Four Essays on Monetary Regimes: Inflation Targeting and a Fixed Exchange Rate system in Emerging Market Economies

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To my precious gifts from God...
To my mum...
To my daughter...

Abstract

Recent evidence has shown that monetary policy has a neutral real effect in the long run. Exploiting the short-run trade-off between inflation and unemployment creates an inflation bias which can be eliminated at a high economic and social cost. Hence, the only variable that could be controlled by the monetary authority in the long run is the inflation rate. This indicates that the monetary policy's role should be placed on achieving the goal of price stability. This thesis considers two monetary regimes with a quantitative target for the goal of price stability. It consists of four separate yet related empirical studies on inflation targeting and a fixed exchange rate system.

First, we assess the institutional preconditions for adopting inflation targeting: central bank independence and transparency, in Jordan, where the credibility of low inflation is imported from abroad. These institutional requirements are assessed based on the experience of two inflation targeters that act as a benchmark of the study: New Zealand and the UK, in their first year of implementing the framework. The chapter addresses the institutional challenges of adopting inflation targeting when a country faces a macroeconomic trilemma of exchange rate stabilisation. The assessment of central bank independence, using the index of Mathew (2003), indicates that the central bank of Jordan is not independent as stated by the central bank's personal legislations. The central bank is also not fiscally independent; non-securitised and securitised lending is offered at no cost to cover the expenditure of the central government as well as the public corporations. The assessment of central bank transparency using the index of Eijffinger and Geraats (2006) shows that although providing the market with more transparent policies will not be infeasible, given the enhancement in the level of central bank independence, the central bank should clarify the policy changes and any inclination of preferences and release all relevant macroeconomic data to the public. Comparing the overall results to the two inflation targeters, the study recommends the need to grant the central bank more personal independence and induce more fiscal discipline which entails non-moneterisation of the government deficit in order to build a domestic reputation for the goal of price stability.

Second, the interest rate pass through is examined within its intermediate lag of action to shed light on the credibility of monetary policy in Jordan, where the reputation of low inflation is imported through a fixed exchange rate system to the U.S dollar. The Johansen approach is performed to estimate the long-run degree of pass-through along with the speed of adjustment to disequilibrium. The parsimonious conditional dynamic model of Hendry and Doornik (1994) is employed to connect the short-run and long-run

effect, and to estimate the mean lag of adjustment under (a)symmetric market response. The results are compared to that of two inflation targeting countries at time proceeding building the credibility of price stability domestically: New Zealand and the UK. This is to show how far Jordan is from building a domestic reputation for the goal of price stability. The empirical findings suggest that the interest rate pass-through in Jordan is weak and slow and the symmetric mean lags in the loan and deposit market are highly sticky. In addition, a deviation from symmetry is found in the loan market, where the mean lag is sticker to decreasing, which indicates the existence of non-competitive pricing behaviour in the market. Comparing the results to the two inflation targeters, the study suggests that Jordan needs to move to a more resilient exchange rate arrangement, provided the need for an intensive reform in economic constitutions and institutions.

Third, we examine the credibility of the current experience of a pegged exchange rate system to the US dollar in eleven emerging market economies: Bahamas, Bahrain, Barbados, Belize, Egypt, Jordan, Oman, Kuwait, Lebanon, Qatar and Venezuela, over the annual span from 1996 to 2012. Based on the first generation-demand mismanagement models, the second generation of currency crises and the empirical works on the European Monetary System crisis, two proxies reflecting the market agents' realignment expectations are employed: the interest rate differential and the exchange rate market pressure index. The two proxies are regressed on a set of macro-fundamentals derived from the theory and empirical works of currency crises and gathered from the IMF-IFS and the World Bank Indicators. The analysis is based on unbalanced panel data models: fixed effects and first difference GMM. We construct different setups to consider the small sample size at hand and the nexus between current account and money stock as in the notion implied by the monetary approach to balance of payments, in which a balance of payments deficit results from excessive domestic credit creation. When interest rate differential is used as a proxy for the credibility, both panel models provide evidence that inflation differential is the main driving force for generating realignment expectations, and explains why anchoring interest rates in not feasible for soft fixed exchange rate targeting countries. This result is consistent with the empirical findings on the credibility of the European Monetary System before the collapse. However, when the exchange rate market pressure index is used as a proxy for the credibility, none of the fundamentals appear significant in explaining the realignment expectations. When we examine the credibility in the countries which have not experienced a shift in monetary regime during the study period: Bahamas, Bahrain, Barbados, Belize, Jordan, Oman, the estimation of the fixed effects model suggests that inflation differential is a vital factor of the credibility. The deterioration in current account and the reserve adequacy also appear to be important indicators for expecting realignment

from the parity condition in these countries.

Fourth, we investigate the relationship between inflation and inflation uncertainty under inflation targeting and a fixed exchange rate system and examine the role of both regimes in lowering inflation rate and inflation uncertainty. We utilise monthly data on consumer price index obtained from the IMF-IFS for the period 01:1980-06:2014 and construct different GARCH in mean models. The findings suggest that the hypotheses of Cukierman and Meltzer (1986) and Friedman (1977) and Ball et al. (1990) are valid under the two monetary regimes, that is, inflation uncertainty increases inflation and inflation generates inflation uncertainty, respectively. The results provide evidence that both regimes could reduce inflation uncertainty; however, it could be argued that the impact of exchange rate targeting on inflation uncertainty holds as long as the possibility to renege on the fixed parity commitment is not perceived by the market. The results also indicate that inflation targeters have been successful at reducing the inflation rate and inflation persistence more than fixed exchange rate targeting countries, where the regime has no impact on lowering average inflation and inflation inertia.

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Contents

List of Tables

List of Figures

Chapter 1

Thesis Introduction

At the beginning of the last century, policy activists believed that monetary policy could keep productivity and unemployment close to their full-employment levels. However, exploiting the relationship between inflation and unemployment failed to reduce unemployment rates and rather resulted in higher inflation rates, which were eliminated at a high economic and social cost. This is because attempting to increase inflation decreases unemployment temporarily as the new level of prices is not perceived by the market. Once wage earners and employers adjust to inflation, unemployment returns back to its natural rate but at a higher inflation rate. Friedman (1968)and Phelps (1968) state that the relationship between inflation and unemployment, or the expectations augmented Phillips curve, is vertical in the long run. Hence, the only variable that can be controlled by the monetary authority in the long run is the inflation rate. In the absence of constrained discretion or the dominance of active monetary policy, the temptation to exploit the trade-off between inflation and unemployment results in inflation bias as suggested by the time inconsistency problem by Kydland and Prescott (1977)and Barro and Gordon (1983). It follows that the emphasis should be placed on the goal of price stability. In 1990, the goal of price stability received the explicit priority with the introduction of inflation targeting by New Zealand. The need for a low-inflation framework which could suppress inflation and provide the leverage over the political inflationary bias encouraged a number of middle and high income countries to adopt inflation targeting. The foremost aspect of inflation targeting is the announcement of a forward-looking inflation target. Providing the market with an explicit quantitative target like the changes in consumer prices eases the public understanding and anchors their inflation expectations. In fact, inflation targeting is built on high institutional arrangements and constitutions related to central bank independence and transparency as well as the existence of a well-developed financial market. These arrangements allow building the credibility of low inflation domestically instead of importing it from abroad.

Over the last century, the majority of countries have abandoned different fixed exchange rate arrangements either discretionary or involuntarily. Since ever, the foreign-built credibility of price stability has been questioned. The first generation models, led by Krugman (1979), and the majority of the post-crisis literature on the European Monetary System suggest that the collapse of fixed exchange rate systems happens due to demand mismanagement. This implies that one or more weak macro fundamentals could generate

successful speculative attacks. On the other hand, advocates of the escape clause models tend to believe that the past currency crises happened due to self-fulfilling prophecy. This view is challenged on the basis that animal spirit scenarios would not generate if macroeconomic factors were well-behaved. In general, recent evidence suggests that even when a fixed exchange rate system does not collapse, deteriorations in the level of nominal interest rates, foreign reserves loss and/or exchange rate devaluation or revaluation often take place (Bubula and Otker-Robe, 2003).

However, fixed exchange rate systems are still a prominent option among emerging market economies for setting the credibility of monetary policy. In fact, inflation targeting and fixed exchange rate regimes provide the market with a quantitative target for the nominal prices through which inflation expectations can be settled (Canavan and Tommasi, 1997) (Herrendorf, 1999). Announcing a quantitative target for monetary policy is the first aspect of transparency, which could eliminate the market uncertainty about future inflation (Dincer and Eichengreen, 2010). Indeed, it is believed that many of inflation costs come from the uncertainty about future inflation. Bernanke et al. (1999) states that " many of the cost of inflation arise from its uncertainty or variability rather than from its level". Hence, a monetary regime should be effective in reducing inflation uncertainty along inflation rate. The nexus between inflation and inflation uncertainty has received heavy attention after the Nobel lecture of Friedman (1977), in which he states that inflation increases inflation uncertainty. This notion of a positive causality from inflation to inflation uncertainty is supported by Ball (1992). However, Cukierman and Meltzer (1986) argue that inflation uncertainty raises the level of inflation rate, whereas Holland (1995), points out the possibility of a negative nexus between inflation uncertainty and inflation as a result of monetary authority stabilising reaction to high inflation.

This thesis consists of four independent chapters related to inflation targeting and a conventional fixed exchange rate system. The first chapter assesses the existence of the institutional requirements for a successful move from a fixed exchange rate system to inflation targeting for the case of Jordan. The chapter highlights the degree of development of the economic institutions and constitutions as well as the transparency of monetary policy when the monetary credibility is imported from abroad. Therefore, the chapter identifies the challenges to build a domestic monetary reputation which is crucially fundamental to adopt inflation targeting when the economy anchors inflation expectations on a foreign base. The preconditions for adopting inflation targeting: central bank independence and central bank transparency are measured, using the index of Mathew (2003) and Eijffinger and Geraats (2006), respectively, and the results are compared to two inflation targeting

role models in their early days of implementing inflation targeting. The second chapter examines the credibility of monetary policy in Jordan under the current fixed exchange rate system to the U.S dollar and assesses the reputation of monetary policy and the degree of development of the financial market, which is fundamental to achieve the goal of price stability domestically. We create a benchmark by comparing the results of the current credibility of monetary policy in Jordan to that of New Zealand and the UK prior to their transition to inflation targeting.

The third chapter examines the credibility of the most recent experience of the conventional fixed exchange rate to the U.S. dollar, based on the empirical literature of the European Monetary System and the first and second generation models of currency crises. It is intended to point out whether the current fixed exchange rate system is different from the past pegged exchange rate arrangements prior to currency crises. The fourth chapter investigates the relationship between inflation and inflation uncertainty under inflation targeting and the conventional fixed exchange rate system to the U.S dollar and examines the role of each monetary regime in reducing inflation and inflation uncertainty.

1.1 Towards Adopting Inflation Targeting in Emerging Market Economies: The level of Central Bank Independence and Transparency When The Monetary Reputation is Imported From Abroad: The Case of Jordan

Over the last two decades, inflation targeting has become a popular monetary policy framework; more than twenty countries have adopted inflation targeting, and the world has been divided into inflation targeters and non-targeters. Indeed, inflation targeting proves its effectiveness in lowering inflation rates and enhancing the performance of inflation and output. It also anchors inflationary expectations and reduces inflation forecast errors. Additionally, it is found that emerging market countries have benefited from the framework, in terms of delivering both lower inflation and a more stable real economy, more than their advanced counterparts (Mishkin and Schmidt-Hebbel, 2007) (Walsh, 2009). These benefits encourage monetary authorities and researchers to question adopting the framework in other countries. In this chapter, we assess the main institutional preconditions of inflation targeting: central bank independence and transparency for Jordan, an emerging market country with a fixed exchange rate system. Each institutional precondition for adopting inflation targeting is compared to two inflation targeting countries: New Zealand and the UK, in their early days of implementing the framework. The study contributes to the literature on adopting inflation targeting in emerging market economies by highlighting the case of a small open economy with a fixed exchange rate system. It also sheds light on the similarities and mismatches between building the credibility of low

prices domestically and importing the mechanism of price stability from abroad.

In fact, building the credibility domestically or committing to an explicit inflation rate requires limited if not absent control over the inflation strategy. Hence, the economic and personal independence of central banks from the fiscal authority must be ensured to enable achieving the declared inflation target. This perspective is supported by the correlation found between the level of independence and inflation rates. In the absence of a clear relationship between the monetary and fiscal authorities, the demand mismanagement of the political actor could lead to a divergence between the real inflation rate and the policy target. In fact, obliging the monetary authority to money finance the government deficit through printing money and/or lending advances to the government creates more inflation. In addition, government tend to create inflation in an attempt to soothe the burden of public debt as implied by the public choice theory of Sargent and Wallace (1981). As a result, central bank independence is crucially fundamental for adopting inflation targeting.

The study assesses the level of independence of the central bank of Jordan using Mathew (2003)index, given that the independence from the political authority can be exercised even if the economy faces a macroeconomic trilemma of exchange rate stabilisation. The index is composed of three independence aspects: personnel, economic and fiscal. According to the index categories and coding, each aspect has six categories capturing the institutional legislations and the real practices that forge the relationship between the two economic authorities. Different weight is assigned to each category based on its importance in measuring the degree of independence from the author's perspective. However, some changes are performed to the index to be consistent with the purpose of the study. Some categories are removed or added and weighted equally with a range of 1 (high independence) to 0 (low independence). The total score for each three independence aspects is different depending on the number of categories included after the amendments. The assessment of the central bank independence is based on the legislations of central banks and the government deeds.

According to many studies on the effect of transparency in improving the rule of monetary policy, it is found that transparency is an optimal rule to anchor inflation expectations and ensure a full monetary policy transmission to achieve the final goals of monetary policy. Hence, announcing an explicit inflation rate establishes the first link with the market; however, this link could be strengthened by enabling the market to infer the direction of monetary policy and increasing the accountability of policy decisions. To examine the current level of central bank transparency, we employ the Eijffinger and Geraats (2006)in-

dex, which classifies the monetary policy making practices under five aspects: political, economic, procedural, policy and operational. Each aspect is associated with three criteria and the overall score of all transparency sub-indexes is fifteen.

The results of the level of central bank independence point out that the turnover rate of Governors, that is, the number of Governors within a given period of time over the length of this period, suggested by Cukierman et al. (1992), as a *defacto* measure of central bank independence in developing countries, is invalid for the case of Jordan. The rate is set on political electoral cycle, which reflects the political intentions to exploit the trade-off between inflation and unemployment. Nonetheless, Jordan is ruled by a king who appoints the Cabinet, Governor of the central bank and the Senate. Therefore, the notion of the turnover rate and, thus the principle of the time inconsistency problem do not apply to Jordan. However, the fiscal mismanagement and the absence of independent personal legislations of the central bank weaken the credibility of adopting inflation targeting in Jordan. The study highlights that there is no limitation on how many times Governor can be reappointed by the government. For example, Al-Nabulsi was appointed five times, holding an eighteen years at chair. Therefore, it could be argued that holding the tenure for a long period of time invalidates the credibility of the turnover rate of Governors and, consequently, it should be an indicator of a low level of independence. In addition, although the central bank's legislations indicate that Governor can be dismissed by the executive branch, subject to the king's consent, only for health or criminal conviction reasons, two Governors were dismissed by the Prime Minister for unclear reasons and without the consent of the Parliament. In addition, the legislations of the central bank are lenient with regards to the non-securitised borrowing from the central bank. The non-securitised lending is offered generously with free market interest rates and covers not only the expenditure of the central government but also the expenditure of the public corporations. The weak fiscal independence and the absence of fiscal restrictions could also threaten the current fixed exchange rate system.

The assessment of the level of transparency suggests that the central bank of Jordan has to provide the market with clear statements regarding the policy changes and outcomes and any inclination of future preferences. Data on capacity utilisation and unemployment has also to be released to the public. However, comparing the level of current transparency to that of New Zealand and the UK in the early days of inflation targeting, it could be argued that enhancing the level of transparency will not infeasible if the country moves towards adopting the full-fledged inflation targeting. However, improving the level of central bank independence is essential to strengthen transparency of data and actions

and to set the base for central bank accountability. Generally, the study prevails that the preconditions for adopting inflation targeting, which are essential to build a domestic reputation for the goal of price stability, do not exist in Jordan. The current monetary regime and the dominance of the political authority over the economic aspects contribute to the weaknesses of monetary policy. In the absence a credible base for independent and transparent policies and the economic schemes that can control the discretion of policy makers adhering to any monetary regime is just a fig-leaf.

1.2 The Credibility of Monetary Policy Under The Fixed Exchange Rate System: The (A)symmetric Transmission Mechanism in Jordan

The credibility of a monetary regime in the market can be measured by the ability of the central bank to induce changes in the market and speed up the transmission of monetary policy to achieve the long-run target of monetary policy along secondary objectives, which are consistent with the goal of price stability. Whether the credibility of low prices is domestically built or imported from abroad, the central banks official instrument should have a quick and complete impact on saving and investment decisions to achieve the final goal of the policy. The interest rate pass-through channel through which policy message is transmitted to the market could reflect the effectiveness of monetary policy in meeting the inflation target. We assess the credibility of monetary policy when the economic fundamentals are managed by fixing the exchange rate to a central currency. Therefore, we examine the interest rate pass-through channel for the case of Jordan within its intermediate lag of action, which reflects the time lag needed by commercial banks to affect spending and investment decisions. The Johansen approach (Johansen, 1991) is conducted to estimate the long run degree of pass-through along with the speed of adjustment to disequilibrium from official interest rates to retail interest rates and by using a parsimonious error correction model of Hendry and Doornik (1994), we connect the short and long run effects of monetary policy. In addition, we examine whether the asymmetric behaviour of banking sector to monetary shocks exist. Berger and Hannan (1989)and Neumark and Sharpe (1992) point out that firms could follow a non-competitive pricing behaviour. Two hypotheses, based on the structure performance and efficient hypotheses in the industrial market, are put forward explaining the asymmetric adjustment in the financial market: the bank concentration, or bank's collusive pricing hypothesis, and the consumer behaviour hypothesis. To examine the asymmetries in the market, we incorporate two dummy variables based on whether retail interest rates are above or below their long-run equilibrium level. The results indicate that the degree of pass-through varies in Jordan from incomplete to overshooting. An asymmetric response is found in

the Jordanian loan market at 10% level of significance, showing that banks follow a non-competitive pricing behaviour as they respond quicker to increasing their interest rates on loans. The symmetric mean lags of the loan rate with respect to changes in official interest rates are slow; in all cases banks need more than twenty months to converge to the long run equilibrium. By contrast, no asymmetry is found in the deposit market, and rather, we find a faster mean lag, i.e., 10-13 months. Comparing the results for Jordan to that for the two inflation targeters, our findings provide evidence that with a weak and sluggish interest rate pass-through, as well as asymmetry in the loan market, the monetary policy in Jordan under the pegged exchange rate regime to the US dollar is dependent and ineffective. This suggests that Jordan has to move to a more resilient exchange rate arrangement following a comprehensive monetary reform, given the weak financial constitutions and the dominance of the government over the central banks policies, to be able to target the level of inflation on domestic bases.

1.3 The Credibility of a Soft Pegged Exchange Rate in Emerging Market Economies: Evidence from a Panel Data Study

The credibility of fixed exchange rate systems has been questioned over the last century. The failure of the gold standard, the Bretton Woods system, the European Monetary System, and the currency crises in Latin America and East Asia has proven that achieving the price stability goal through fixing the exchange rate is short-lived. Consequently, the literature has emerged to identify why a fixed exchange rate is more prone to crises and how the credibility of the fixed system would be weakened. The collapse of a fixed exchange rate system according to the first generation models happens due to the inconsistency between the monetary and fiscal policies. The empirical works on past currency crises indicate that a number of bad fundamentals has led to the abandonment of the peg. The most important fundamentals were the inflation differential between a domestic economy and anchor country, real exchange rates, current account deficit and fiscal deficit.

Based on the first generation-demand mismanagement models and the empirical works on the European Monetary System crisis, we assess the credibility of the current experience of pegged exchange rates in emerging market economies. Eleven countries adherent to the fixed exchange rate to the US dollar are selected: Bahamas, Bahrain, Barbados, Belize, Egypt, Jordan, Oman, Kuwait, Lebanon, Qatar and Venezuela over the yearly span from 1996 to 2012. The countries are selected based on their $defacto$ and $dejure$ exchange rate policy. We utilise the IMF $defacto$ classification, however, this classification was first published in 1999. Therefore, we classify the countries for the years 1996-1998 based on the behaviour of nominal exchange rate and international reserves as in the $defacto$

classification of Levy-Yeyati and Sturzenegger (2005). The study is the first to examine the current credibility of a soft-fixed exchange rate regime.

Two proxies measuring the credibility are adopted to reflect realignment expectations of market agents: the interest rate differential and the exchange rate market pressure index. The two proxies are regressed on a set of macro-fundamentals derived from the theory and empirical work of currency crises. The macroeconomic fundamentals selected are: inflation differential, debt to GDP, current account to GDP, money growth, international reserves and import to GDP.

