	**42.0236**	**29.7962**	**8.6333**	**0.4523**

The numbers show the annual averages.
ER arrangement measures Reinhart and Rogoff (2004).

Capital control is based on Fernández et al. (2016).

Table B.2: Splitting model 2

Country	CBI	Inflation	Output Gap	Financial Capitalisation
Group 1				
Argentina	0.7631	20.2267	0.0011	15.2739
Kenya	0.5116	19.4738	-0.0005	17.2406
Morocco	0.3588	4.2804	-0.00002	14.8515
Nigeria	0.5227	28.8826	0.0016	15.6352
Sri Lanka	0.5928	14.9950	0.0002	14.1710
Tunisia	0.5181	6.9880	0.0007	12.9304
Average Group 1	**0.5445**	**15.8078**	**0.0005**	**15.0171**
Group 2				
Costa Rica	0.6942	17.7427	-0.0003	3.9304
Egypt	0.4901	14.9066	-0.0003	17.1568
Indonesia	0.7562	15.9173	0.0004	27.3820
Malaysia	0.4902	4.7260	0.0008	157.3900
Pakistan	0.3192	14.2623	0.00003	20.7483
Philippines	0.6173	9.5637	-0.0005	46.0461
South Africa	0.3389	11.3456	-0.0009	197.0858
Thailand	0.2200	5.3353	0.0007	64.2979
Turkey	0.7332	51.4683	-0.0003	23.2546
Venezuela	0.6974	48.5877	0.0015	3.5288
Average Group 2	**0.5357**	**19.3855**	**0.0001**	**56.0821**

The numbers show the annual averages.

Table B.3: Splitting model 3

Country	CBI	Inflation	Bond Yield	Sovereign Risk
Group 1				
Ghana	0.4528	30.4840	24.5796	16
Malaysia	0.4902	4.7260	4.0348	7
Nigeria	0.5227	28.8826	12.3383	14
South Africa	0.3389	11.3456	11.0737	12
Sri Lanka	0.5928	14.9950	12.6552	14
Thailand	0.2200	5.3353	6.0113	8
Zambia	0.4616	44.6631	30.0672	14

Continued on next page

Table B.3 – *Continued*

Country	CBI	Inflation	Bond Yield	Sovereign Risk
Average Group 1	**0.4399**	**20.0617**	**14.3943**	**12**
Group 2				
Barbados	0.4060	5.6292	4.7344	10
Egypt	0.4901	14.9066	9.9767	14
Mexico	0.6194	15.6881	13.5055	9
Nepal	0.4474	13.0049	7.7663	-
Pakistan	0.3192	14.2623	7.9314	16
Trinidad	0.4420	10.1755	5.8443	6
Average Group 2	**0.4540**	**12.2778**	**8.2931**	**11**
Group 3				
Bolivia	0.7067	11.0994	8.7977	11
Kenya	0.5116	19.4738	13.7345	14
Philippines	0.6173	9.5637	8.2210	11
Tanzania	0.5414	20.7101	14.7451	-
Uganda	0.5232	11.8785	13.4943	14
Uruguay	0.5445	29.2257	19.0844	11
Average Group 3	**0.5741**	**16.9919**	**13.0129**	**12**

The numbers show the annual averages.
Sovereign risk is S & P rating, the numerical scale based on Canuto et al. (2012).
Nepal and Tanzania are not rated by any of the seven rating agencies.

Table B.4: Splitting model 4

Country	CBI	Inflation	Exchange Rate Arrangement	Capital Control	Financial Capitalisation	Sovereign Risk
Egypt	0.4901	14.9066	5.8846	0.1504	17.1568	14
Kenya	0.5116	19.4738	8.9231	0.3256	17.2406	14
Malaysia	0.4902	4.7260	7.8846	0.7931	157.3900	7
Pakistan	0.3192	14.2623	7.3462	0.7228	20.7483	16
Philippines	0.6173	9.5637	9.1154	0.8404	46.0461	11
South Africa	0.3389	11.3456	12.4615	0.6143	197.0858	12
Thailand	0.2200	5.3530	9.1923	0.7365	64.2979	8

The numbers show the annual averages.
ER arrangement measures Reinhart and Rogoff (2004)
Capital control is based on Fernández et al. (2016)
Sovereign risk is S & P rating, the numerical scale based on Canuto et al. (2012)

Appendix C

Appendix to Third Study

Biography

DR. CEP JANDI ANWAR

Dr. Cep Jandi Anwar is currently an Assistant Professor at Department of Economics, University of Sultan Ageng Tirtayasa, Indonesia. Dr Anwar obtained his PhD in Economics from University of Leicester, UK. He participated in several high profile conferences. He has published several papers in reputable international journal. His research interests are Macroeconometrics, Monetary Economics and Macroeconomics.

Indonesia menulis

This book is composed of three studies on the effect of central bank independence in developing countries. The first study investigates the relationship between CBI and inflation in developing countries. The second study presents the responses to financial asset prices, consumption and investment in relation to CBI shocks in developing countries. The financial asset prices are divided into three categories: exchange rate, stock index and bond yield. The last study examines whether CBI and macroprudential policy can contribute to enhancing financial stability in terms of credit per GDP.

Author

Cep Jandi Anwar, Ph.D, is currently an Assistant Professor at Department of Economics, University of Sultan Ageng Tirtayasa, Indonesia. Dr Anwar obtained his PhD in Economics from University of Leicester, UK. He participated in several high profile conferences. He has published several papers in reputable international journal. His research interests are Macroeconometrics, Monetary Economics and Macroeconomics.

Media Sains Indonesia

Media Sains Indonesia
Melong Asih Regency B.40, Cijerah
Kota Bandung - Jawa Barat
Email : penerbit@medsan.co.id
Website : www.medsan.co.id

IKAPI
IKATAN PENERBIT INDONESIA

GET IT ON Google Play

ISBN 978-623-6882-50-4 (PDF)
9 786236 882504