In fact, the exchange rate fixers are assumed to preserve a very low interest rate differential, which, according to the uncovered interest rate parity condition, is supposed to equal the expected changes in exchange rate. When the system is highly credible, market agents anticipate a zero domestic inflation rate and presume the parity condition to hold. Due to data limitation and the short frequency for macroeconomic data gathered from the IMF-IFS and the World Bank Indicators, the analysis is based on panel data models. On the basis of weak exogeneity of regressors, the fixed effects model is employed to remove the country-specific heterogeneity. To allow for endogeneity in the macroeconomic setting, Arellano and Bond (1991)'s first difference GMM is carried out. Different setups are constructed to consider the small sample size at hand and to account for the nexus between current account and money stock as in the notion implied by the monetary approach to balance of payments.

When the credibility is assessed by the interest rate differential, and under the strict assumption of regressors exogeneity, the groupwise heteroscedasticity test and the Pesaran (2004)'s cross sectional dependence test indicate that the countries are spatially dependent. Accordingly, the specification tests are corrected; the Hausman test is estimated under different procedures to consider the use of robust standard errors and cross sectional dependence, and suggests that fixed effects model is more consistent than random effects model. In all setups modelled, inflation differential is found to be significant at 1%, and explains 20% of the spread between the exchange rate fixers and the United States. This finding is consistent with other studies on the credibility of the European Monetary System, in which inflation differential appeared as a main factor in reducing the credibility of the system. The same finding is obtained when we allow for endogeneity. On contrary, when the exchange rate market pressure index is used as a proxy for the credibility, none of the fundamentals appear significant. The cross sectional tests also provide mixed inferences about whether to accept the spatial dependence among countries. This is likely

to be due to the variance-weighted scheme of the index, where the weight of the small exchange rate changes is considerably large, while huge changes in foreign reserves are assigned with a negligible weight. We then examine the credibility in the countries which have not experienced a shift in monetary regime during the study period. The estimation of the fixed effects model provides evidence that inflation differential is a vital factor in determining the credibility of the peg. The deterioration in current account and the reserve adequacy also appear to be important indicators for expecting realignments in these countries.

The results suggest that anchoring inflation through pegging the currency is questionable. The positive inflation rates explains why anchoring interest rates, as implied by the uncovered interest rate parity, is not possible in countries with soft pegs to the US dollar and, consequently, it explains why the foreign credibility of low prices in the absence of strong domestic constitutions and institutions is difficult to import.

1.4 Inflation Targeting or Exchange Rate Targeting: Which Monetary Rule Supports The Goal of Price Stability in Emerging Market Economies?

The adoption of monetary regimes of quantitative identification constrains the ability of policy makers to pursue their political advantages. The confined discretion of policy makers' deeds that can be exercised by declaring a nominal anchor provides the market with a reference for the goal of price stability. When non-discretionary monetary policies are not exercised, eliminating the inflationary bias could result in high social and economic costs. However, it is thought that many inflation costs come from the uncertainty about the course of future inflation rather than from its level (Bernanke et al., 1999). In fact, the link between inflation and inflation uncertainty has received attention in the literature after the Nobel lecture of Friedman (1977). Friedman argues that the relationship between unemployment and nominal wage changes is not stable owning to inflation uncertainty, and hence inflation increases inflation uncertainty. Ball (1992) also points out, based on a monetary policy-time inconsistency game theoretical model of Barro and Gordon (1983), that inflation leads to higher inflation uncertainty. On the other hand, on the basis of the same time inconsistency model, Cukierman and Meltzer (1986) argue that, an increase in inflation variability raises the level of inflation rate. Holland (1995), however, shows that a negative link could be an indicator of stabilising effects of monetary framework, as central banks respond to inflation uncertainty by reducing money supply and thus decreasing the inflation rate.

It is believed that inflation uncertainty can be reduced by settling the market inflationary expectations, which can come through better inform the market about the direction of monetary policy. The simplicity of monetary quantitative targets improves the market awareness about the course of future inflation; however, market agents can easily understand the changes in consumer prices more than the changes in other nominal variables. In this chapter, we investigate the relationship between inflation and inflation uncertainty under two quantitative monetary targets for the objective of price stability: a fixed exchange rate and inflation targeting. We assess the impact of monetary regime on inflation uncertainty. In fact, there are a large number of studies which investigate the nexus between inflation and inflation uncertainty, but little attention has been paid to the cases with soft fixed exchange rates, or for such cases the influence of monetary regime has not been considered. So, this study is the first to compare between the two monetary regimes and detail the role of the fixed exchange rate system in affecting inflation and inflation uncertainty. We utilise different GARCH in mean models to investigate the relationship between inflation and inflation uncertainty in two emerging market economies adherent to the fixed exchange rate to the US dollar: Jordan and Egypt, and three inflation targeters: South Africa, Brazil and Poland.

GARCH in mean allows examining the relationship between inflation and inflation uncertainty simultaneously, by incorporating a measure of volatility in the inflation equation. We examine the relationship under plausible asymmetric responses to inflation shocks by exponential GARCH in mean. The effect of the examined monetary regimes on inflation uncertainty in the long run is also assessed by applying component GARCH in mean model. To model the impact of monetary regime on inflation dynamics, slope dummies are plugged in the conditional mean equations, in which the dummy takes the value of one when the examined monetary regime is in effect, and zero otherwise. Two interactive dummies are selected based upon the overall improvement in the model fit. To examine the nexus between inflation and inflation uncertainty, we utilise monthly data on consumer price index obtained from the IMF-IFS for the period 01:1980-06:2014. The calculated inflation series is seasonally adjusted by executing the Census Bureaus X12. The series properties indicate that the distribution is positively skewed and leptokurtic. To consider this asymmetry and peakness of the distribution in modelling the relationship between inflation and inflation uncertainty, we use a generalised error distribution.

The findings suggest that inflation uncertainty increases inflation and inflation generates inflation uncertainty under the two monetary regimes, as argued by Cukierman

and Meltzer (1986)and Friedman (1977)and Ball (1992), respectively. We show that inflation targeters have been successful at reducing the inflation rate and inflation persistence more than fixed exchange rate countries, where the regime has no impact on lowering average inflation and inflation inertia. Both regimes appear effective in lowering inflation uncertainty, as the inflation regime slope dummy, incorporated in the conditional inflation variance equation, is found significant and negative in all respective countries; however, its magnitude is close to zero for Egypt. This could be due to the several depreciations in the Egyptian Pound in the last three years before opting out of the system, which might have resulted in lowering the credibility of the fixed exchange rate and raising the likelihood of the collapse. Hence, it could be argued that fixing the exchange rate could still influence inflation uncertainty as long as the possibility to renege on the fixed parity commitment is not perceived by the market. The negative effect, which reflects a decrease in inflation uncertainty, of both regimes holds under asymmetries and also in the long run, except for South Africa, where the regime dummy turns insignificant. The findings provide evidence that inflation targeters have not equally benefited from inflation targeting. The chapter highlights the importance of monetary regimes in reducing the uncertainty about future inflation and underlines the direct benefits of inflation targeting. The role of the fixed exchange rate in lowering inflation and inflation uncertainty in the two exchange rate fixers is not obvious. Although the fixed exchange rate system could be effective in reducing inflation uncertainty, according to the results, the continuation of this effect depends on the credibility of the system in the market.

Chapter 2

Towards Adopting Inflation Targeting in Emerging Market Economies: The level of Central Bank Independence and Transparency When The Monetary Reputation is Imported From Abroad: The Case of Jordan

2.1 Introduction

This chapter is carried out to investigate adopting inflation targeting at institutional levels in Jordan. The institutional features characterised inflation targeting are assessed to underline the possibility and challenges to target inflation domestically in Jordan. The first part of the introduction provides an overview about inflation targeting and the preconditions for adopting the framework. The second part highlights the monetary history of Jordan and the motivations of the study.

2.1.1 Inflation Targeting

It was widely believed among the advocates of activist policies that monetary policy could keep productivity and unemployment close to their full-employment levels. The principle of policy activism was based on the tenet that the nexus between inflation and unemployment, known as the Philips curve, could be utilised to achieve a long-run low unemployment. However, the activist policies failed to deliver the promises of low unemployment and rather resulted in high inflation rates. The activism was challenged in different aspects; the most important one was the dynamics of market agents' expectations about future policy outcomes. Both Friedman (1968) and Phelps (1968) state that the trade-off between inflation and unemployment is transitory, and in the long run, due to adjustments to market agents' wage settings, the only macroeconomic variable that can be controlled by the central bank is the inflation rate (Bernanke et al., 1999). Two decades later, namely in December 1989, New Zealand led the world to a new monetary framework called Inflation Targeting (IT), with one focused objective of monetary policy, that is, price stability. The need for a low-inflation framework which could suppress inflation and provide the leverage over the discretionary intentions of policy makers encouraged a number of middle and high income countries to follow IT. The movement to IT was supported by the failure of other monetary anchors such as monetary aggregates in the mid-1980s and the pegged exchange rate in the early 1990s.[1]

In effect, IT is based upon announcing a forward-looking medium inflation forecast, either in a range or point form. The announcement of the policy target allows the market agents to perceive the direction of monetary policy and act in accordance with the path of inflation target. It is thought that central banks under IT could prolong the effect of the main monetary instrument, i.e., interest rates, the benefit which works out to settle the market expectations (Thornton, 2012). Hence, it is widely believed that

[1] A nominal anchor is a nominal variable that is the target of monetary policy, which restricts the price level to a certain value

IT is an inflation expectation anchor (Mishkin, 2004), which leads to decrease inflation uncertainty, and eliminates the volatility of inflation rates (Drew and Karagedikli, 2008). Indeed, with the privilege of establishing a clear link with the public, and making the economic information available for the market, inflation targeters are ranked among the most transparent central banks in the world (Eijffinger and Geraats, 2006). In fact, the level of transparency of inflation targeters policies has evolved over the years of adoption to be consistent with the expectation hypothesis. For instance, the forward path of monetary policy was released by the Reserve Bank of New Zealand in 1997, through disclosing up to three year projections for inflation and output and the formal macroeconomic model.

Nevertheless, the use of monetary policy instruments entails the existence of an unambiguous relationship with the political authority. In fact, the rationale behind adopting a nominal anchor is to eliminate the leverage of governments in exploiting the short-run trade-off between inflation and unemployment for political advantages as implied by the time inconsistency problem, by Kydland and Prescott (1977) and Barro and Gordon (1983), which creates an inflationary bias. Therefore, it is essential to tame the government intentions by ensuring a politically independent monetary authority represented in the personnel legislations of the central bank. In addition, as central bankers under IT are held responsible for achieving an inflation target, the credibility and stainability of the system hinge mainly upon the ability of monetary policy to control its instruments, which requires an economic independence from the government. That is why all inflation targeters except Brazil (Hammond, 2012) enjoy legal independence,[2] and many of them after adopting IT have increased their central banks' economic independence to achieve the announced inflation target and strengthen the base of accountability.[3]

Financial independence is also fundamental for central banks to control their liquidity management. The need to impose restrictions on fiscal deficit is supported by the perspective that fiscal deficit is an inflationary phenomenon. Lin and Chu (2013)[4] and Catao and Terrones (2005)[5] argue that the dynamic relationship between inflation and fiscal deficit comes from the fact that government tends to finance its deficit throughout Seigniorage,

[2]This refers to its personnel independence; the Bank of Brazil's legislations do not specify the terms of appointment of both Governor and deputies. However, Gutiérrez (2003) indicates that the bank of Brazil is $defacto$ independent.

[3]This concept implies the features which enable central banks to be responsible of their actions. These features are determined by Eijffinger and Hoeberichts (1998) as the existence of formal rank objectives, monetary policy transparency, and the ability of monetary policy to bear the last responsibility, i.e., central bank independence.

[4]The empirical results show that inflation rate is strongly affected by fiscal deficit, namely during high-inflation periods. This happens because money supply tends to grow quickly when inflation is high.

[5]They conclude that the positive correlation between fiscal deficit and inflation takes place in developing and high-inflation countries rather than in low-inflation countries.

which, consequently, leads to high inflation. The government might also prefer to create inflation to reduce the burden on fiscal debt. This means that limiting government borrowing from central banks is one way to discipline the government expenditure. In fact, most inflation targeters have either prohibited securitised lending or imposed rigorous constraints upon advances from the central bank.

The successful implementations of IT across developed and emerging market countries have led monetary authorities and researchers to question adopting this strategy. However, one of the challenges that faces countries which seek to adopt IT is the level of development of monetary institutions and constitutions that may hamper building the credibility of low inflation domestically. Therefore, adopting IT or building the base to move towards a domestic reputation for the price stability goal, particularly in developing and emerging market economies, requires intensive considerations of the economic conditions to assess the level of monetary institutional development, or what kind of reforms should be implemented to successfully manage the transition to the low inflation framework. From the inflation targeters' experience, there are some key features associated with IT framework, agreed among economists to be preconditions for adopting the framework. These preconditions are: central bank independence, transparency, credibility, the existence of a well-developed financial market, and the presence of a stable and predictable relationship between inflation and monetary instruments. The focus of this chapter is on assessing the institutional preconditions for the case of Jordan.

2.1.2 Historical Background and objectives of the study

Jordan is a small open economy, which relies on foreign aid and workers' remittances and experienced a fragile monetary history, the factors which make the economy highly vulnerable to internal and external shocks. During the late 1960s, Jordan witnessed a continuous depreciation in its exchange rate due to internal and regional circumstances. The major internal source was the inappropriate easy monetary policy, accompanied with government dominance to ease fiscal policy laxity, which took place at the end of the 1960s and lasted until the early 1990, when the monetary policy started adopting an intermediate target M2. This was the first step to improving the ability of the Central Bank of Jordan (CBJ) to achieve its monetary goals and develop its autonomy. However, the political external disturbances, especially the 1967 Arab-Israeli War, had more severe effects on the economy, as Jordan lost its primary port, Jaffa port, part of its land in the Jordan Valley and essential markets of its exports and imports (Hammarneh, 1994). This was followed by a drop in oil prices, simultaneous with the 1982 first Persian Gulf War, which dried up the main sources of aid, remittances and foreign money flows (Maziad, 2009). The outcome of all these problems, known in the Jordanian history as the dinar crisis, was a remarkable depreciation in the Jordanian currency and the distortion of economic policies, which reached its peak between 1988 and 1989. However, the procedures taken after the crisis were reforming and enhancing the monetary policy's autonomy and restoring the market credibility, especially when the CBJ proved its effectiveness in coping with the 1990 second Gulf War (Al Malki, 1994). During the reform process, a decision was taken in 1995 to peg the exchange rate to the US dollar. Undoubtedly, fixing the exchange rate enables the CBJ to improve its credibility and builds the base for attracting investments from domestic and global markets.

Nevertheless, the subsequent dollar depreciations in early 2002, and the 2008 financial crisis (Ghanem et al., 2010), as well as the difficult economic conditions of Jordan after the 2003 Iraq War and the Arab Spring raise skepticism on the stability and sustainability of the pegged exchange rate system. Many economists in Jordan, especially after the 2008 financial crisis, advised the CBJ to change its monetary anchor; however, the policy makers argued that the pegged exchange rate to the US dollar has played an important role in improving the credibility of the currency. They also pointed out that the level of foreign reserves has been increased unprecedentedly, as the current regime worked out to attract investment (the CBJ's 2010 annual report). Moreover, the CBJ's own view according to the IMF evaluation report (1989-2004) is that "there is no reason to fix a system that is not broken". Nonetheless, the IMF's executive directors suggest that Jordan should move

towards a more flexible exchange rate regime and focus on maintaining the price stability as a leading objective. Furthermore, in 2010, the bank underwent a considerable reduction in its holding of international reserves coupled with enormous fiscal deficit, which present a direct threat to the pegged exchange rate system.

Therefore, in the light of these reasons we are motivated to study the preconditions for a successful IT institutional implementation in Jordan. We examine to what extent the institutional factors, i.e., central bank independence and transparency, which are fundamental to build a domestic reputation for price stability, are developed in Jordan. In order to support our analysis, the level of independence and transparency of central bank of Jordan is compared to two inflation targeters taken as models: New Zealand and the UK. However, as we aim at assessing the possibility for adopting IT in Jordan, we focus on the early days of IT for both inflation targeters, given that the shift to a high IT form is most likely to be gradual for an emerging market country with a fixed exchange rate regime. Moreover, the two inflation targeters have implemented many enhancements to solidify their anchor; some of these needed a decade to apply. The plausible question that may seem to arise here is why to compare the economic conditions and institutions of a small developing open economy like Jordan to that of two advanced economies. The choice to compare the results to New Zealand and the UK is important for two main reasons. First, considering the UK and New Zealand as role models allows creating a factual benchmark for measuring the level of central bank independence and transparency; this comparison helps understanding the degree of development of institutional and operational arrangements that should exist to build the credibility of low prices domestically. Second, both countries were targeting exchange rate and have experienced a shift from a fixed exchange rate system at a certain time prior to targeting price stability domestically, and hence by comparing the results to New Zealand and the UK we conduct the normative economic perspective of how the best practical institutional implementation of IT should be.

In fact, many studies have been conducted to measure the level of central bank independence and transparency in many countries; however, Jordan has been rarely considered. For instance, Gisolo (2007) measures central bank independence in many countries including Jordan, ranking the CBJ among the least independent central banks. Nevertheless, the study is based on legal personnel independence, which makes the assessment incomplete for our objective. Therefore, this chapter aims to assess the level of the CBJ's $de facto$ independence and transparency.

The analysis of central bank independence shows that the formal collaborations be-

tween the central bank of Jordan and government are fragile and unclear, and that the government's words do not match its deeds, this presents the first challenge to target price stability domestically. However, increasing the level of transparency will not be infeasible, and although some modifications have to be made in this respect, improving the level of central bank independence is essential to provide the market with high transparent policies.

The chapter is organised as follows. Section one provides the literature review and theoretical issue. Section two and three review the measurement of central bank independence and transparency, respectively. The final section gives a summary, concluding remarks and recommendations.

2.2 Literature Review

IT has become a well-known framework for monetary policy. To date, over twenty countries have shifted their monetary regimes towards IT, and the world has been divided into inflation targeters and non-targeters. Many studies, e.g., Mishkin and Schmidt-Hebbel (2007), Hu (2003), Van der Merwe (2004), have been written to assess the benefits of adopting this framework in different developing and emerging economies. [6] Empirical evidence that focuses on whether IT strengthens the nominal anchor would be more telling about these gains.

In an early study by Bernanke and Mishkin (1997), after just seven years of the introduction of IT, the authors highlight that IT has a number of advantages related to enhancing monetary authorities transparency and accountability, and promoting the coherence of policymaking. Neumann and Von Hagen (2002) find that IT improves the credibility of central banks significantly. They further point out that this result supports the conclusion that IT is a useful regime to communicate with the public. Similarly, Mishkin and Schmidt-Hebbel (2007) examine the economic performance of IT in certain developing and developed economies that adopted IT explicitly. Their results show that the average inflation rates for all inflation targeters were reduced, and they were slightly lower than non-inflation targeters'. Recently, many studies indicate that inflation targeters have achieved lower inflation rates after IT, and their inflation rates have become even lower compared to non-inflation targeters. According to Batini et al. (2007), implementing IT controls inflation expectations and makes them consistent with the inflation target. A similar conclusion is reached by Capistrán and Ramos-Francia (2010), who argue that IT reduces the volatility of inflation expectations. Corbo et al. (2002), also state that inflation targeters have been successful at achieving their inflation targets, and they have consistently reduced inflation forecast errors.

In South Africa, for instance, Van der Merwe (2004) provides evidence that the introduction of IT has benefited the effectiveness of monetary policy. His evaluation shows that central bank transparency and accountability, which are essential to target inflation, help anchoring the market expectations of future inflation, the factors which affect the price and wage settings. Moreover, Mboweni (1999), the Governor of the central bank of South Africa, states that adopting IT, which is based on the forward looking strategy, allows the monetary policy to reduce the changes in economic activities and output growth fluctuations.

[6] Such as: Indonesia, Romania, Turkey, Ghana, South Africa, Thailand, Poland, Philippines, Peru, Mexico, Hungary, Chile, and Brazil.

Mishkin and Schmidt-Hebbel (2007) conclude that IT leads to a significant reduction in the volatility of output growth and output gap, namely in emerging market economies. This may happen because inflation expectations are supposed to be well-anchored under IT framework. However, Ball and Sheridan (2004) claim that their findings suggest no evidence that IT improves the economic performance of its followers, the result, which is based on a performance comparison between some industrialised inflation targeters and a control group of industrialised non-inflation targeters, contradicts the intuition that IT affects inflation, output and interest rates and ignores how IT helps economies with their disinflationary efforts. However, other studies show that IT plays an important role in enhancing the performance of economic variables. Hu (2003) assesses empirically the impact of IT on real economic variables for sixty-six countries: inflation targeters and non-targeters. He finds evidence that IT is effective in improving the performance of inflation and output, i.e., low inflation, low GDP growth volatility and high GDP growth, which is consistent with the view that the major motivation of this framework is to improve the overall economic performance. In addition, Walsh (2009) finds that inflation targeting has improved the macroeconomic performance in developing economies. The study's conclusion regarding the effectiveness of IT in emerging markets is consistent with Mishkin and Schmidt-Hebbel (2007)'s. Both reveal that emerging market economies have benefited more from IT, in terms of delivering both lower inflation and a more stable real economy, than advanced countries.

The benefits gained from this framework have encouraged more countries, namely emerging market economies and developing countries, to adopt it. Hence, several empirical studies have searched for the possibility and readiness to shift towards IT in different economies, and come up with different conclusions. In case of emerging markets, once preconditions of stable economy are met, IT can be used to shift the economy from high to low inflation equilibrium (Martínez, 2008).

Schaechter et al. (2000) illustrate that a successful IT is built upon: "central bank instrument independence, price stability as a leading objective, a well-developed financial market, well understood channels between policy instruments and inflation, and transparent policies to build accountability and credibility". Their conclusion comes from studying the mutual institutional and operational key aspects of developed and developing inflation targeters.[7] When the previously mentioned preconditions are met in an economy, it will be ready for adopting the full fledged IT. However, three main forms of IT have been iden-

[7]Study conducted by the Monetary and Exchange Affairs for Emerging Market Department at the IMF.

tified. Full fledged IT, that is, when a country has only one final objective of maintaining low inflation, and enjoys a transparent and credible monetary policy along with a well-developed financial market and a flexible exchange rate (Mishkin and Schmidt-Hebbel, 2007). Eclectic IT when a country is able to achieve price stability as a result of its high monetary credibility, less monetary transparency, but at the same time it does not adhere to all IT's rules (Aliyu and Englama, 2009). The last form of IT is inflation targeting lite. This form is usually pursued by a country which is committed to other monetary objectives along the objective of price stability due to its vulnerability to external shocks and its weak financial market (Angeriz and Arestis, 2007).

Undoubtedly, adopting IT across developed countries has encouraged emerging market economies to move towards this framework. However, the experience of IT in developing countries reflects that a transition period was needed to adopt the highest form of IT, i.e., the full-fledged. Therefore, many scholars have studies the readiness of developing inflation targeters to move towards the full-fledged IT, while others have focused on assessing the ability of developing non-inflation targeters to follow IT framework.

Alamsyah et al. (2001) investigate whether Indonesia was able to follow the full-fledged IT after the introduction of the new central bank Act of May 1999.[8] The findings suggest that the existing preconditions cannot be satisfied and need to be improved. In Hungary, Siklos and Ábel (2002), find that the country is ready for full-fledged IT, although the relative responsibilities and expectations of the central bank and government need clarification and elaboration.

Jha (2008) assesses the readiness of India to adopt IT, by examining the existence of a stable and significant relationship between inflation rate and short-term interest rates. Using a VAR model, she concludes that the interest rate has no effect on inflation. Likewise, Aliyu and Englama (2009) evaluate the feasibility of IT in Nigeria by testing the relationship between inflation and monetary instruments, also through a VAR model, finding the existence of a weak relationship between the inflation rate and interest rate. Similarly, following the same methodology, Saleem et al. (2010) assesses the preconditions of IT in Pakistan, and reveals that Pakistan cannot adopt the full-fledged IT due to the undeveloped financial market and weak transparent monetary policies. However, the last two studies suggest that both Nigeria and Pakistan could adopt inflation targeting lite.

For Tunisia, Boughrara (2007) explores the ability of Tunisia to move to IT. A VAR

[8] Indonesia has been categorised as a fully fledged inflation targeter since 2005.

methodology is used, and the results indicate that adopting IT strategy may lead to increase exchange rate volatility, which generates uncertainty about future inflation, the effect which weakens the controllability over inflation. In another study conducted by Boughrara et al. (2008), the authors simulate the effectiveness of IT under the current financial system in Tunisia, by testing the reaction of frozen loans to official interest rates, suggesting that Tunisia has to improve its financial market structure before adopting IT.

Both Youssef (2007) and Awad (2008) review the prerequisites for IT in Egypt. The former focuses on the financial sector, the central bank's transparency, credibility, technical capabilities and accountability. The latter tests the efficiency of the monetary aggregates strategy, adopted by the central bank of Egypt, and finds that the current monetary regime is not satisfactory and adopting IT is preferred once the institutional preconditions are reached.

Boughrara et al. (2008) examine the transmission mechanisms in Morocco, in an attempt to clarify the effectiveness of monetary policy under the current financial market, concluding that Morocco is not yet ready for adopting IT. Using the same approach, Neaime et al. (2008) aim to shed light on the monetary transmission mechanism across the Middle East and North Africa region. Their results show that the exchange rate has a dominant impact on the transmission mechanism of monetary policy in Egypt, while in Jordan, Lebanon, Morocco and Tunisia, the interest rate plays a key role in monetary policy effectiveness. The same result for Jordan is found by Poddar et al. (2006).

2.3 Central Bank Independence

Since the seventeenth century, central banks were established, with limited operations and constraint functions, to provide financing to governments and protect the stability of the financial system. However, the pervasion of stagflation in the 1960s and the collapse of the Bretton Woods system in 1972 were the cornerstone to shift the monetary policy's helm to focus on maintaining price stability. These challenges have stimulated numerous researches, at both empirical and theoretical levels, to explore the efficient policies to achieve the goal of price stability. Hence, Central Bank Independence (CBI) has long been a topic of interest, propped by the correlation found between high levels of independence and low inflation. This nexus has created so much controversy concerning its impact on improving the performance of macroeconomics.

Alesina and Summers (1993) and Grilli et al. (1994) find that countries with an independent central bank have lower rates of inflation. Cukierman et al. (1992) constructed a well-known CBI index, including seventy two countries: twenty-one industrial countries and fifty-five developing countries, and using a wide range of information to investigate the relationship between CBI and inflation. They ensure that CBI by all means reduces inflation. In addition, Al-Marhubi and Willett (1995) point out that the causality between CBI and inflation holds even when a number of explanatory control variables, like openness, exchange rate regime, budget deficit, are included. Recently, the same finding was yielded by other authors: De Haan and Kooi (2000), Mathew (2003), Crowe and Meade (2008), Arnone et al. (2006), Siklos (2008). However, for some developing countries, it is found that CBI alone cannot decrease inflation rates since the main causes are beyond the direct control of central banks. This, for example, applies to five central and Eastern Europe countries considered by Dvorsky (2000), who measures the legal and real CBI. Similarly, the results of Kasseeah et al. (2011) indicate that the CBI contributes to reducing inflation rates in many African countries; however, it is not sufficient to resolve the problem of inflation in these countries. Nevertheless, interestingly, a remarkable increase in the degree of CBI has been observed in developing and emerging market economies, albeit the increase in the overall levels of CBI in developed countries.

In fact, CBI has been an important argument since the well-known time inconsistency problem is suggested by Kydland and Prescott (1977), and developed later by Barro and Gordon (1983), who have shed light on the negative implications of central bank $laissez faire$ as a result of sacrificing long-run welfare for short-term political gains. This problem occurs when politically motivated policy makers attempt to play on the short

run trade-off between unemployment and inflation for purely electoral gain, and hence the optimal plan made for some future periods becomes invalid. Therefore, Rogoff (1985) recommends that CBI is important to insulate central banks from political influence, which leads to eliminate the inflationary bias from the outcome of monetary policy.

CBI is believed to be a good discipline to reducing the budget deficit. If the fiscal authority is the dominant actor, the principle of easy money will be preferred and the government will rely on the yield from Seigniorage to finance its deficit. This argument is propounded by Sargent and Wallace (1981) who debate that fiscal authorities will tend to pull down its deficit when the monetary policy is dominant. Certainly, an independent central bank is less exposed to political pressure, and this would enhance price stability and stimulate economic growth (Alesina and Summers, 1993). Some studies consider CBI as a mandatory condition to access the European Union. When New Zealand adopted IT in 1990, CBI becomes a main precondition for adopting IT. According to Eijffinger and De Haan (1996), a high level of CBI is an important institutional device for maintaining the price stability goal. In other words, CBI is an important mean to ensure the government commitment to the goal of price stability. This should effectively benefit both the economy and the government itself, as the price stability leads to reduce the cost of high inflation, and develops the domestic credit market by enabling the government and businesses to borrow cheaply in the long run (Cukierman et al., 1992).

Over the last quarter century, many authors, e.g., Grilli et al. (1994), Cukierman et al. (1992), Mathew (2003) have constructed indexes to measure the level of CBI. The components of each index are quite similar, categorising the independence under three aspects. Firstly, Personnel or Political Independence (PI), which refers to the central bank's personal character. Supposedly, central banks should be isolated from any government pressures in appointing the central bank's Governor, or deputies among other personal characteristics. Secondly, Economic Independence (EI), which entails the absence of government approval in policy formulation, the setting of the policy rate or the objectives of the central bank. Thirdly, the Financial Independence (FI), which is sometimes inscribed under the economic independence aspect. FI is a critical aspect that requires the existence of restrictions on credit given to governments.

Yet, countries are ranked differently from an author to another, depending on the period and categories taken into account. Moreover, although many studies have found the evidence that there is an inverse relationship between CBI and inflation, this relationship may be invalid when the *dejure* measure of independence, built by the CBI indices, fails

to capture the *defacto* independence of central banks in some developing countries, where economic legislations could be violated by the political authority.

Cukierman et al. (1992) find that the turnover rate of Governor (TOR) is a statistically significant proxy for assessing the factual CBI in developing countries. They alluded to Argentina as an example where the TOR is extremely high as its Governor is dismissed after every cabinet reshuffle. The TOR refers to the average terms of office, calculated by dividing the number of Governors within a given period of time over the length of this period. This rate does not include any deputy who serves as a Governor in a transitory period, and counts Governor who is reappointed for a second tenure only once.

Although many studies have relied on the TOR as an informal indicator of personal independence in developing countries, this rate is invalid for the the case of Jordan as well as for other developing and emerging market economies. The TOR will be a reliable measure for CBI, if it is based on setting the electoral cycle every four or five years. Taming the political intensions for re-election in order to eliminate the time inconsistency problem is a main motivation of CBI, and that explains why Cukierman et al. (1992) consider a point like 0.25 consistent with low CBI. Nevertheless, this case of political manipulation of the trade-off between inflation and unemployment to satisfy intensions for re-election does not apply to many countries. The theory of time inconsistency and, consequently, the TOR becomes invalid in a country like Jordan, where the head of the state is a king, who is responsible for appointing the government, the senate and also the central bank's Governor. This also applies to other republic countries whose presidents are elected over their life to leave the political legacy to their successors. So, we agree with Siklos (2008) that there is no single definition of CBI valid for all countries, but there are a set of components which can define the relationship between governments and central banks.

In Jordan, both the CBJ's Governor and deputies are nominated by the government, and then appointed by the king, who is responsible for appointing the government itself. By other means, since there is no election in Jordan, both the government and the CBJ are supposed to execute the national economic strategy, sanctioned by the king. Eight Governors, as can be seen from Table 1, were appointed from 1963, the first appearance of the CBJ, until the end of 2011. The calculated TOR, with the exclusion of the new Governor, is roughly 0.17, which is slightly low. This would mistakenly be interpreted as a high level of political independence. If the last ten years are taken as a period of reference, the judgment of a high level of political independence will be inaccurate.[9] Thus, to avoid

[9]See the CBJ's Personal Independence section 2.3.1 for more details.

any inconsistent results in measuring the CBJ's independence, given that assessing CBI based on the *dejure* index in developing countries and emerging markets is misleading, the study depends on assessing the real practices of the bank and government alongside the central bank's legislations using Mathew (2006) index. The results obtained are compared to New Zealand, the first country to adopt IT in 1990, and the UK that adopted IT in 1992.

Many studies have relied on the most widely used indices: Grilli et al. (1994) and Cukierman et al. (1992). Nevertheless, Mathew (2003) has constructed a more comprehensive index, which includes three aspects to measure CBI: personnel, economic or monetary policy and financial independence, and is applied to twenty five countries. Each aspect has six categories capturing the institutional legislations and the real practices that identify the relationship between the government and the central bank. In addition, the author gives different weight to each category depending on its importance in measuring the degree of CBI from his perspective; however, each aspect of CBI has the same total score of 12 points. Nevertheless, we perform some modifications to the index, i.e., we add or drop some categories and change the weight of each category to be equal in measuring the degree of CBI, which ranges from 1 (high independence) to 0 (low independence). The total score for each three independence aspects is different depending on the number of categories included after the amendment.[10].

Table 1: The CBJ's Governors (1963-2012)

Governor	Terms of office
Dr. Ziad Fariz	2012-
Mohammed Said shahin	2011-2010
Alsharif Faris Sharaf	2011-2010
Dr. Umayya Toukan	2010-2006
	2005-2000
Dr. Ziad Fariz	2000-1996
Dr.Mohammad Said Al Nabulsi	1995-1989
Mr. Hussein Al Qasim	1989-1985
Dr. Mohammad Said Al Nabulsi	1985-1983
	1983-1978
	1978-1973
Dr. Khalil Al Salem	1973-1968
	1968-1963

Note: Gathered by the author from Al Malki (1994) and the CBJ's website

[10]Details on these amendments are explained separately in the section of measuring each aspect. The modified index of Mathew (2003) is enclosed in Appendix A

2.3.1 Political Independence or Personnel Independence (PI)

The personal independence entails appointing Governor and deputies for a relatively long tenure independently from the political authority, and with no government delegates on the central bank board. According to our modified index, the PI is assigned based on six categories: who appoints Governor, deputies, terms of office for both Governor and deputies, Governor's dismissal and the absence of any government delegates on the central bank board. For Jordan, Governor and two deputies, as stated by the 1959 constitutive Act of the CBJ, are appointed by the cabinet conditional to king's approval for five year tenure; this also applies to the case of reappointment. The term of office for reappointment of the two deputies was changed from three to five years by the 1966 Act.

According to the CBJ's Acts, the Governor and their deputies are prohibited to work in paid and unpaid employment. In general, since the CBJ's establishment no action has been taken by the government to violate any of the CBJ's personnel legislations but Governor's dismissal. Clearly, as stated by all Acts, Governor can be dismissed by the executive branch, subject to king's approval, only for health or criminal conviction reasons. However, in 2011, the Prime Minister, with the consent of the king, dismissed the Governor Sharaf after just ten months at the chair of the CBJ. This decision was taken without informing the legislative branch nor the public about the reasons for the dismissal. It seems that history sometimes repeats itself, as this was not the first time when the government policies clashed with the CBJ perspectives. Al Nabulsi, who served as Governor for nineteen years, unveiled after Sharif's dismissal that he was dismissed in 1985 because he refused to increase the internal government borrowing by extra five million dinars, which was a breach of the financial legislations of the central bank.[11]

In New Zealand, the Governor is appointed by the Minister of Finance on the recommendation of the bank's board, for a term of five years; the same term is also for reappointment. Governor's deputies are appointed by the board on the recommendations of the Governor for five years. In the UK, the Bank of England (BoE)'s Governor and their deputies are appointed for five years by the government.

The dismissal of Governor for both the BoE and the Reserve Bank of New Zealand (RBNZ) happens only for reasons mentioned in their Acts, e.g., for health or criminal convention reasons. Both the CBJ and the RBNZ have no nominees on the bank board, as the members are appointed according to their economic knowledge, skills, and experience.

[11] AlGhad newspaper, an interview, market and money section, p.1, 2^{nd} October 2011.

Interestingly, the majority of the CBJ's personnel legislations is almost cognate with that of the RBNZ, except that the government in Jordan breaks the law, as previously stated. However, the RBNZ is more conservative regarding the dismissal of Governor; the law indicates directly that any Governor who fails to achieve the target of monetary policy is inadequate and could be replaced by the Parliament. This is considered an impetus to enhance the accountability of achieving the policy target. Indeed, the RBNZ's legislations are more comprehensive compared to the CBJ's. It is stated that Governor will not be appointed unless there is a mutual agreement between the Governor and the Minister of Finance, in terms of specifying the policy targets.

What it is noteworthy for both the RBNZ and the CBJ is that there is no limitation on how many times it is allowed to reappoint Governor or deputies. This was also the case of the BoE until 2009, when its Act was modified to include two new paragraphs 1 (3) and (4) by section 243 (1) to state that a person must not be appointed as Governor or deputy more than twice. In other words, Governor or deputy of the BoE should not hold the same tenure more than ten years. Probably, imposing such restriction is not important for New Zealand, as the bank's history shows that no Governor was appointed more than twice. Nevertheless, in Jordan, the king may accept to appoint Governor who is competent to achieve his economic vision many times. This clearly happened in the past, when Al-Nabulsi was appointed five times, holding an eighteen year tenure at chair, given that he was forced to resign twice, i.e., in 1985 and 1995. Hence, holding the tenure for a long period of time should be an indicator of a low level of independence.[12]

Table 2 shows PI score assigned for each bank. The results indicate that the RBNZ is more politically independent than the CBJ by the difference of the dismissal and deputy's appointment categories. In addition, the results reflect that the BoE is the lowest independent among the three banks. This finding is consistent with other CBI studies which classify the BoE as the lowest independent central bank compared to all OCED countries. This apparently supports the argument that PI is not essential to target inflation domestically. However, it could be argued that a low level of PI might be a threat to achieve the central bank's goal, i.e., price stability, namely if, at any time, there is a government need or advantage to contradict it.

[12]This explains the low TOR obtained for the CBJ.

Table 2: The PI score

PI categories	CBJ (2012)	RBNZ (1990)	BoE (1992)
Governor's Appointment	0.5	0	0
Governor 's Term	0.5	0.5	0.5
Governor's Dismissal	0	0.5	0.5
Deputy' Appointment	0.5	1	0
Deputy's Term	0.5	0.5	0.5
Presence of Government Nominees	1	1	0
Total (6)	3	3.5	1.5

Note: Assigned by author based on Mathew index

Although our assessment relies mainly on the Mathew index, we amend two categories here: the fourth and the fifth, to be for Governor's deputy instead of the bank's board members. We think that deputy has some essential duties that enable them to affect the monetary policy either as a representative of Governor or as temporary Governor in some cases like Governor's death, dismissal, resignation, or illness. In other words, as Governor in some countries, such as in Jordan and New Zealand, has the last word on designing the monetary policy targeting rules, it could be argued that deputy's responsibilities are stronger in affecting the monetary policy more than the board members'. Moreover, even in other countries, where monetary policy decisions are made by a monetary or financial commission, as in the UK, Governor and deputies are permanent members of each commission.

2.3.2 Monetary Policy Independence or Economic Independence (MPI)

Measuring MPI according to Mathew (2003) index encompasses six categories: central bank's objectives, targets, instruments, conflict resolution, exchange rate policy and the separation of banking supervision.

The literature has pointed out that compelling monetary policy to focus on other objectives than price stability, such as output growth and unemployment, arouses inflation because monetary policy has neutral real effects in the long run.[13] Hence, in order to enable central bankers to achieve the long run objective, central banks should be granted their independence on intermediate variables or related variables like interest rate, exchange rate or monetary aggregates. Monetary authorities should also be independent of any political influences in using monetary instruments like open market operations, short interest rates or discount window operations to achieve its target. It follows that the central bank is the only responsible entity for the exchange rate policy. Furthermore, the

[13]For more details, see Kydland and Prescott (1977.)

economic independence entails that any clash between the two economic actors should tilt in favour of central banks' perspectives.

The CBJ has many objectives, all of them are related to maintaining monetary and financial stability. The objectives include: achieving an appropriate inflation rate, preserving exchange rate stability, ensuring the convertibility of the Jordanian Dinar and banking supervision. As a matter of fact, all these objectives aim at attracting investors and enhancing the investment environment.

Unlike the CBJ, the primary function of the RBNZ, according to the 1989 Act, is simply clarified as achieving and maintaining stability of the general level of prices, and by contrast to its previous legislations, the bank has no specified secondary objectives, i.e., employment and output growth. However, the key issue of IT, which appeared after the 2008 financial crisis, was how to combine the goal of financial stability with the goal of price stability. In order to overcome this challenge, inflation targeters have included the objective of achieving a sound and efficient financial system alongside their objective of price stability. Nevertheless, a few studies, for example, Arnone and Gambini (2007) and Goodhart and Schoenmaker (2006) support the point that the banking supervision should be institutionally separated from the monetary policy's roles as a condition to improve the level of CBI. This comes from the notion that the implementation of monetary policy and banking supervision are two different functions. This view is further buttressed by statistical evidence showing that countries with a specialised agency for supervising financial markets exhibit lower levels of inflation compared to those where the banking supervision is the central bank's responsibility. Nevertheless, this evidence needs to be reconsidered especially after the 2008 financial crisis. Hence, we omit the category of banking supervision as a determinant of CBI from the Mathew index.[14]

Regarding the monetary policy target, the RBNZ is not fully independent, as setting its target is a shared responsibility with the treasury. That is why New Zealand is largely classified as the least economically independent central bank among all OECD, sharing the same or raking slightly higher than the BoE whose target is reaffirmed each year by the Chancellor of the Exchequer within the annual budget statement. In effect, the UK was not granted its operational independence until 1998, when the new Labour government came to the power tasking the monetary policy committee the responsibility of setting the official interest rate. In contrast, the RBNZ has " full operational autonomy in the

[14]It is worth mentioning here that the banking supervision becomes again the responsibility of the BoE in 2008 after it was transferred to a special authority called the Financial Services Authority in 1998

conduct of monetary policy" (Graham et al., 2012). The CBJ has also its independence in setting the preferable target, as stated by the 1966 Act, which classifies the bank as an independent institution. This was witnessed during the economic reform process after the 1989 Dinar crisis.[15] In New Zealand, it not expected that a coordination problem is likely to occur between the two authorities. The Minister of Finance has the power to appoint Governor after determining the target of the policy.[16] In addition, the legislations indicate that any Governor who fails to achieve the target will be dismissed.[17] In Jordan, dealing with economic conflicts is not clear in Acts but in practice. It is true that the CBJ's Acts state that the CBJ is an independent body and has its own privileges; however, the Prime Minister of Jordan, Al- Bakheet, commented on his decision to dismiss the Governor Sharaf in 2011, by claiming that the strategy of Sharaf contradicted the government policy.[18] Generally,the government in all cases determines the last word, albeit the consultations between the two economic bodies.

In Jordan, the exchange rate is decided by the Council of Ministers, after consultations with the central bank. Likewise, exchange rate policy is not independent in both the UK and New Zealand. The Minister of Finance in New Zealand has the power to influence the exchange rate. However, according to paragraph 20 (1) of the 1989 Act, Governor can advise the Minister of Finance if they consider any inconsistency with the economic objective of monetary policy. Table 3 shows the total MPI score for the three central banks and that of each category, which indicates that CBJ has more economic independence compared to the BoE, in its early days of IT.

[15] One of the main indicators of the CBJ's instrument independence is what was taken to resolve the 1989 crisis, when Al Nabulsi decided to fix the exchange rate to the SDR's (Al Malki, 1994). However, it is worth noting that this independence is not absolute nor genuine, and that the government is the dominant player in setting the preferable target.

[16] According to the 9 (a) paragraph of the 1989 Act "the Minister shall, before appointing, or reappointing, any person as Governor, fix, in agreement with that person, policy targets for the carrying out by the bank of its primary function during that person's term of office, or next term of office, as Governor"

[17] This is related to the principle of accountability, which has a positive impact on market agents' inflation expectations. Holding Governors accountable of their decisions is essential to make a belief in the market that the bank will achieve the target.

[18] Petra News Agency (Jordan's official news agency), (20 th September 2011).

Table 3: The MPI score

MPI categories	CBJ (2012)	RBNZ (1990)	BoE (1992)
Objectives	0.5	1	1
Target	0.5	0.5	0
Instrument	1	1	0
General Policy Conflict	0.5	0.5	0.5
Exchange Rate Co-ordination	0.5	1	1
Total (5)	3	4	2.5

Note: Assigned by author based on Mathew index

2.3.3 Fiscal Independence or Financial Independence (FI)

This aspect plays an important role in ensuring the degree of MPI of central banks. Direct credit to the government must be limited to be consistent with monetary objectives and targets. It is proven statistically that there is a significant fiscal deficit impact on inflation. Therefore, one of CBI main motivation is to discipline the fiscal policy by decreasing the pressure of financing the fiscal deficit (Catao and Terrones, 2005). Indeed, it is completely irrational to enforce central banks to achieve its objectives without forging its financial relationship with the government. Limiting advances to cover the fiscal deficit is crucial for building the credibility of the system, the feature which is a key ingredient to ensure monetary policy effectiveness (Jácome et al., 2012).

In fact, more attention has been devoted recently to this issue in the literature, since direct borrowing from the central bank is prohibited or limited by central banks' Acts of developed countries. Fortunately, a large number of emerging market economies has followed this process recently. Many countries have modified their legislations to limit advances to the government, through prohibiting them entirely as in the case of most developed countries, or tightening them to a small percentage of government revenue for less than one financial year maturity, charged at market-related interest rates. The limitation can also be securitised by negotiable securities; this limitation is applied by the majority of developing countries and some developed economies (Jácome et al., 2012).

Mathew index measures FI based on six categories: limitations on non-securitised lending, limitations on securitised lending, specification of the limits of lending, maturity of loans, restrictions on interest rates, and participation of central bank in the primary market. However, we adjust some categories to be compatible with the recent global changes and also to be harmonised with each others. In particular, we give the same weight for countries which either prohibit any advances or put rigorous restrictions on non-securitised lending. In addition, we remove one category from the Mathew index, related to restricting

the amount of non-securitised lending to be in absolute currency or shares of government revenue.[19] We think that this category is not essential in our assessment, since it does not apply to our inflation targeters cases. Besides, it is not clear to what extent this restriction should be in terms of shares of government revenue or expenditure. Furthermore, we add a new category to the index to identify who can benefit from non-securitised advances. It could be argued that if non-securitised loans are not prohibited, then it should be limited to the central government and not to local or public corporations.

It is not unexpected that the CBJ was established in 1963 with little political independence; however, the limitations on lending to the government set by the 1959 Act were more restrictive compared to the limitations specified by the following Acts. According to paragraph 25-A of the 1959 Act, it is prohibited to lend the government any advances, or buy any government bonds, except what is specified in paragraph (40). Paragraph (40) states that the bank can provide a temporary loan to cover the provisory government deficit with a limit of 10% of government revenues, sanctioned by the Parliament for the year during which the loan is given, and subject to be paid off before the end of the financial year. Otherwise, the bank reserves the right not to lend any other advances until the loan is paid off. Moreover, the 1966 Act includes a paragraph regarding the interest rate on provisory advances to be at least 2% per annum. The same Act allows the CBJ to buy government bonds, only from the secondary market, subject not to increase above 20% of government revenues from the last three financial years. However, the 1971 Act was more permissive, legalising according to paragraph (49), the non-securitised lending with free market interest rates. The next Acts were even more lenient as the limit of loans was widened; the limit was increased 5% in 1979. In practice, the CBJ lending to the government, according to the CBJ data, exceeded systematically the 20 percent limit. From 1983 to 1990, the average annual lending to the government was 52 % of revenues with a peak of 95 % in 1989 (Maziad, 2009). However, Fortunately, what might be considered a promising step to constrain the ongoing government borrowing from the CBJ is the introduction of the public law in 2001. The law states that the government shall be prohibited to borrow directly from domestic commercial banks or any financial institutions, and that domestic borrowing shall be executed by issuing government securities. Moreover, according to the article 23 of the law, the total, internal and external, outstanding public debt, at any time, should not exceed 80% of GDP, at current prices, from the recent year for which data are available. Calculating the total government borrowing as a percentage of government revenues, as shown in Table 6, it is found that the percentages are consistent

[19] Cukierman et al. (1992) think that the limitations in form of absolute currency is more rigours and restrictive

with the law as the percentage of Debt to GDP does not exceed 80%. Similarly, the total outstanding debt did not go beyond 80% of GDP for the period 2008-2011, as presented in Table 5, but not directly after 2001, when the law was drafted. In fact, the public debt law does not affect the level of FI directly; rather, it improves the leverage to maintaining the price stability and decreases the cost of sterilisation under the pegged exchange rate system.

The fiscal independence for the RBNZ was shaped before moving to IT. One of New Zealand striving steps to achieve price stability was a commitment from the government to pursue a program of fiscal consolidation to ease the monetary policy stance. Therefore, New Zealand Debt Management Office was established in 1988 as a part of the treasury to improve the management of government debt portfolio. Similarly, in the UK, any kind of government non-securitised borrowing from the BoE is forbidden, and the responsibility for government debt management was transferred to the UK Debt Management Office in April 1998 in order to improve the statutory independence of the BoE. Table 4 shows the results of the FI based on the amended Mathew index for all three central banks. It is worth noting that all the improvements made by the inflation targeters after the date of initial implementation of IT are disregarded.

As adopting IT requires the absence of any form of fiscal dominance, it seems that the CBJ needs a transition period to be fiscally independent, as can be seen from Table Table 4. The main challenge which faces the CBJ is that the government violates the law to achieve its advantages. This, in another way, can be seen from the expansion of non-securitised lending to cover not only the central government expenditures but also the public corporations', although this kind of lending is indisputably prohibited by all the CBJ's fiscal legislations. In other words, this means that the CBJ needs a great deal of reform to strengthen its liquidity management in case of moving to build the credibility of low inflation domestically. It could even be argued that the fiscal discipline is essential to maintain the stability of the current fixed exchange rate system. The results shown in Table 4 indicate that the CBJ has lower FI than the two inflation targeters in their early days of adopting IT.

Table 4: The FI score

MPI categories	CBJ (2012)	RBNZ (1990)	BoE (1992)
Limitation on non-securitised advances	0.5	1	1
Limitation on securitised advances	0.5	1	1
Specification of the limits	0.5	1	1
Maturity of Loans	0.5	1	1
Restrictions on interest rates	0	1	1
Beneficiary of non-securitised advances	0	1	1
Participation in the primary market	1	1	1
Total(7)	3	7	7

Note 1: Categories are assigned by author based on Mathew index. Note 2: Although the 2001 Public Debt law abolishes the 1971 public debt law, the provisory advances to the government, as specified in Article (49) with all its amendments, has not been abrogated by the agreement. Note 3: Maziad (2009) mentions that the 2008 memorandum of understanding, signed between the central bank of Jordan and the government, abolishes the short-run free interest rate facility on advances to the government. However, $800 million backed by government securities were lent to the government in 2008 at no cost. We agree with Jácome et al. (2012) that any negotiation between the two economic authorities on setting the interest rates on securitised and non-securitised advances would "tilt the balance in favour of governments". Note 4: for more details on the sixth category see Jácome et al. (2012).

Table 5: The Ratio of Total Outstanding Debt to GDP

Year	Debt/GDP
2004	102.79%
2005	92.99%
2006	91.28%
2007	83.82%
2008	77.43%
2009	70.25%
2010	74.44%
2011	77.19%

Note: own calculations. Data on Debt and GDP are extracted from the CBJ's Statistical Database

Table 6: The Ratio of the CBJ's Lending to Government Revenue

Year	Debt/GDP
2004	16.23%
2005	12.66%
2006	10.61%
2007	8.59%
2008	29.54%
2009	22.67%
2010	21.77%

Note: own calculations based on data obtained from the CBJ's Statistical Database

2.4 Central Bank Transparency

Twenty years ago, a new concept defining the communication between central bankers and market agents started to take place, especially with the increasing interest in CBI. The way through which central banks can communicate and affect the markets behaviour is known as Central Bank Transparency (CBT). This new term comes clearly into existence with the introduction of IT, since the first and foremost prominent aspect of IT is to announce a forward looking point or range inflation target. The process of announcing and publishing an inflation target establishes an invisible link between the public and central banks. However, whether or not IT alone stimulates the recent improvements in transparency is still open to debate. Some argue that CBT is not necessarily linked to IT since many central banks have amended their legislations to be more transparent although they are not classified as inflation targeters. Nevertheless, the unanimous motivation behind CBT comes as a result of the need to satisfy the increasing appetite of information as financial markets become deeper and broader (Crowe and Meade, 2008).

Broadly speaking, the issue of CBT has gained much importance as many studies have been carried out to investigate the impact of inflation expectations on inflation rate. Proponents of CBT believe that transparency is the only mean to anchor inflation expectations and ensure the full monetary policy transmission.[20] Hence, many studies have developed from the belief that increasing the communications with private agents leads to enhance the credibility of monetary policy. In other words, increasing the level of transparency can affect the expectations of market agents and, consequently, the inflation rate (Van der Cruijsen and Demertzis, 2007). According to the forward looking New Keynesian model, monetary policy could influence the future values of inflation and output gap throughout anchoring the market expectations about the current macroeconomic variables (Van der Cruijsen et al., 2010). Crowe and Meade (2008), provide evidence that the private sector's expectations about central banks practices become more accurate when transparency is enhanced. Likewise, Van der Cruijsen and Demertzis (2007) find that countries which invest in improving the monetary policy transparency benefit from fixing the private sector expectations. According to them, a high level of transparency weakens the relationship between inflation expectations and inflation. In addition, other authors point out that the benefits of managing the market expectations are not limited to achieving the monetary policy targets. Svensson (2001) believes that CBT also improves the structure of monetary policy accountability. These benefits can only be gained by enabling the market agents to

[20] The concept of well-anchored inflation expectations refers to insensitivity of market agents' reactions to macroeconomic data releases. In other words, if market agents' inflation expectations are weakly anchored, it is expected that their future inflation expectation will be considerably affected by policy changes in the long-run.

understand the exact direction and settings of monetary policies (Blinder et al., 2008).

In fact, there are several ways through which the level of transparency can be increased in order to reduce policy uncertainty and stabilise the private sector's expectations, such as releasing monetary forecasts and/or publishing the minutes, voting records, preferences and control errors.[21] Dincer and Eichengreen (2010) suggest that CBT is a key source of policy credibility that enables the central bank to respond more effectively to market changes. In addition, anchoring inflationary expectations is not only effective in improving the reputation of the central bank, it is also the cheapest way to decrease the sacrifice ratio of disinflation efforts (Chortareas et al., 2002). Nevertheless, the effect of transparency on anchoring inflation expectations can only work out when all economic agents behave similarly. This implies that if one economic actor, that is, the central bank, changes its monetary policy behaviour, the conduct of market agents will be alerted, and thereby their inflation expectations will change tremendously (Bernanke et al., 1999). According to Lucas (1976), policy makers should employ a well-structural micro-founded model in forming expectations to make their decisions effectively predictive.[22] It follows that an unexpected change in the central bank's policy instrument should be incorporated by adjusting the coefficients of central bank's prediction model.

In fact, the effectiveness of monetary policy relies mainly on the extent to which central banks have the influence to use the interest rate tool efficiently. Theoretically, the level of monetary policy effectiveness is associated with the impact of central banks' official interest rates on the market. Geraats et al. (2006) state that the degree of CBT has an impact on the level of interest rate. The authors incorporated a dummy variable to reflect the level of transparency in eight central banks over the span 1998-2002, using the index of Eijffinger and Geraats (2006). They find that, in most cases, transparency lowers long run interest rates. In addition, Kohn et al. (2003) point out that the United States' market interest rates are influenced by the speeches and congressional testimony of Greenspan, who was the Federal Reserves Governor between 1987 and 2006. Transparency gives the monetary authority the power to influence the long-run interest rate, and thereby enhance the role of monetary policy decisions in affecting consumption and investment (Dincer and Eichengreen, 2010). This reflects the fact that releasing information from the monetary authority, as a part of transparency, eliminates uncertainty about future inflation.

However, the request of gathering and analysing the information seems to be more

[21] More details in section 2.4.1.

[22] The model should include some micro variables like: agents' preferences and the level of technology.

efficient and highly demanded by market agents in countries with larger and deeper financial markets and flexible exchange rate regimes. (Dincer and Eichengreen, 2010) study the effect of CBT for hundred central banks on inflation with respect to political determinants. Greater transparency is found in advanced countries, where transparency can play a fundamental role in improving the mechanism of accountability. Their study indicates that countries with a fixed exchange rate are less transparent in their policy decisions. Chortareas et al. (2002) state that higher degree of CBT has insignificant impacts on inflation rates in countries with an exchange rate target. However, the impact of an exchange rate peg on the level of transparency is arguable. Canavan and Tommasi (1997) and Herrendorf (1999) suggest that a fixed exchange rate is a monetary anchor through which transparency can be improved.[23] Their argument is based on the belief that a fixed exchange rate regime provides the market with a long-run rigid indicator of monetary policy (Chortareas et al., 2002).

It is found that CBT helps reducing the inflation volatility rather than the level of inflation rate. The studies of Demertzis and Hallett (2007) and Drew and Karagedikli (2008) indicate that there is no statistically significant correlation between CBT and the level of inflation, but the variance of inflation is affected by the degree of transparency.

Nevertheless, the extent to which CBT is generally beneficial is still controversial. Some authors argue that transparency should be unconditionally ample. According to Chortareas et al. (2002) "the choice of optimal degree of transparency is related to the trade-off between flexibility and credibility". Thus, increasing the level of transparency might be harmful in countries with high level of transparency, while it is largely fundamental for poor-transparent countries. Similarly, Van der Cruijsen et al. (2010) note that greater transparency may provide the market with bad indications over which central bank is uncertain about the economic conditions. This may lead to confusing market agents, and thereby decreasing the monetary policy effectiveness. The findings of Ehrmann et al. (2012) also reveal that increasing the level of economic transparency is only optimal at low levels of transparency.

Nonetheless, whether CBT is limited to IT rather than other nominal anchors or discretionary policies is unsettled in the literature. Some economists believe that CBT has gained economic interest and that the literature on this issue has become popular with the adoption of IT across many central banks. Proponents of this view tend to argue that

[23] They claim that a fixed exchange rate regime is preferable to other nominal anchors, as it is easily understood and observed by the public.

adopting IT establishes a communication link with the market, where central banks' preferences and data are shared with market agents. Crowe (2010) finds that the adoption of IT decreases the uncertainty among the private sector in forecasting future inflation. Similarly, Orphanides and Williams (2004) point out that IT increases the public's awareness and enables them to behave more rationally. However, Levin et al. (2004) conclude that the concept of CBT is much broader than to be restricted to IT, arguing that announcing a quantitative target is just one aspect of transparency. Nevertheless, Mishkin (2004) and Savastano et al. (1997) have gone further to claim that transparency is a prerequisite for adopting IT. Proponents of this notion have been supported by the intensive amendments made by inflation targeters to enhance their transparency in order to achieve their inflation target efficiently and at low costs. Eijffinger and Geraats (2006) show that the degree of CBT of nine central banks was improved between the years 1998 to 2002. The major amendments to central banks legislations, which directly affect the level of transparency, have occurred in inflation targeting countries. As a matter of fact, the economists who claim that transparency is not an IT phenomenon provide examples of inflation targeters which have lower levels of CBT compared to some non-inflation targeters (Geraats et al., 2006). Furthermore, some opponents usually mention the United States as a preeminent example of a country with a high transparent monetary authority whose monetary anchor is not formally IT.[24] Yet, all their classifications underline that the highest transparent central banks in the world are all inflation targeters, e.g., New Zealand, the United Kingdom, Canada and the Czech Republic.

Our objective in this section is to measure the transparency level of the CBJ. The current level of transparency for the CBJ is compared to the level of transparency in the year of announcing IT for the two inflation targeters models. To do so, this study uses the index of Geraats et al. (2006). This index has been utilised by the majority of studies on CBT, since it is the most comprehensive index and also workable for processing time series and panel data analysis (Van der Cruijsen and Demertzis, 2007).

The Eijffinger and Geraats (2006) index classifies the monetary policy-making practices in five aspects; each is associated with three criteria:[25]

1. Political Transparency presents the central bank clarification about their objective, target quantification and the presence of institutional arrangement between government and central bank.

[24] Note that the US is implicitly an inflation targeter
[25] The full index of Eijffinger and Geraats (2006) is enclosed in Appendix B

2. Economic Transparency includes the information regarding the publication of the economic data, economic model and forecasts.

3. Procedural Transparency reflects the degree of central bank openness in announcing its strategy, voting records and minutes.

4. Policy transparency measures the transparency at explaining monetary decisions, announcing policy changes and clarifying the information regarding the future path of policy.

5. Operational transparency exists when the central bank assesses its performance with respect to its objective, evaluates its monetary achievement and announces control errors.

The overall score of all transparency sub-indexes is fifteen; each aspect has three categories with three scores in total. Thus, the aggregation of the overall index ranges from 0 (low transparency) to 15 (high transparency).

Although CBT has five dimensions, the political transparency seems to be jointly correlated with the definition of some CBI's features. Nevertheless, the significant increase in CBT has been observed in developed countries, whereas the level of CBI has been remarkably improved in developing and emerging market economies. In effect, enjoying a high level of transparent policies ensures the insulation of central bank from political authority. Greater transparency constrains the government power to contradict the central bank's objective of price stability. So, it could be argued that CBI is the first step to improving the level of transparency.

To the best of our knowledge, the study of Dincer and Eichengreen (2010) is the only study that assesses CBT for Jordan using the index of Geraats et al. (2006), ranking Jordan among the lowest transparent central banks. However, their sample period is relatively old, i.e., 1998-2004. So, our study assesses the level of transparency of the CBJ for the year 2012, and explains each CBT aspect. Our assessment relies mainly on all published information for the three central banks and also on other studies which have been carried out in this scope.

2.4.1 Political Transparency

The majority of central banks have formal objectives, but transparency is associated with how these objectives are clarified and prioritised. Both the RBNZ and the BoE amended in 1989 and 1992, respectively, their legislations and announced that there are officially inflation targeters with the objective of maintaining price stability. Although after the 2008 financial crisis both countries added the financial stability to their primary objectives, the goal of price stability remained the first priority, and indeed achieving financial stability leads to achieving price stability. Both central banks announce an inflation target; Governor and the Minister of Finance together set a range inflation target in New Zealand, while the government in the United Kingdom announces a point target of inflation in the annual budget statement. So, according to the index criteria, both central banks are assigned the full score for the first two criteria of political transparency. Unlike the two cases, the CBJ has many objectives to achieve. As previously mentioned, the monetary anchor in Jordan is the fixed exchange rate to the US dollar; however, the objectives' ordering published on the CBJ's website is confusing, and rather no priority is set. Although it could be argued that the exchange rate is a quantitative target through which the price stability goal can be achieved, the expression of the CBJ's objectives requires more elaboration in terms of specifying the main objective of monetary policy. All the three central banks are assigned the full score for the third criterion, i.e., the presence of institutional arrangement between government and central bank. All of them have an institutional arrangement with the government in which each central bank has its own legislations with explicit instrument independence. However, for Jordan, some arrangements could be violated by the political authority, and thereby the constitutions and arrangements between the government and the central bank need more elaboration.

Table 7: Political Transparency Scores

Categories	CBJ (2012)	RBNZ (1990)	BoE (1992)
Objective	0.5	1	1
Quantification of the primary goal	1	1	1
Institutional arrangement	0.5	1	1
Total	2	3	3

Note: Calculated by author based on the index of Geraats et al. (2006)

The full score is assigned to the RBNZ and the BoE, as shown in Table 7, as a result of adopting IT. This indicates that it is feasible for the CBJ to be more politically transparent if the full-fledged IT is adopted, given the need for more central bank independency. In fact, IT provides the market with a clear visible quantitative macro-variable with one single

objective, i.e., price stability. Generally, inflation targeters became politically transparent when they adjusted their legislations to start the era of IT. So, it could be argued that the CBJ can be fully politically transparent once it shifts to the full-fledged form of IT.

2.4.2 Economic Transparency

Economic transparency is associated with the information that formulate the policy decisions. According to the index, the information that should be released by the monetary authority includes: the economic data, the model used for forecasting or assessing the bank's own decisions, and macro-forecasts.

For the two inflation targeting countries, all the key fundamental data that assess the performance of macroeconomics were made available from 2002 (Eijffinger and Geraats (2006)). Before this year all data on money supply, inflation, GDP, unemployment rate, but the capacity utilization were available on the RBNZ's website and the Office of National Statistics of the United Kingdom. The CBJ publishes a long series of money supply, inflation and GDP, available in Arabic and English. Yet, neither the data on capacity utilisation nor on unemployment are published, although the data on unemployment rate can be obtained from the Statistical Department of Jordan by authenticated request. However, following the index coding, all three central banks are given the same score with regards to this criterion.

The second criterion reflects the disclosure of the formal macroeconomic model. The model was not available for both New Zealand and the United Kingdom before 1997 and 1999, respectively (Geraats et al., 2006), but it is still unpublished for Jordan. The third criterion of economic transparency clarifies whether central banks publish their own forecasts. In the United Kingdom, the BoE publishes inflation and output forecasts in the quarterly inflation report, this report started being published from 1997. Similarly, the RBNZ begun publishing the quarterly monetary policy statement which includes up to three years projections for inflation and output from 1996. Although macroeconomic forecasts are unpublished on the CBJ's website, we find that the key macro-variables are published in the 2010 IMF country report. However, the three central banks, according to our assessment, are assigned the same score as shown in Table 8.

Although the CBJ shares the same score with the two inflation targeters, there is a distinction worth repeating here is that the CBJ, unlike the two inflation targeters in their early days of IT, does not disclose data on unemployment to the public and it can just be

obtained by a special request from the Statistics Department.[26]

Table 8: Economic Transparency Scores

Categories	CBJ (2012)	RBNZ (1990)	BoE (1992)
Data	0.5	0.5	0.5
Macro-model	0	0	0
Macro-forecasts	0	0	0
Total	0.5	0.5	0.5

Note: Calculated by author based on the index of Geraats et al. (2006)

2.4.3 Procedural Transparency

This aspect of transparency gives an indication of how monetary policy decisions are made. Its first criterion measures the clarity of the policy strategy. The second and third criteria are related to why a decision has been taken and how this decision has been made, respectively. Our three cases have an explicit monetary strategy. The RBNZ and the BoE are inflation targeters, while the CBJ is an exchange rate fixer. The second criterion is evenly assigned for all three central banks. The RBNZ currently publishes the explanations of decisions throughout the quarterly monetary policy statement, which, as mentioned earlier, started being published from 1996. This is also the case of the BoE, which started publishing such explanations via the minutes from 1998.[27] However, the CBJ does not until the time of writing this give any clear explanations of its decisions. Revising all the CBJ publications and news on the previous decisions, it is found that the CBJ provides unclear statements with regards to its reaction to economic changes by stating that "a decision has been taken by the Governor due to economic circumstances".

Although all central banks are given the same score for the second criterion, both the CBJ and the RBNZ have a full extra point above the BoE for the third one. In Jordan and New Zealand, policy decisions are taken by the Governor, whereas a decision at the BoE is taken by the monetary policy committee.[28] So, for the BoE to be transparent, the individual voting records should be submitted. Indeed, the BoE started including the voting records along with the minute from 1998.

[26] However, it is not clear whether the Statistics Department has a long series of unemployment rates and to what extent the criteria of measuring unemployment are transparent and precise.

[27] The 1998 Act paragraph 15-1- states that the bank "shall publish minutes of the Monetary Policy Commission meeting before the end of the period of 6 weeks beginning with the day of the meeting".

[28] The Governor of the RBNZ states that holding the Governor responsible of taking decisions is essential for accountability. This is because the Parliament cannot ask the bank board nor the monetary commission to step down, but the Governor can be easily dismissed.

Table 9: Procedural Transparency Scores

Categories	CBJ (2012)	RBNZ (1990)	BoE (1992)
Policy strategy	1	1	1
Decision explanation	0	0	0
How a decision is reached	1	1	0
Total	2	2	1

Note: Calculated by author based on the index of Geraats et al. (2006)

Although the CBJ is ranked similar to the RBNZ and higher than the BoE, as shown in Table 9, the CBJ has to provide the market with clear statements regarding the policy changes and outcomes, though this was not provided by both the RBNZ and the BoE in their early days of IT. We think that providing the market with clear explanations about the changes in the policy, the target or the instruments improves the credibility of monetary policy.

2.4.4 Policy Transparency

This aspect of transparency assesses the speed of the announcement of any adjustments in the policy. In addition, it concerns about whether the central bank provides an explanation when adjustments are announced, and whether it takes into consideration the declaration of future desires or intentions. All three central banks announce their decisions concerning adjustments to key monetary policy instruments at least on the day of implementation. The CBJ publishes any changes to its major instrument, i.e., the interest rate on the same day before their implementation. However, the bank does not indicate when a decision is precisely taken.

Although the three central banks have the commitment to announce the policy changes promptly, the CBJ and the BoE do not give detailed explanations of why a decision is taken. For instance, the CBJ, as mentioned earlier, attributes any changes in the policy to the economic conditions. The RBNZ used initially to conduct in the same way but not after the introduction of the official cash rate in 1999 (Geraats et al., 2006). Unlike the RBNZ, both the CBJ and the BoE provide no indication or inclination about their future preference policy. Again, as greater transparency in the policy aspect happened for the RBNZ only after a decade of adopting IT, these amendments are not considered in our assessment. Therefore, all the three cases are given the same score according the index.

Table 10: Policy Transparency Scores

Categories	CBJ (2012)	RBNZ (1990)	BoE (1992)
Prompt announcing of policy adjustment	1	1	1
Explanation of the adjustment announced	0	0	0
Explicit inclination of future actions	0	0	0
Total	1	1	1

Note: Calculated by author based on the index of Geraats et al. (2006)

All the three central banks announce their policy changes almost on the day when the decision is taken, so all of them are assigned the full score. However, the second criterion in Table 10 may cause confusion with the second one in Table 9. Hence, it is worth explaining that the two criteria are not overlapping. The criterion of policy transparency reflects whether the central bank announces promptly an explanation of its decision regarding the operating target or instrument, namely on the day when the decision is taken, whereas, the second criterion of procedural transparency does not refer to the immediate comprehensive explanation of a policy change.

2.4.5 Operational Transparency

This aspect evaluates whether central banks assess their policy actions and outcomes with regards to their objectives on a regular basis. It also evaluates whether the central bank provides information regarding the control errors that affected the monetary policy transmission in the past. The CBJ issues monthly, quarterly and yearly reports concerning the performance of major macroeconomic variables. These reports show how the indicators are reached and evaluated according to the bank's objectives. The reports also provide an upshot about the changes in the economic sectors, detailing a number or percentage of every change. However, the CBJ does not indicate how control errors affect the transmission of monetary policy nor it indicates the reaction of monetary policy to shocks.

At the beginning of IT, the RBNZ and the BoE did not evaluate their main operating target. For the the UK, this is because the BoE was granted its operational independence in 1997. For the RBNZ, the policy outcomes were not evaluated until 1999, when the official cash rate was introduced. In addition, both the BoE and the RBNZ used to publish no information about the control errors and the assessment of the policy outcomes until the end of the previous century.[29] However, they do not, until the time of writing this, achieve the full score of the second and third criteria of the index. This is because the effect of operational transparency is unsettled in the literature and flexibility could be

[29] See Geraats et al. (2006) and Van der Cruijsen and Demertzis (2007) for more details

costly in high-transparent economies (Geraats et al., 2006).

Interestingly, the CBJ is more operationally transparent compared to the case of the BoE and the RBNZ in their early days of IT, as can be seen from Table 11. The CBJ does not provide information about the control errors, though. This criterion is still controversial and not implemented entirely by any central bank in the world.

Noticeably, greater transparency in our two inflation targeters models has not happened after moving to IT, but has rather started after a lag period of time, approximately five years for the BoE and ten years for the RBNZ. The immediate increase in transparency due to adopting IT affected the political aspect. Accordingly, it could be argued that improving the level of the CBJ transparency is feasible, given a high level of central bank independence. However, it is worth noting that the two inflation targeters are currently classified as the most transparent central banks in the world.

Table 11: Operational Transparency Scores

Categories	CBJ (2012)	RBNZ (1990)	BoE (1992)
Policy operating target evaluation	1	0	0
Information about disturbances	0	0	0
Evaluation of the policy outcome	1	0	0
Total	2	0	0

Note: Calculated by author based on the index of Geraats et al. (2006)

Table 12: Total Transparency Scores

Categories	CBJ (2012)	RBNZ (1990)	BoE (1992)
Political transparency	2.5	3	3
Economic transparency	0.5	0.5	0.5
Procedural transparency	2	2	1
Policy transparency	1	1	1
Operational transparency	2	0	0
Total	7	6.5	5.5

Note: Calculated by author based on the index of Geraats et al. (2006)

According to Table 12, Jordan appears to have higher level of CBT than the two inflation targeters in the first year of IT. On the other hand, the standard of the index coding treats all banks similarly regarding the economic transparency although the unemployment rate for Jordan is not published. Besides, the CBJ should provide the market with any change in monetary policy as well as detailed explanations of adjustments. However, the CBJ could improve its political transparency in case of adopting a full-fledged IT.

2.5 Conclusions

From the experience of developed and emerging market economies in adopting inflation targeting, there are some features found to characterise inflation targeters, and agreed to be preconditions for other countries aiming at successfully moving to target inflation on domestic bases. Our main purposes are to assess whether it is possible to target inflation in a small emerging market economy like Jordan, and to highlight the institutional difficulties in building the credibility of low inflation domestically. In this study, the main institutional preconditions for inflation targeting: central bank independence and transparency are assessed. We intend to compare the current economic conditions of Jordan to that of two inflation targeters, taking as model cases: New Zealand, the first to adopt IT, and the UK, in their early days of implementing inflation targeting

The central bank independence index, set by Mathew (2003), is utilised to assess the level of personal, economic and financial independence; however, we made some changes to the index criteria to be compatible with our purpose of the study. We capture the dominance of the political authority in Jordan in different aspects. The study highlights some weaknesses in the central bank's Acts and the clash between the government practices and the monetary authority's legislations. Although according to many criteria the central bank appears to have its autonomy, the practices of the government clash with the personal legislations of the bank, and thereby the formal collaborations between the two authorities are ambiguous. In terms of political independence, although appointing and dismissing Governor and deputies are decided by two sides; i.e., the head of the country and the Prime Minister, it is recommended to entrust the parliament with the role of appointing and dismissing Governor and deputies, given that the Prime Minister in Jordan is appointed by the king. We also suggest the need to set limitations on Governor or deputy tenure; i.e., the terms of office should not exceed ten years, as in the case of the UK; paragraphs 1 (3) and (4) by section 243 (1) of 2009 Act.

If the country decides to move towards building the credibility of low prices domestically, central bank target independence should be granted; both the central bank and the government should elaborate on how to set and announce the inflation target. Considering the weak and fragile historical collaborations between the monetary authority and the government in Jordan and unlike the two inflation targeters cases, it is fundamental to set legal limitations on exchange rate policies and negotiations with the government which ensure that the words of the monetary authority are always heard and that the monetary policies are tilted in favour of long-term social and economic benefits. It is also impor-

tant to have an independent exchange rate strategy. In this respect, we refer to Al Malki (1994) on his notes on the 1967 exchange rate depreciation, when the currency was fixed to the British Pound, "... The central bank provided the government with a comprehensive study upon the adverse effects and consequences of depreciating the currency against the British Pound and recommended to keep the exchange rate parity fixed...; However, on 20^{th} November 1967 and upon a meeting between the central bank board and the Cabinet, the currency was allowed to depreciate by 14.3%... After that, it had taken two decades, namely during the 1989 Dinar crisis, to reckon the adverse consequences of opposing the deep perceptive of the central bank..." (Al Malki, 1994, p.261).[30] Given that historical context, target independence is highly important for the case of Jordan under any monetary regime. However, having suggested this, New Zealand, where the target of monetary policy is set mutually between the Minister of Finance and Governor, is still an appealing example to follow coupled with the motivation of ensuring central bank accountability.

In addition, according to our assessment, the central bank of Jordan is weakly independent in terms of financial policies; the non-securitised lending offered generously with free market interest rates to cover the expenditure of the public corporations alongside the central government. Taking into account the legislations enacted by the 2001 Public Debt Law, the absence of fiscal discipline presents a challenge to achieve price stability domestically; this could also be a threat to the current monetary anchor. The central bank of Jordan and the government, side by side, should collaborate to enhance the central bank's legislations and policies and curtail fiscal deficit moneterisation. In this respect, it would be ideal to establish a sperate office to hold the responsibility for government debt management, similar to the experience of the UK.

The level of transparency is assessed using the Eijffinger and Geraats (2006) index. The challenges concerning the level of central bank transparency appear to be less prominent. However, ensuring an independent central bank is a fundamental base to make improvements to the level of transparency. Comparing the scores assigned for Jordan to the two inflation targeters, it could be argued that the central bank of Jordan could be more politically transparent by adjusting its objectives and target to move towards a full-fledged inflation targeting. Nonetheless, the central bank has to be more transparent stating clearly the policy changes and the corresponding actions and releasing all macroeconomic data that help setting the market expectations and improve the credibility of the central bank, taking into consideration the trade-off between flexibility and credibility of information releases.

[30] translated by the researcher.

Chapter 3

The Credibility and limitations of Monetary Policy Under The Fixed Exchange Rate System: The (A)symmetric Transmission Mechanism in Jordan

3.1 Introduction

The credibility of achieving the announced quantitative target for price stability requires an effective and efficient monetary policy. This effectiveness is determined by the magnitude and speed at which monetary policy affects retail interest rates to reach the final goals by influencing consumption and investment decisions. Although they are different channels for monetary policy and the importance of each channel varies across countries, economies and time (Amarasekara, 2005), the interest rate pass through channel is the most widely used channel through which the monetary objectives of maintaining price stability and/or inducing output growth can be achieved. In fact, this channel has gained much attention in recent literature and started cropping its popularity with the introduction of inflation targeting to be a vital and effective channel in achieving the goal of price stability (Gigineishvili, 2011).

If the transmission mechanism is incomplete and inefficient, the monetary authority will find it difficult to influence consumers' and businesses' behaviour, and, consequently, it will be impeded to achieve its intermediate and long-run goals. Hence, it is important to assess the effectiveness of monetary policy in achieving the key macroeconomic goals and the effectiveness in bringing price stability into economy. This assessment is crucially essential for designing policymaking rules.

The interest rate channel is designed to convey the policy message, that is, to influence domestic demand and output, through affecting retail interest rates. In other words, in case of expansionary monetary policy, lowering official interest rates should pass on to retail interest rates to encourage investment and consumption (Karagiannis et al., 2011).

Essentially, the monetary policy accounts for one side of the whole transmission process; the part of inducing the change. The other side of sending the change to the public is represented by the financial intermediaries, and their role is as essential as central bank's. Commercial banks play a major role, as dispatchers of monetary policy innovations, in correcting the economic path. For monetary policy to be effective and highly credible in the market, a change in official interest rates should be completely and quickly transmitted into changes in retail interest rates.

To understand to how extent monetary policy affects investment and consumption to meet the monetary policy goals, measuring the size and speed at which monetary impulses are transmitted could reflect the credibility of monetary policy. In this study, we focus

on assessing the monetary policy transmission within its intermediate lag of an action for the case of Jordan. Practically, there are three time lags between taking an action to when the macro variables react to official changes. The first lag, or the central bank inside lag, lies between the time when an action is taken and when it is pragmatically implemented. The intermediate lag is the time lag from when an action is taken by commercial banks to when spending decisions are affected. The third lag, or outside lag, occurs in the last part of the chain, reflecting the time needed for macroeconomic variables to assimilate the changes transmitted through the monetary policy conveyers (Amarasekara, 2005).

Inflation targeting countries, either developed or developing, employ the interest rate channel to achieve the long run objective of price stability along the other intermediate targets. Our aim is to assess the effectiveness of the Interest Rate Pass-Through (IRPT), the main monetary policy transmission channel in Jordan, by examining whether the degree of pass-through is complete and quick and comparing the results to two inflation targeters models, New Zealand and the UK, at time proceeding building the rules of monetary policy domestically. This comparison helps better understand the size of reforms needed for countries with monetary policy actions veiled behind a fixed exchange rate system, and allows understanding the difficulties facing a country while building the credibility of low inflation domestically.

We focus on the role of marginal pricing costs which reflects how official monetary policies are strong in affecting banks profitability, regulating banking system and thus achieving price stability. Therefore, we first test whether the degree of pass-through is complete and quick. An effective monetary policy means that a one percent change in official interest rates, which could initially be exerted to money market interest rates, leads promptly to a one percent change in retail interest rates. In fact, the degree of pass-through could reflect the market structure. In the presence of incomplete pass-through, the market reflects a high degree of imperfect competition (De Bondt, 2002), switching costs, information asymmetries (Sander and Kleimeier, 2004), banks fixed adjustment costs or reliance on long-term capital market funds (Bredin et al., 2002). The pass-through in such cases of sluggishness is described as sticky.

In addition, while symmetric behaviour of financial intermediaries to monetary shocks can be an indicator of market efficiency, in which retail interest rates respond indifferently to changes in official interest rates, the mismatching response in loan and deposit markets would occur due to market concentration or consumer sophistication (Karagiannis et al., 2011). There are two hypotheses which explain the deviation from symmetry in an in-

dustry. According to the structure performance hypothesis, the non-competitive pricing behaviour happens in concentrated markets where firms have the power to set the market prices. On contrary, an efficient structure of economy as implied by the efficient structure hypothesis allows firms to enjoy large scale of economies and thus to produce at a low cost which adds to the welfare of households and public. Hannan and Berger (1991) Berger and Hannan (1989) explain the two behaviours in the banking industry. Banks in concentrated markets, according to them, set low deposit interest rates compared to other banks operating in less concentrated markets. Hence, banks respond faster to decrease their interest rates on deposit, following an official change, when they are above long-run equilibrium. Therefore, we also examine the (a)symmetric behaviour of the financial market.

The chapter is organised as follows. Section two explains the methodology applied to examine the interest rate pass-through and the asymmetries in the market. Section two and three present the data and results, respectively. The last section provides conclusions and policy implications.

3.2 Methodology

Since many economic variables are found to be cointegrated of order one, studying the relationship between two economic variables in first difference will invalidate their long run nexus. In principle, a random linear combination of two series of the same order will also be cointegrated of that order, and the problem of spurious regression may arise (Harris, 1995). Nevertheless, if we have two cointegrated series of order one, the residuals of the regression will be stationary I(0), and inference by means of standard hypothesis testing would be valid.

The partial adjustment model, which identifies the relationship between retail interest rates and official interest rates, where the latter is assumed to be weakly exogenous, can be represented as follows:

$$rr_t = \phi_0 + \phi_1 mm_t + u_t \tag{1}$$

rr is the price charged for given loans, or offered to depositors by commercial banks, ϕ_0 is constant markup or markdown on retail interest rate, mm is the official or money market interest rate set by central banks, and u_t is the error term. Money market interest rates could also be seen as banks marginal cost of funding, which reflects the marginal yield of free-risky assets (Weth, 2002). In a perfect competitive financial market, prices set by commercial banks should equal marginal costs, represented in our study by official or money market interest rates. Therefore, the derivative of retail interest rates with respect to money market interest rates should equal one (De Bondt, 2002). In most cases, ϕ_1 lies between zero and one. The value of one implies a complete pass-through, which means that retail interest rates are perfectly elastic to changes in money market interest rates. However, it is rare that ϕ_1 would equal one, owing to market power, information asymmetries, switching costs, adverse customer reaction, adjustment costs and the possibility to access different source of finance. In addition, because of information asymmetries, an overshooting in the pass-through, that is, $\phi_1 > 1$, might also occur in a situation where banks behave irrationally in compensating their default risk (De Bondt, 2002), by increasing their interest rates instead of decreasing the supply of loans (Aziakpono and Wilson, 2010).

Studying the stickiness in prices or retail interest rates has received heavy attention in the literature, which came initially from studying the pass-through of industrial organisation prices in concentrated markets (Hofmann and Mizen, 2004), using different error correction models. In this study, we use the Johansen approach (Johansen, 1991) to estimate the long run degree of pass-through along with the speed of adjustment to

disequilibrium. The Johansen general equation of vector error correction form is as follows:

$$\Delta Z_t = \mu + \pi \Delta Z_{t-1} + \sum_{i=1}^{p-1} \tau Z_{t-i} + \epsilon_t \tag{2}$$

$$\pi = \alpha\beta \tag{3}$$

Where Z_t is a vector of jointly endogenous variables and π contains information about the long run relationships between the variables.[31] In accordance, the Johansen reduced rank regression of the long run relationship is identified in equation 3, as α represents the speed of adjustment to disequilibrium, whereas β is a matrix of long run coefficients. In this case, β reflects the magnitude of pass-through, while α shows the speed at which retail interest rates respond to changes in official interest rates.

According to equations 2 and 3, Johansen suggests that the reduced rank of π contains a number of cointegrating vectors exist in $\beta : r \leq n-1$. To specify the number of r, Johansen puts forward to test two ratios of maximised likelihood functions, known as the maximal eigenvalue, or *lambda*-max statistic, and the trace test. In order to look for $[n-1]$ cointegrating relationships, the non-stationarity should be ensured.

After obtaining the long run equilibrium, we examine the existence of asymmetries over an interest rate cycle. Hence, we employ the dynamic model, which connects both the short-run and the long-run effects using the error correction term. The following equation represents the full system of Hendry and Doornik (1994), which identifies the conditional dynamic model when the money market interest rate is weakly exogenous:

$$\Delta rr_t = \delta_0 + \delta_1 \Delta mm_t + \sum_{q=1}^{p} \delta_{t-q} mm_{t-q} + \sum_{i=1}^{n} \gamma rr_{t-i} + \lambda ect_{t-1} + \varepsilon_t \tag{4}$$

Δ denotes the first difference of retail and money market interest rates. δ_1 and δ_2 represent the short run pass-through and the parameters of the lagged exogenous variable, respectively. γ is the coefficient of the lagged endogenous interest rates. λ refers to the speed of adjustment when retail interest rates adjust indifferently to money market rates changes. $ect_{t-1} = [rr_{t-1} - \alpha_0 - \alpha_1 mm_{t-1}\ ]$ is the residual of the long run relationship obtained from equation 1 by the Johansen approach at time (t-1). The sign of λ should be negative to ascertain stationary. q and i are the optimal lag length determined by the information criteria. ε_t is the white noise error term.

The simple model of equation 4 is:

$$rr_t = \alpha_0 + \alpha_1 mm_t + \lambda ect_{t-1} + \varepsilon_t \tag{5}$$

[31] Note that, according to Johansen equation, no restriction is imposed. Nevertheless, in our analysis, money market interest rates are considered exogenously determined.

According to the equation above, the mean lag (Hendry and Doornik, 1994) is:[32]

$$ML = (\delta_1 - 1)/\lambda \tag{6}$$

The mean lag of equation 6 measures the degree of stickiness for symmetric error correction model, where high ML reflects a slow or sticky response to changes in money market interest rates. This in our analysis reflects the short run lag, i.e., months, needed for a full long run equilibrium adjustment.

In practice, banks would respond differently to official interest rates changes in an attempt to maximise their profit by widening the spread between interest rates on deposit and that on loans. However, this behaviour depends mainly on the level of market structure. In a weak competitive market, banks incline to respond to a decrease in official interest rates by lowering their interest rates on deposit quicker than on loans (Weth, 2002), whereas a high competitive market adds to the welfare of households and investors (van der Cruijsen, 2008).

According to the findings of Berger and Hannan (1989) and Hannan and Berger (1991), banks in oligopolistic markets have major price rigidity, and thereby their deposit interest rates are stickier upward. Similar view of noncompetitive pricing behaviour is argued by Neumark and Sharpe (1992). Two hypotheses are put forward to explain asymmetric reactions to monetary policy shocks: the bank concentration, or bank's collusive pricing hypothesis, and the consumer behaviour hypothesis (Scholnick, 1996). The latter hypothesis exhibits "the degree of consumer sophistication with respect to capital market" Karagiannis et al. (2011). In other words, this means that sophisticated consumers are able to hinder the market power and thereby, deposit markets respond slower following a decrease in money market rates but quicker following an increase. By contrast, the bank concentration pricing hypothesis suggests that banks can exercise their market power by adjusting their interest rates quicker downward on deposit and upward on loans.

Therefore, to see if retail interest rates are rigid upward or downward, we incorporate two dummy variables depending on whether retail interest rates are above or below their long-run equilibrium level. This approach is followed by Scholnick (1996) and Ozdemir (2009). However, we do not use their specification of the dynamic equation; we do not remove the lagged coefficients of retail and money market rates as in Scholnick (1996) nor we do omit the intercept from the main equation 4 as in Ozdemir (2009). We spilt the

[32] In a simple dynamic model, a mean lag measures the time needed for the regressand to converge to its long-run equilibrium level, and depends on the magnitude of $(\delta_1 - 1)$. For further details, see (Hendry, 1995).

error correction term into two series:

$ect^+ = \text{ect if } ect > \mu$

$ect^+ = 0 \text{ if } ect < \mu$

$ect^- = \text{ect if } ect < \mu$

$ect^- = 0 \text{ if } ect > \mu$

Where μ is the mean of ect. After including the two dummy variables to equation 4, the new equation is presented as:

$$\Delta rr_t = \delta_0 + \delta_1 \Delta mm_t + \delta_{t-q} \sum_{q=1}^{p} mm_{t-q} + \gamma \sum_{i=1}^{n} rr_{t-i} + \lambda_1 ect_{t-1}^{+} + \lambda_2 ect_{t-1}^{-} + \varepsilon_t \qquad (7)$$

λ_1 acts as the speed of adjustment when retail interest rates are above their equilibrium level, and the opposite for λ_2.

Our methodology to examine the asymmetries in the financial market could also be seen as a threshold autoregressive error correction model followed by Enders and Siklos (2001) and Enders and Chumrusphonlert (2004). In both studies, two dummy variables are included to capture the changes, i.e., when the error term is above and below its long run equilibrium level; however, they set the threshold value, μ in our case, to zero.

Retail interest rates are said to be adjusted symmetrically if the coefficient of ect_{t-1}^{+} is not statistically different from the coefficient of ect_{t-1}^{-}. Hence, a Wald test is conducted to test the equality between the two coefficients: $\lambda_1 = \lambda_2 = 0$. The asymmetric hypothesis can be rejected if the P-value is less than the level of significance. As explained by the bank's collusion hypothesis, if $\lambda_1 > \lambda_2$, then the response in deposit market is quicker upward than downward, while if $\lambda_2 > \lambda_1$, the change in loan rate is faster upward than downward. It is assumed, according to equations 4 and 6, that retail interest rates behave indifferently with respect to decreases or increases in official interest rates. The following equations show the mean adjustment lag when retail interest rates respond asymmetrically to money market interest rates changes (Liu et al., 2008):

$$ML^+ = (\delta_1 - 1)/\lambda_1 \qquad (8)$$

$$ML^- = (\delta_1 - 1)/\lambda_2 \qquad (9)$$

3.3 Data Collection and Description

All data on Jordanian official, money market interest rates and retail interest rates are obtained from the CBJ's Statistical Database. For our comparison purpose, the series of New Zealand's deposit interest rate and British interest rates on lending and deposit are extracted from the International Monetary Fund/ International Financial Statistics, whereas, the remaining series: the RBNZ's bill rate-30 and 60 days, interest rate on housing loan and deposit and British certificates of deposit, are collected from the released Statistical Database of the their central banks.

All the series represent monthly data from January to December. However, we allow the time prior to IT for the two inflation targeters models to be compared to the recent period for Jordan. In accordance, as IT has been adopted in 1990 by the RBNZ and in 1992 by the BoE, we cover the span 1985-1990 and 1985-1992 for New Zealand and the UK, respectively. For Jordan, the years between 1995 and 2011 are covered; however, we cover the years from 1997 to 2007 for one money market interest rate, that is, the interest rate on three months certificates of deposit, as it was the CBJ's main operating instrument until the early 2008. Each country's official and retail interest rates utilised in the analysis are illustrated in Table 13 and Table14, respectively.

Table 13: Official Interest Rates

Country	Official Interest Rate
Jordan	CD: Interest rate on Certificate of Deposit
Jordan	Redis: Rediscount rate
Jordan	Repo: Interest rate on repurchase agreement
New Zealand	TB-30: Bank bill yield-30 days
New Zealand	TB-60: Bank bill yield-60 days
UK	CD: 3 months average of Sterling certificates of deposit interest rate

Table 14: Retail Interest Rates

Country	Retail Interest Rate
Jordan	Deposit: Weighted average interest rate on demand deposit
Jordan	Loan: Weighted average interest rate on loans and advances
New Zealand	Housing: Floating first mortgage new customer housing rate
New Zealand	Deposit: Six-month term deposit rate
UK	Lending: Lending interest rate
UK	Deposit: Interest rate on deposit

3.4 Results

We test for the order of integration of the variables by the mean of the well-known Dickey and Fuller (1979) test. The results, shown in Tables 15, 16 and 17 point out the possibility for a long-run of order one relationship between each retail interest rate and money market rate. A constant is added to the test equation, and the lag length of the test is determined by the Schwartz information criterion.

Table 15: Unit Root Test-Jordan

Series	NO. Obs	Level	Prob.	First difference	Prob.
loan	204	-0.408	0.904	-17.648	0.000
Deposit	204	-0.713	0.839	-16.035	0.000
Redisc	204	-1.206	0.671	-7.399	0.000
Repo	204	-0.904	0.76	-11.726	0.000
CD	132	-1.796	0.38	-11.46	0.000
Loan	132	-0.619	0.861	-16.066	0.000
Deposit	132	-0.913	0.781	-14.086	0.000

Table 16: Unit Root Test-New Zealand

Series	NO. Obs	Level	Prob.	First difference	Prob.
TB-30	72	-1.953	0.306	-9.751	0.000
TB-60	72	-1.871	0.343	-3.277	0.000
Housing	72	-1.357	0.598	-3.277	0.019
Deposit	72	-1.158	0.687	-6.67	0.000

Table 17: Unit Root Test-UK

Series	NO. Obs	Level	Prob.	First difference	Prob.
CD	96	-1.245	0.651	-7.714	0.000
Lending	96	-1.258	0.646	-6.875	0.000
Deposit	96	-2.241	0.192	-11.503	0.000

In all cases, the series are found to be stationary on first difference, which comprises the first step to look for a cointegrating relationship. The optimal lag length is determined based on the Schwartz information criterion to ensure that the residuals are all Gaussian. Tables 18, 19 and 20, 2_{nd} column, show the optimal lag length of the relationship between each retail and money market interest rate. Using the Johansen approach, a cointegrating relationship is found between each official interest rate and retail interest rate, except between the British CD and deposit.[33] Both Johansen maximum likelihood tests confirm that we cannot reject the hypothesis of one cointegrating vector, as given in Tables 18, 19 and 20.

[33]Even in the short run, the relationship between the two interest rates is found to be weak with money market coefficient equals 0.40.

Post to the 2003 Iraq War, Jordan's official interest rates increased rapidly until the 2008 financial crisis as can be seen from Figure 1. Apparently, the money market interest rates do not respond to changes in domestic inflation rates. The official interest rates reflect the changes in the Federal Fund Interest Rate (FFIR), depicted in Figure 2, given the commitment to the pegged exchange rate to the U.S. dollar system. In addition, in Figure 3, the mark-up of the interest rate on loans and the mark-down of interest rate on deposit increased markedly during the financial crisis onwards. This could be attributed to the cost-minimisation pursuit of the banking sector in Jordan.

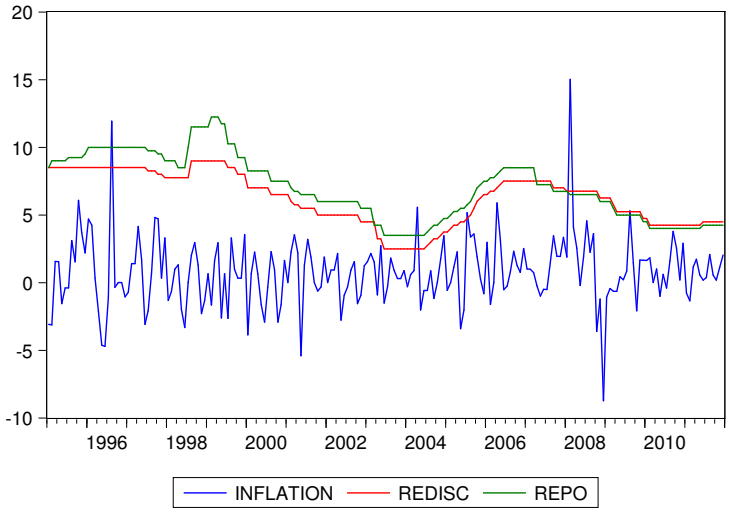


Figure 1: : Jordan- rediscount rate, repo rate and inflation
*Inflation rate is calculated based on the monthly consumer price index gathered from the CBJ's Statistical Database.

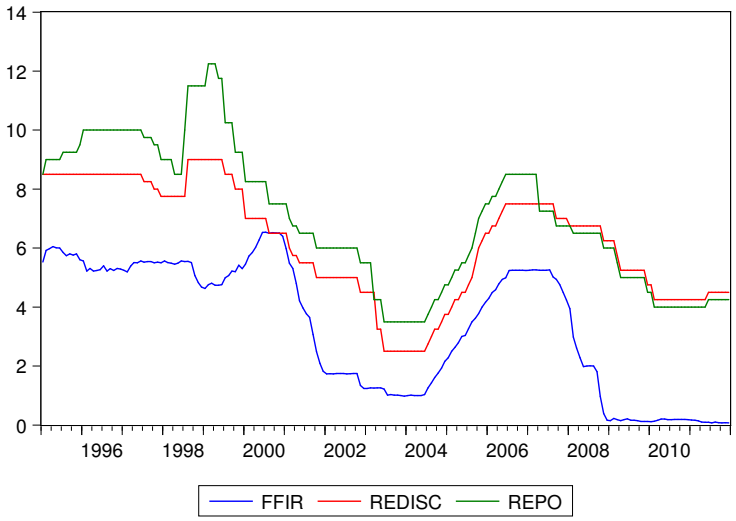


Figure 2: : Jordan- rediscount rate, repo rate and Federal Fund interest rate
*FFIR is obtained from the database of the Federal Reserve Bank of America .

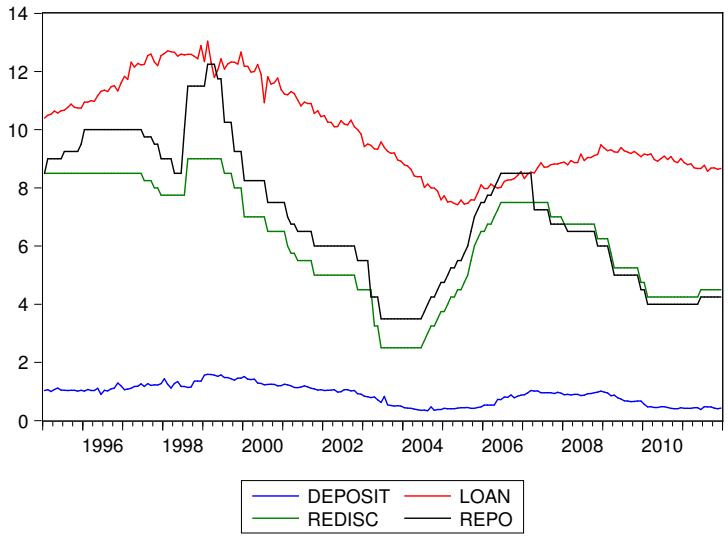


Figure 3: : Jordan- rediscount rate, repo rate, loan and deposit

Table 18: Trace and Max-Eigen Tests-Jordan

Series	lags	Trace statistic	critical value	Max-Eigen statistic	critical value
		$r \leq 1$	%5	$r \leq 1$	%5
Redisc/Deposit	2	28.592*	20.261	19.947*	15.892
Redisc/loan	1	32.401*	20.261	26.397*	15.892
Repo/ Deposit	3	30.484*	20.261	23.840*	15.892
Repo/loan	1	23.282*	20.261	20.945*	15.892
CD/Deposit	3	29.632*	20.261	24.793*	15.892
CD/loan	2	24.872**	15.494	21.633**	14.264

Note: *significant at 5% level according to Osterwald-Lenum (1992) critical values of model 2 (Constant in the cointegration space). **significant at 5% level according to Osterwald-Lenum (1992) critical values of model 3 (Constant in the cointegration space and linear trend in the data).

Table 19: Trace and Max-Eigen Tests-New Zealand

Series	lags	Trace statistic	critical value	Max-Eigen statistic	critical value
		$r \leq 1$	%5	$r \leq 1$	%5
Housing/TB-30	2	23.809*	20.261	20.206*	15.892
Deposit/TB-30	1	20.347**	15.494	17.535**	14.264
Housing/TB-60	2	22.286*	20.261	19.163*	15.892
Deposit/TB-60	1	20.244**	15.494	17.614**	14.264

Note: *significant at 5% level according to Osterwald-Lenum (1992) critical values of model 2 (Constant in the cointegration space). **significant at 5% level according to Osterwald-Lenum (1992) critical values of model 3 (Constant in the cointegration space and linear trend in the data).

Table 20: Trace and Max-Eigen Tests-UK

Series	lags	Trace statistic	critical value	Max-Eigen statistic	critical value
		$r \leq 1$	%5	$r \leq 1$	%5
Lending/CD	1	45.276**	15.494	43.547**	14.264
Deposit/CD	...	No cointegration			

Note: *significant at 5% level according to Osterwald-Lenum (1992) critical values of model 2 (Constant in the cointegration space). **significant at 5% level according to Osterwald-Lenum (1992) critical values of model 3 (Constant in the cointegration space and linear trend in the data).

Intuitively, as official interest rates are supposed to affect retail interest rates and not vice versa, money market interest rates should be treated as weakly exogenous. This implies that the speed of adjustment or α for official interest rates in equation 3, should not be significantly different from zero. This is to ensure that the past disequilibria have no remaining effects on official interest rates. The results, shown in Table 18, Table 19 and Table 20, indicate that all α of official interest rates are weakly exogenous.[34]

Table 21: Cointegration Test-Jordan

Official/Retail	lags	β	α(retail)	α(official)
			normalised	
Rediscount/Deposit	2	0.204 (0.027)	-0.073*** (0.018)	-0.120 (0.064)
Rediscount/loan	1	1.088 (0.161)	-0.0415*** (0.007)	-0.010 (0.009)
Repurchase/Deposit	3	0.173 (0.017)	-0.102*** (0.020)	-0.077 (0.108)
Repurchase/loan	1	0.848 (0.129)	-0.043*** (0.009)	-0.005 (0.014)
CD/Deposit	6	0.233 (0.029)	-0.091*** (0.018)	0.132 (0.140)
CD/loan	2	1.276 (0.216)	-0.037*** (0.008)	0.021 (0.019)

Note: Standard errors are in parentheses.

Table 22: Cointegration Test-New Zealand

Official/Retail	lags	β	α(retail)	α(official)
			normalised	
Housing/TB-30	2	0.657 (0.086)	-0.082*** (0.027)	0.283 (0.164)
Deposit/TB-30	1	0.715 (0.125)	-0.157*** (0.038)	0.166 (0.135)
Housing/TB-60	2	0.634 (0.082)	-0.097*** (0.030)	0.152 (0.159)
Deposit/TB-60	1	0.700 (0.118)	-0.173*** (0.041)	0.116 (0.113)

Note: Standard errors are in parentheses.

[34] For the case of Jordan, saving deposit interest rate was found to be first difference stationary; however, their market rates' α (money market; Redisc and Repo) are significantly different from zero. Therefore, we exclude this retail rate from our analysis although the Granger causality test indicates that the causality runs from the money market rates to saving interest rates.

Table 23: Cointegration Test-UK

Official/Retail	lags	β	α(retail)	α(official)
			normalised	
Lending/CD	1	1.012 (0.011)	-0.620*** (0.298)	0.237 (0.366)

Note: Standard errors are in parentheses.

The estimated β, which indicates the degree of pass-through, varies in Jordan from incomplete to overshooting. Although this might reflect the imperfect competition in the Jordanian banking sector, it is not possible, due to the lack of information released by the CBJ which explain the market structural behaviour, such as the commercial banks' market share of all mortgages issued, to infer whether or not market power exists. In general, for Jordan, the degree of pass-through indicates that the changes in money market interest rates are not fully absorbed by retail interest rates. Furthermore, the overshooting response of retail interest rates, with respect to changes in rediscount rate, indicates that banks in Jordan behave irrationally due to information asymmetries. Nevertheless, as it is clear from the results, the repo rate has the most significant impact on the loan interest rate; a unit change in repo rate is reflected after one lag by 0.85 changes in loan rate. However, the degree of pass-through from all money market interest rates to deposit interest rates is weak.

For New Zealand, the magnitude of pass-through points out that the bill interest rates changes are not completely reflected into changes in retail interest rates. However, these results might not be optimal owing to the fact that bank bill rate was not the RBNZ's main monetary instrument. The main monetary interest rate between 1985 and 1990 was the overnight interbank cash rate, which is found stationary at level.[35] Nevertheless, according to Liu et al. (2008), IRPTC in New Zealand is still, even after the introduction of the official cash rate in 1999, incomplete for all retail interest rates, but some: floating mortgage rate, the base lending rate, and the six-months deposit rate. This was attributed to low household savings and the reliance of the banking sector on international markets to finance their supply for mortgages. An immediate pass-through is only observed for the British case, where the magnitude of pass-through is close to one.

In fact, for Jordan, the results provide evidence that the money market instruments are not effective in inducing changes in retail interest rates. This might be due to the

[35] Bill rates are the only cointegrated of order one series found to match our targeted period (1985-1990). The cointegrating relationship between the interbank-overnight rate and deposit is found to be starting from the year 1994.

existence of market power, information asymmetries, switching costs, and the openness to the world financial markets. Besides, as shown in Figure 1, it is likely that the official interest rates in Jordan are not powerful at provoking changes in the domestic market, given the current monetary anchor.

Tables 24 to Table 32 provide the results of the dynamic model estimated for all cases.[36] The symmetric and asymmetric dynamic model of equations 4 and 7 are estimated, respectively, before and after dropping the insignificant lagged values of exogenous and endogenous variables. The parsimonious results of both equations do not give any noteworthy difference compared to the general results. We conduct a Wald test to examine the asymmetries. For each case, we test the null hypothesis if λ_1 is not different from λ_2 and reject the null if the critical value of the F test's critical value is less than the calculated value. Generally, in most cases, we could not reject the equality between λ_1 and λ_2.

We find an asymmetric response in the Jordanian loan market, when the monetary instrument is the repo rate, at 10% level of significance. The asymmetric result shows that banks are more sluggish to decrease their interest rates on loan but they are quicker to increase them. This behaviour could be explained by the structure hypothesis or the bank concentration hypothesis, which indicates that the non-competitive pricing behaviour exists in Jordan. Moreover, even when we assume no asymmetries in the loan market, the symmetric mean lags of the loan rate with respect to changes in rediscount and repo rates are slow; in both cases the banks need more than twenty months to converge to the long run equilibrium, while the deposit market shows no deviation from symmetry, and rather a faster mean lag, i.e., 10-13 months. Generally, the results reveal that even if there are no asymmetries in the market, substantial lags are needed in the short run, reflecting a sluggish response to changes in the CBJ's interest rate instrument. In addition, it is clear that the changes in the retail market interest rates in Jordan are not mainly due to changes in the money market interest rates. Adjusted R^2 for the loan and deposit market are very low, i.e., 20%. This questions the efficiency of the monetary policy in Jordan in handling the changes in the domestic market. The results of the dynamic effects, in Table 24, Table 25, Table 26 and Table 27 indicate that monetary policy in Jordan is not only weak in the long-run but the impact of money market interest rates on retail interest rates is also neutral in the short-run as the magnitude of pass-through for most money market interest rates lags appears insignificant.

Interestingly, the asymmetric behaviour in deposit markets is not observed in Jordan

[36] Parameters constancy tests and CUSUM test for stability are provided in Appendix C.

but in New Zealand. The deposit interest rate in the latter is found to be sticky upward, which is compatible with the collusive hypothesis. The quickest response with no asymmetries among all cases is found in the UK; the lending rate was adjusted to a monetary shock within the same month, while the retail interest rates in New Zealand needed eight to nine months to converge to the long run equilibrium.

The IRPT results for Jordan clarify the limitations of monetary policy under the pegged exchange rate regime. With a low degree of pass-through, deviation from symmetry in the loan market and high mean lags, supporting with low R^2, the results indicate that the monetary policy in Jordan is ineffective. Therefore, the credibility of monetary policy in Jordan in affecting the domestic disturbances, other than providing the market with a price anchor, is obscure. Considering central bank independence as a prior condition, and by comparing the results to our two inflation targeters in their period prior to IT, we can conclude that the effectiveness of the IRPTC in Jordan needs to be thoroughly solidified to enable building the credibility of low inflation domestically.

Table 24: Jordan: Short-run Symmetric/Asymmetric Results

Official/Rediscount	Retail/Deposit		GTA	GTA
	Symmetric	Asymmetric	Symmetric	Asymmetric
Constant	-0.061	-0.065	-0.059	-0.062
	(-0.015)	(0.22)	(0.014)	(0.022)
Δrediscount	-0.002	-0.002	dropped	dropped
	(-0.02)	(0.02)		
Δrediscount$_{t-1}$	-0.006	-0.007	dropped	dropped
	(-0.02)	(0.02)		
Δrediscount$_{t-2}$	0.073***	0.072***	0.072***	0.072***
	(-0.02)	(0.021)	(0.02)	(0.02)
Δdeposit$_{t-1}$	-0.284***	-0.284***	-0.286***	-0.286***
	(-0.065)	(0.065)	(0.064)	(0.064)
Δdeposit$_{t-2}$	-0.131*	-1.32*	-0.131*	-0.131*
	(-0.066)	(0.066)	(0.065)	(0.065)
Symmetric ect	-0.075		-0.072	
	-0.018		0.017	
Symmetric ML	13			
Above equilibrium		-0.081		-0.079
		0.04		0.039
Below equilibrium		0.077		-0.075
		0.024		0.023
ML^+		12		
ML^-		13		
R^2	0.232	0.232	0.231	0.231
AdjustedR^2	0.208	0.204	0.215	0.211
F-statistics	9.75	8.33	14.75	11.75
Wald test P(F* > Fc)*		0.853		0.856

Note: Official: Official interest rates; Retail: Retail interest rates; GTA: General-to-specific approach. ***, **, * denote significance at 1%, 5% and 10%, respectively. Standard Errors are between parenthesis. Wald test tests whether the deviation of the speed of adjustment to positive and negative monetary shocks is equal.

Table 25: Jordan: Short-run Symmetric/Asymmetric Results

Official/Redisc	Retail/loan		GTA	GTA
	Symmetric	Asymmetric	Symmetric	Asymmetric
Constant	0.242**	0.137**	0.237**	0.135**
	(0.051)	(0.067)	(0.049)	(0.067)
Δrediscount	0.01	0.016	dropped	dropped
	(0.06)	(0.06)		
Δrediscount$_{t-1}$	-0.033	-0.031	dropped	dropped
	(0.061)	(0.061)		
Δloan$_{t-1}$	-0.369***	-0.368***	-0.369***	-0.368***
	0.064	0.064	0.04	0.064
Symmetric ect	-0.041		-0.04	
	(0.008)		(0.007)	
Symmetric ML	24			
Above equilibrium		-0.027		-0.027
		(0.009)		(0.009)
Below equilibrium		-0.017		-0.017
		(0.014)		(0.014)
ML$^+$		36		
ML$^-$		58		
R2	0.208	0.203	0.207	0.202
Adjusted R^2	0.192	0.183	0.199	0.19
F-statistics	13	10.02	26.06	16.75
Wald test P(F*>Fc)*		0.131		0.137

Note: Official: Official interest rates; Retail: Retail interest rates; GTA: General-to-specific approach. ***, **, * denote significance at 1%, 5% and 10%, respectively. Standard Errors are between parenthesis. Wald test tests whether the deviation of the speed of adjustment to positive and negative monetary shocks is equal.

Table 26: Jordan: Short-run Symmetric/Asymmetric Results

Official/Repo	Retail/Deposit		GTA	GTA
	Symmetric	Asymmetric	Symmetric	Asymmetric
Constant	-0.073	-0.039	-0.077	-0.043
	0.015	0.012	0.014	0.011
Δrepo	0.007	0.011	dropped	dropped
	(0.013)	(0.014)		
Δrepo_{t-1}	-0.041***	-0.040***	-0.040***	-0.039***
	(0.014)	(0.015)	(0.014)	(0.014)
Δrepo_{t-2}	0.035**	0.036**	0.038**	0.039**
	(0.014)	(0.015)	(0.015)	(0.015)
Δrepo_{t-3}	0.023	0.023	dropped	dropped
	(0.015)	(0.015)		
$\Delta\text{deposit}_{t-1}$	-0.304***	-0.314***	-0.27***	-0.282***
	(0.067)	(0.068)	(0.064)	(0.065)
$\Delta\text{deposit}_{t-2}$	-0.158**	-0.152**	-0.145**	-0.141**
	(0.066)	(0.068)	(0.064)	(0.065)
$\Delta\text{deposit}_{t-3}$	-0.064	-0.061	dropped	dropped
	(0.655)	(0.067)		
Symmetric ect	-0.102		-0.108	
	(0.021)		(0.067)	
Symmetric ML	10			
Above equilibrium		-0.037		-0.041
		(0.018)		(0.018)
Below equilibrium		-0.058		-0.063
		(0.014)		(0.013)
ML^+		27		
ML^-		17		
R^2	0.277	0.253	0.267	0.242
Adjusted R^2	0.247	0.218	0.248	
F-statistics	9.173	7.187	14.24	10.36
Wald test P(F*>Fc)*		0.141		0.134

Note: Official: Official interest rates; Retail: Retail interest rates; GTA: General-to-specific approach. ***, **, * denote significance at 1%, 5% and 10%, respectively. Standard Errors are between parenthesis. Wald test tests whether the deviation of the speed of adjustment to positive and negative monetary shocks is equal.

Table 27: Jordan: Short-run Symmetric/Asymmetric Results

Official/Repo	Retail/Loan		GTA	GTA
	Symmetric	Asymmetric	Symmetric	Asymmetric
Constant	0.382***	0.185**	0.373***	0.184**
	(-0.081)	(0.074)	(0.080)	(0.074)
Δrepo	0.033	0.026	dropped	dropped
	(0.043)	(0.043)		
Δrepo_{t-1}	-0.049	-0.044	dropped	dropped
	(0.043)	(0.043)		
Δloan_{t-1}	-0.35***	-0.347***	-0.356***	-0.352***
	(0.064)	(0.064)	(0.010)	(0.064)
Symmetric ect	-0.046			
	(0.009)			
Symmetric ML	21			
Above equilibrium		-0.026		-0.025
		(0.008)		(0.007)
Below equilibrium		-0.018		-0.018
		(0.01)		(0.01)
ML^+		37		
ML^-		54		
R^2	0.202	0.202		0.197
Adjusted R^2	0.186	0.181		0.185
F-statistics	12.48	9.93	24.23	16.22
Wald test P(F*>Fc)*		0.087*	0.087*	0.094*

Note: Official: Official interest rates; Retail: Retail interest rates; GTA: General-to-specific approach. ***, **, * denote significance at 1%, 5% and 10%, respectively. Standard Errors are between parenthesis. Wald test tests whether the deviation of the speed of adjustment to positive and negative monetary shocks is equal.

Table 28: New Zealand: Short-run Symmetric/Asymmetric Results

Official/TB-30	Retail/Deposit		GTA	GTA
	Symmetric	Asymmetric	Symmetric	Asymmetric
Constant	0.209*	0.441***	-0.19*	-0.043***
	(0.105)	(0.151)	(0.099)	(0.141)
ΔTB-30	0.024	-0.008	dropped	dropped
	(0.035)	(0.038)		
ΔTB-30$_{t-1}$	-0.025	-0.011	dropped	dropped
	(0.039)	(0.039)		
Δdeposit$_{t-1}$	0.126	0.093	dropped	dropped
	(0.039)		(0.033)	
Symmetric ect	-0.161			
	(0.039)		(-0.149)	
Symmetric ML	7			0.033
Above equilibrium		-0.258		-0.263
		(0.068)		(0.053)
Below equilibrium		-0.044	-0.04	
		(0.068)	(0.053)	
ML$^+$		4		
ML$^-$		22		
R^2	0.259	0.306	0.229	0.295
Adjusted R^2	0.213	0.251	0.218	0.274
F-statistics	5.68	5.64	20.55	14.25
Wald test P(F*>Fc)*		.037**		.011**

Note: Official: Official interest rates; Retail: Retail interest rates; GTA: General-to-specific approach. ***, **, * denote significance at 1%, 5% and 10%, respectively. Standard Errors are between parenthesis. Wald test tests whether the deviation of the speed of adjustment to positive and negative monetary shocks is equal.

Table 29: New Zealand: Short-run Symmetric/Asymmetric Results

Official/TB-30	Retail/Housing		GTA	GTA
	Symmetric	Asymmetric	Symmetric	Asymmetric
Constant	1.202***	1.027**	1.136***	0.855**
	(0.287)	(0.391)	(0.196)	(0.284)
ΔTB-30	0.079***	0.074***	0.054***	0.072***
	(0.018)	(0.02)	(0.014)	(0.019)
ΔTB-30$_{t-1}$	-0.005	-0.001	dropped	dropped
	(0.018)	(0.019)		
ΔTB-30$_{t-2}$	-0.008	-0.008	dropped	dropped
	(0.015)	(0.015)		
Δhousing$_{t-1}$	-0.125	-1.22	dropped	dropped
	(0.104)	(0.104)		
Δhousing$_{t-2}$	0.308	0.297***	dropped	0.298***
	(0.104)	(0.106)		(0.101)
Symmetric ect	-0.107		-1.02	
	(0.025)		(0.017)	
Symmetric ML	9			
Above equilibrium		-0.093		-0.077
		(0.032)		(0.231)
Below equilibrium		-0.083		-0.068
		(0.043)		(0.033)
ML$^+$		10		
ML$^-$		11		
R^2	0.491	0.495	0.375	0.482
Adjusted R^2	0.442	0.437	0.357	0.449
F-statistics	10	8.55	20.45	14.9
Wald test P(F*>Fc)*		0.508		0.47

Note: Official: Official interest rates; Retail: Retail interest rates; GTA: General-to-specific approach. ***, **, * denote significance at 1%, 5% and 10%, respectively. Standard Errors are between parenthesis. Wald test tests whether the deviation of the speed of adjustment to positive and negative monetary shocks is equal.

Table 30: New Zealand: Short-run Symmetric/Asymmetric Results

Official/TB-30	Retail/Deposit		GTA	GTA
	Symmetric	Asymmetric	Symmetric	Asymmetric
Constant	0.275**	0.449**	0.271**	0.448**
	(0.112)	(0.136)	(0.104)	(0.136)
ΔTB-60	0.009	-0.015	dropped	dropped
	(0.045)	(0.045)		
ΔTB-60$_{t-1}$	-0.017	-0.017	dropped	dropped
	(0.05)	(0.049)		
Δdeposit$_{t-1}$	0.012	0.106	dropped	dropped
	(0.107)	(0.105)		
Symmetric ect	-0.174		-0.173	
	(0.041)		(0.034)	
Symmetric ML	6			
Above equilibrium		-0.251		-0.25
		(0.054)		(0.048)
Below equilibrium		-0.063		-0.064
		(0.066)		(0.059)
ML$^+$		4		
ML$^-$		16		
R^2	0.28	0.327	0.262	0.313
Adjusted R^2	0.236	0.275	0.251	0.292
F-statistics	6.33	6.24	24.53	15.49
Wald test P(F*>Fc)*		0.033**		0.024**

Note: Official: Official interest rates; Retail: Retail interest rates; GTA: General-to-specific approach. ***, **, * denote significance at 1%, 5% and 10%, respectively. Standard Errors are between parenthesis. Wald test tests whether the deviation of the speed of adjustment to positive and negative monetary shocks is equal.

Table 31: New Zealand: Short-run Symmetric/Asymmetric Results

Official/TB-60	Retail/Housing		GTA	GTA
	Symmetric	Asymmetric	Symmetric	Asymmetric
Constant	1.369***	1.452***	1.062***	1.155***
	(0.316)	(0.373)	(0.224)	(0.296)
ΔTB-60	0.099***	0.101***	0.099***	0.101***
	(0.02)	(0.021)	(0.026)	(0.02)
ΔTB-60$_{t-1}$	-0.014	-0.016	dropped	dropped
	(0.02)	(0.02)		
ΔTB-60$_{t-2}$	-0.014	-0.013	dropped	dropped
	(0.019)	(0.019)		
Δhousing$_{t-1}$	-0.111	-0.106	dropped	dropped
	(0.101)	(0.103)		
Δhousing$_{t-2}$	0.327***	0.333***	0.35***	0.359***
	(0.102)	(0.104)	(0.095)	(0.098)
Symmetric ect	-0.113		-0.088	
	(0.026)		(0.018)	
Symmetric ML	8			
Above equilibrium		-0.119		-0.094
		(0.029)		(0.022)
Below equilibrium		-0.123		-0.099
		(0.035)		(0.029)
ML$^+$		8		
ML$^-$		7		
R^2	0.536	0.538	0.521	0.523
Adjusted R^2	0.491	0.485	0.499	0.493
F-statistics	11.97	10.15	23.62	17.56
Wald test P(F*>Fc)*		0.671		0.628

Note: Official: Official interest rates; Retail: Retail interest rates; GTA: General-to-specific approach. ***, **, * denote significance at 1%, 5% and 10%, respectively. Standard Errors are between parenthesis. Wald test tests whether the deviation of the speed of adjustment to positive and negative monetary shocks is equal.

Table 32: UK: Short-run Symmetric/Asymemtric Results

Official/CD	Retail/Lending		GTA	GTA
	Symmetric	Asymmetric	Symmetric	Asymmetric
Constant	-0.089***	-0.072**	-0.085***	-0.070**
	(0.021)	(0.029)	(0.019)	(0.027)
Δcd	0.755***	0.756***	0.752***	0.753***
	(0.031)	(0.032)	(0.03)	(0.03)
Δcd_{t-1}	0.002	0.001	dropped	dropped
	(0.083)	(0.083)		
$\Delta lending_{t-1}$	-0.028	-0.029	dropped	dropped
	(0.078)	(0.078)		
Symmetric ect	-0.801		-0.776	
	(0.111)		(0.074)	
Symmetric ML	0.31			
above equilibrium		-0.951		-0.889
		(0.201)		(0.17)
Below equilibrium		-0.732		-0.716
		(0.136)		(0.11)
ML^+		0.26		
ML^-		0.33		
R^2	0.89	0.891	0.89	0.89
Adjusted R^2	0.885	0.885	0.887	0.887
F-statistics	181.48	145	372.67	247.4
Wald test P(F*>Fc)*		0.376		0.461

Note: Official: Official interest rates; Retail: Retail interest rates; GTA: General-to-specific approach. ***, **, * denote significance at 1%, 5% and 10%, respectively. Standard Errors are between parenthesis. Wald test tests whether the deviation of the speed of adjustment to positive and negative monetary shocks is equal.

3.5 Conclusions

In monetary policymaking, an assessment of the main monetary policy channel is fundamental to identify the credibility of monetary policy actions in the domestic market. In this chapter, we shed light on the credibility of monetary policy under the fixed exchange rate regime for the case of Jordan. Our aim is to show to how extent a country with a peg is able to move towards building the credibility of low inflation domestically instead of importing prices from abroad. Hence, we assess the magnitude and speed of interest rate pass-through channel and the behaviour of the financial market to monetary policy shocks and compare the results to two inflation targeters, New Zealand and the UK, prior to official announcement of inflation targeting. The country-specific comparison allows understanding whether the move to achieve price stability domestically under the current financial and monetary system is possible and the reform needed to move towards building independent domestic monetary policies.

We perform the Johansen approach to examine the degree and speed of adjustment to disequilibrium in the long run, then we apply a univariate error correction parsimounous model of Hendry and Doornik (1994) that connects the short-run and long-run effects. We also test whether asymmetries occur in the deposit and loan markets by incorporating two dummy variables in the conditional dynamic model to act when retail interest rates are above or below their long-run equilibrium level. The years from 1995 to 2011 are taken into consideration to assess the current economic situation for Jordan, while we allow the period prior to IT for our model cases. All data on Jordanian official, money market interest rates, and retail interest rates are obtained from the central bank's Statistical Database. Data on New Zealands deposit interest rate, and British interest rates on lending and deposit are extracted from the IMF-IFS, whereas, the remaining series: the RBNZ's bill rate-30 and 60 days, interest rate on housing loan and deposit and British certificates of deposit are collected from the released statistics data of the their central banks.

Initially, we notice that official interest rates follow changes in the American Federal reserve rate, given the imported credibility for the goal of price stability. The findings show that the interest rate pass-through in Jordan is weak and sticky and substantial lags are needed for a full equilibrium adjustment. Furthermore, banks non-competitive pricing behaviour is observed in the loan market, where a significant deviation from symmetry in the speed of adjustment is found sticker to decreasing. Interestingly, an asymmetric behaviour to monetary shocks in the deposit market is found for the case of New Zealand.

Our findings indicate, and in comparison with inflation targeters, that with weak and slow interest rate pass-through, as well as an asymmetric reaction in the loan market, moving towards achieving price stability by adopting any form of inflation targeting in Jordan will not give its desirable outcomes. Although the possibility for the lite form of inflation targeting could be claimed, any commitment to an inflation target while preserving the goal of exchange rate stabilisation will put the central bank at the risk of losing its credibility, and increase the likelihood to renege on inflation targeting framework. This suggests that Jordan has to move to a more resilient exchange rate arrangement to build in the goal of price stability domestically, given the importance to have an independent central bank.

Chapter 4

The Credibility of a Soft Pegged Exchange Rate in Emerging Market Economies: Evidence from a Panel Data Study

4.1 Introduction

Over the last century, fixed exchange rate systems have drawn considerable attention on their stability and durability. In fact, exchange rate targeting has been widely adopted to act as a trustworthy mechanism to the low inflation objective, and to eliminate the exchange rate risk, which complicates the decisions on financial and trade transactions. Theoretically, it is thought that a fixed exchange rate can act as a coordinating and signalling device to stabilise inflation expectations (Tamgac, 2013), with its virtue of being a perfectly controllable policy variable and an easily observed quantitative target of monetary policy (Herrendorf, 1997). These characteristics are based on the belief that all market agents under a peg propose zero domestic inflation rates and, consequently, with unambiguous actions of policy makers, the monetary policy is fully observed by individuals.

Despite these appeals, the salient failure of pegged exchange rate regimes across the world proves that the lifetime of pegs is short-lived. Even when the system does not fall apart, deteriorations in the level of nominal interest rates, reserves loss and/or exchange rate devaluation or revaluation often take place (Bubula and Otker-Robe, 2003). Indeed, the failure of fixed exchange rate systems, from the collapse of the gold standard, the Bretton Woods system, the European Monetary System (EMS), to the currency crises in Latin America and the contagion crisis in East Asia, raises susceptibilities on the real stability of pegs. Hence, the literature on currency crises has emerged to identify why a fixed exchange rate is more crises prone and what factors hamper the credibility of this nominal anchor. The first generation model of currency crises, led by Krugman (1979), demonstrates that the fall of the fixed exchange rate regime comes as a result of the inconsistency between the exchange rate policy and fiscal stance. The second generation models, on the other hand, presume that a currency crisis may happen when all macrofundamentals are well-behaved, owning to self-fulfilling expectations or sunspot events.[37] However, this assumption seems unlikely. Some economists; e.g., Krugman (1979) and Bordo and Schwartz (1996), have challenged this belief on the grounds that keeping the exchange rate fixed can only be threatened when the economic fundamentals are not sound.

In effect, during the past two decades, while the majority of countries abandoned all forms of exchange rate restrictions, and moved towards more resilient exchange rate arrangements, pegging exchange rates remained a preferable choice to import the anti-inflationary credible policy in some emerging markets and developing countries. The empirical works on past currency crises have shown that exchange rate fixers were not

[37] Sunspots are extrinsic random variables that affect market agents' decisions and are fundamentally based on the market psychology and self-fulfilling prophecies.

successful at bringing the foreign credibility into their economies prior to the regimes fall (Svensson, 1994), and thereby, the system collapsed eventually. Therefore, following the insights of currency crises models, the pertinent question to raise is whether or not the recent experience of a conventional pegged exchange rate has been successful in bringing low inflation and consistent macroeconomic foundations into domestic economies.

To answer this question, and on the basis of currency crises empirical works, we build a projection exercise, as in the work of Rose and Svensson (1994), to study the credibility of a fixed exchange rate regime in eleven countries: Bahamas, Bahrain, Barbados, Belize, Egypt, Jordan, Oman, Kuwait, Lebanon, Qatar and Venezuela, adhered to the fixed exchange rate to the US dollar. The dollar, according to the IMF 2013 report on exchange rate arrangements and restrictions, serves as the preeminent anchor currency. However, owning to data limitation for emerging markets and developing countries, the analysis is constrained to include eleven countries with few missing observations. With the difficulty to consider the analysis at individual level, and the intention to draw a general conclusion about the overall credibility of the conventional pegged exchange rate to the US dollar, the analysis relies on linear unbalanced panel data models.

The analysis is based upon the previous work on the EMS credibility before the crisis, which are mainly built on the Uncovered Interest rate Parity (UIP) condition. Ideally, the UIP presumes, under the assumption of market efficiency, that the expected changes in exchange rates are captured by nominal interest rate differentials. The interest rate differentials are thus used in the previous works on credibility to measure the realignment expectations of market agents. This measure for the credibility reflects the behaviour of the economic fundamentals, which are the determinants of market agents' realignment expectations. Nevertheless, the UIP failed empirically because of its fundamentals of rationality and risk neutrality (Sarno and Taylor, 2002).[38] So despite being a clearing mechanism in the capital market, the UIP condition has received criticisms on its biasedness. However, the UIP could differ across exchange rate regimes, time horizons and country-specific characteristics (Chaboud and Wright, 2005). Hence, not accepting the UIP could be attributed to the absence of a precise specification of the sampling distribution of data or to other reasons (Huisman et al., 1998). In this respect, Juselius (1995) explains that neglecting the general properties of time series data and the ignorance of analysing the purchasing power parity and the UIP together by considering the interactions between the goods market and the capital markets as well as the deviation from a steady state could invalidate

[38] McCallum (1994) claims that the deviation from the UIP occurs as a result of monetary policy actions which exploit the trade-off between the interest rate and exchange rate stability.

the statistical results. The UIP may also fail if the time-varying risk premium is ignored (Francis et al., 2002). Therefore, to reflect the premium required to convince agents to invest in risky currencies, it is necessary to account for the time-varying risk premia which comes from highly volatile prices and interest rates, namely in emerging market economies (Li et al., 2012). Consequently, as the exchange rate expectations can be correlated with the default risk premium (McCallum, 1994), the interest rate differential consists of two components: the currency premium and country premium (Frankel et al., 2004), both of which are highly vulnerable to economic fundamentals.[39] Unfortunately, a key problem with this is that decomposing the country risk premium from exchange rate premium is not a possible task.

In fact, the UIP works systematically across different economies, but its validity could differ across time, data and exchange rate regimes. Nevertheless, the tendency for any deviation in the short-run will revoke adjustments to restore equilibrium (Juselius, 1995). For fixed exchange rate regimes, a deviation from the UIP is one of fixed exchange rate systems' defences, i.e., the interest rate defense. According to Flood and Rose (2002) deviations from the UIP can be seen as a policy action, which is "a necessary condition for an interest rate defense", to convince investors to invest in domestic securities. The persistence of a positive interest rates differential also reflects that "the announced commitment to a fixed exchange rate may not be sufficient to eliminate devaluation risk completely" (Caramazza, 1993).

Hence, our aim is to study the overall credibility of a fixed exchange rate system, thus it is more important to understand how the economic fundamentals, which are used to form the market agents' expectations, may complicate anchoring domestic interest rates and widen the spread between the anchor country and that of the followers. In fact, market agents would ask for more return to bearing the risk related to investing in risky assets (De Paoli and Sondergaard, 2009), or holding long-term assets (Thornton, 2012). So, if risk averse investors perceive that the monetary regime is highly credible and can meet the convertibility of the currency, such additional uncertainty should not exist. In addition, the interest rate used in our analysis is on annual deposits. Hence, the potential risk must be related to the financial intermediaries whose actions are supervised by the monetary authority itself.

The only risk to hold assets denominated in domestic currency that needs to be considered should be placed on the nature of the peg under investigation; the peg which is

[39] The latter component of risk was ignored in all previous studies on currency crises.

described in the literature as 'soft'. It has been argued that the degree of central bank independence in financially integrated world with soft pegs is not completely eliminated, as implied by the trilemma, and thereby, a central bank has bound rooms to weather real shocks (Stone et al., 2008). In other words, it is believed that anchoring interest rate might not necessarily preserve the stability of exchange rate, since the UIP might be violated by real shocks, and some bound flexibility is preferred to stabilise the exchange rate in the short run (Benigno et al., 2007). This arguments, however, is criticised by Husain et al. (2005), who think that flexibility might have reverse influences on investment, which could put the credibility of the peg at stake.

To examine the credibility of a soft peg to the US dollar, we regress the interest rate differential as a measure of realignment expectations on a set of relevant macroeconomic indicators. The interest rate differential reflects the macroeconomic structure of the domestic economy, as changes in the macroeconomic factors affect domestic interest rates, given that the macroeconomic fundamentals of the anchor country are exogenous. In addition, we use the exchange rate market pressure index, constructed by Eichengreen et al. (1994), to study the role of fundamentals in explaining the pressure on the parity condition. The set of macro-fundamentals chosen in our analysis is derived from the theory and empirical works of currency crises. Those fundamentals are likely to be included by market agents in their exchange rate expectations formation. However, we do not consider any reputational factor since we believe that long-time ensuring a fixed exchange rate parity might be counterproductive.

The chapter reveals that inflation differential is the main factor that generates realignment expectations on the fixed exchange rate parity condition. This explains why anchoring interest rates is not possible for countries with conventional fixed exchange rate systems. Overall, importing the credibility of anti-inflationary policies from abroad is doubtful and, therefore, it is suggested that the monetary credibility should be built domestically.

The chapter is organised as follows. Section two presents the currency crises models and related literature review. Section three discusses the credibility measures used in the study. Section four outlines the data and the exchange rate classification. Section five presents our methodology. Section six contains the empirical results. Section seven provides the conclusions and economic implications.

4.2 Literature Review

The ineffective monetary policy in a pegged exchange rate economy implies that any change in domestic assets, [increase/decrease], induces financial mobility, [outflow/inflow], but leaves the level of output unaffected. This means that the use of monetary tool leads only to a deterioration in current account which lasts temporarily. In effect, restoring the equilibrium back to a predetermined central parity is achieved at the expense of foreign reserves. This indicates that money supply should be restricted to increasing. However, the first generation models of currency crisis have shown that monetary authorities with an exchange rate target may raise the stock of domestic assets.

The inconsistency of conflicting macroeconomic priorities between the two economic actors appears when the central bank finds it is mandatory to money finance the fiscal deficit. This demand mismanagement is first illustrated by Krugman (1979), who argues that a country cannot maintain a fixed exchange rate when its government runs a deficit. He shows that unbalanced fiscal policies endanger the level of international reserves, and as long as the stock of domestic currency continues to grow, the market agents will replace the domestic assets in their portfolios. He further argues that even when the increase in domestic assets does not provoke a speculative attack, the capital loss, due to the increase in the level of prices, would force investors to engage in selling the domestic currency. The principles of the Krugman's model of "balance of payment crisis" assumes that the time of speculative attack or the international reserves depletion is necessarily known (Bordo and Schwartz, 1996).

Theoretically, the basic monetary assumption, under the fixed exchange rate, implies that money stock 'M' in the central bank's balance sheet must be consistent with the fundamentals, which we refer to their total here as 'L'. In one word, 'M' must remain constant. In a simple monetary model under the uncovered interes rate parity (UIP) this can be shown as follows:

$$s_t^{sh} = m_t - cy_t + \delta r_t^d \tag{10}$$

The shadow exchange rate, s_t^{sh}, on the left hand side of the equation, may appear if central banks interventions are not generated. The small letter of m and y are the log of money stock and output relative to the base country, respectively, and r_t^d denotes the domestic interest rate. Replacing r_t^d on the basis of UIP yields:

$$s_t^{sh} = m_t - cy_t + \delta r_t^f + \gamma \Delta s_t^e \tag{11}$$

Where r_t^f is the base country's interest rate and s_t^e is the expected change in the

exchange rate. To achieve the equilibrium, the domestic country's level of prices must be compatible with purchasing power parity, given that both the domestic nominal exchange rate and anchor country's prices are exogenously fixed. So, the fundamentals consist of all the variables treated as exogenous:

$$l_t = -\overline{m_t^f} + \overline{cy_t} + \overline{br_t^f} \tag{12}$$

Where $-\overline{m_t^f}$ is the base country's money stock, given that the domestic money supply is an endogenous variable. The bars over the right hand side of the equation denotes that the fundamental factors are fixed exogenously. Substituting equation 12 into equation 11:

$$s_t^{sh} = l_t + m_t + \gamma \Delta s_t^e \tag{13}$$

Consequently, by assuming a credible fixed exchange rate system, the expected change in exchange rates must cancel out. Hence, we end up with the following equation:

$$m_t = \overline{s} + l_t \tag{14}$$

As the monetary authority has no control over the exogenously determined fundamentals, the money stock, for any given level of fundamentals, must remain constant; otherwise, the increase in the stock will lead to reserves loss. If a country keeps running a deficit, or in other words, if its domestic money is allowed to grow above the zero-level implied by the fundamentals, the collapse of the regime becomes impending. To put things differently, with ongoing fiscal deficit, the increase in 'm_t' drives an upward movement in prices. This real appreciation makes the economy uncompetitive. So, in order to erode the high demand for imports and settle the deterioration in current account, unsterilised interventions reinstate the equilibrium at the cost of losing foreign reserves.[40]

However, the nature collapse, hypothesised by Krugman (1979), has two theoretical pitfalls.[41] First, the model postulates that a central bank with a fixed exchange rate commitment acts as a passive agent. This, means that market agents are endowed with perfect foresight while the central bank waits until its reserves are depleted to renege on the commitment. In reality, this is unlikely. An exchange rate fixer will strive hardly to defend the exchange rate parity and not as easily as it is suggested by the model (Lahiri and Végh, 2000). Second, in the original work of Krugman, the inconsistency of demand management under the pegged system is based on the exogeneity assumption of money

[40] The monetary model used here is illustrated by Copeland (2008) for the first generations model of currency crises.

[41] The nature collapse occurs prior to speculative attacks due to the increase in domestic money supply and reserves loss.

growth which ignores the dynamic nature of money markets (Bordo and Schwartz, 1996).

Nevertheless, the theoretical supposition that an abandonment of a peg occurs due to the conflicting objectives and weak monetary independence is controversial. While some economists; Andersen and Chiriaeva (2007), Marini and Piersanti (2003) and Tamgac (2013), believe that the demand mismanagement explains why fixed exchange rate regimes collapse, others are convinced that many currency crises from the EMS to the far East Asian and Latin American crises happened while the macrofundamentals were flawless and sound. From the latter view, a new generation of models grows based on the belief that sunspots or self-fulfilling expectations can provoke a crisis or force a devaluation, while the economy works consistently with the bases of a fixed exchange rate system. Nonetheless, the view that the monetary system might be threatened by self-fulfilling expectations is rejected by many economists. For example, Bordo and Schwartz (1996) show that in the past and recent currency crises, one or more unstable fundamentals have driven the economy onto instability and, consequently, into crisis. Krugman (1996) and Jeanne (1997) also confirm that self-fulfilling expectations cannot be unconnected from the economic fundamentals. Moreover, Kaminsky (2006) points out that although the currency crises have not generated equally, many of them occurred owning to the bad fundamentals, the fact which makes the self-fulfilling argument improbable.

In order to compromise between the sunspots perspective and the monetary-fiscal policies discrepancy, the second generation models presume that the monetary authority confronts multiple equilibria while considering whether to sustain a peg, or opt out for reasons related to improving unemployment, competitiveness or current account deterioration. So the central bank behaves as a loss function minimiser concerning the feasibility of holding a peg (Jeanne and Masson, 2000). This implies that the durability of pegs in the so-called escape clause or "endogenous policy" models (Jeanne, 1997) depends on the series of market agents actions. It follows that the government defies different scenarios which may end up with realignment or abandonment of the regime. In fact, renege on the fixity commitment unveils the government's desired exchange rate, while from one dimension, the cost of doing so increases with the length of the past successful record of no realignments. From the other dimension, such long history of credibility is likely to be counterproductive to unemployment. Thus, although a tough government is seen to be credible at achieving low inflation, as argued by Edwards (1996), Holden and Vikøren (1996), Rose and Svensson (1994) and Eichengreen et al. (1994), the accumulated jobless rates may intimidate the stainability of pegs (Drazen and Masson, 1993).

4.3 Realignment expectations measures and macro-fundamentals

On the basis of the standard UIP condition, the interest rate differential between the domestic countries and their anchor country, reflects the devaluation or realignment expectations of market agents, the representation of the UIP is as follows:

$$\Delta s^{e}_{t+k} = i_t - i^{f}_{t} \tag{15}$$

Where Δs^{e}_{t+k} denotes the changes in the logarithm of the spot exchange rate at time t, while the subscripts e and k refer to the market expectations and maturity of assets denominated in domestic currency, respectively, and the right hand side of the equation represents the interest rate differential (IR).

The vast majority of empirical works which attempt to explain the currency crises measure the devaluation expectations as the interest rate differential or the interest differential-drift adjustment for a fixed exchange rate currency within horizontal bands. However, the drift approach does not work for all the countries with soft pegs under assessment, since the majority of the countries in the study are point fixer except Egypt and Kuwait.[42] Furthermore, the literature on the EMS and other currency crises presumes that the country risk premium is relatively small and can be neglected, which means that the interest rate differential could fully reflect the expected changes in exchange rate. In our study and due to huge differences in economic structure between the base country and its followers, the measure of interest rate differential consists of two components: currency and country risk premium. However, although accounting for the country risk premium is intricate, we intend to measure the overall credibility of importing low prices from abroad, so such differentiating is not needed, given that realignment expectations increase with weak economic structure and institutions. In addition, the study considers interest rate on deposits, thereby, the country risk premium is likely to be attached to the deregulation of banking system and financial intermediaries whose work per se can be supervised by central banks.

In general, currency crises are mainly characterised with huge devaluation in the value of currency; however, the devaluation is not always the only threat of speculative attacks. In some cases, the revaluation may result from speculations over a strong currency (Grilli, 1986). This in our study represents the case of an oil-producing country, namely Kuwait, which dropped out of the fixed exchange rate regime voluntarily during the onset of the

[42]The central bank of Egypt was spurred to devalue several times to stimulate the competitive position. There is no determined band, though. Due to the capital inflows, the central bank found itself obliged to devalue with the escalating fiscal deficit, until it surrendered the parity in 2003. It is worth noting that the Egyptian Pound has been again in distress since the 2011 revolution; however, in our study, all the years following the exit from the pegged system is disregarded, provided our aim to measuring the credibility of the fixed exchange rate system.

2008 financial crisis. The central bank of Kuwait could not preserve the central fixed parity, set at 299.63 fils per dollar with margins ± 3.5%, throughout the whole adoption period from 2003 to 2007; the nominal exchange rate even jumped to exceed the upper limit of the margin. Although it might be thought that the accumulation of foreign reserves in such cases is better than their loss, maintaining the peg comes at the cost of price stability.

We calculate our first measure of realignment expectations, i.e., the interest rate differential, as the difference between the domestic interest rates on deposits, with one year maturity, and the annual interest rate on treasury bills of the base country.[43] We utilise another index-proxy to measure the realignment expectations or the pressure on currency of pegged exchange rate, constructed by Eichengreen et al. (1994), and applied by many studies, e.g., Pattillo and Berg (1998), Kaminsky (2006), Mouratidis (2008), Lin et al. (2008). The index comprises three components: foreign reserves, international differential and expected change in exchange rate. The weighting scheme of the index is assigned as the inverse of each series variance in the past.

The Exchange rate Market Pressure (EMP) index is presented as follows.

$$EMP_{i,t} = w_1 \Delta s_{i,t} + w_2 \Delta (r^D_{i,t} - r^{US}_t) - w_3 \Delta R_{i,t} \tag{16}$$

Where the subscripts i and t refer to the domestic countries and time, respectively. Δs_t represents the changes in nominal exchange rates over the period of analysis. This variable is dropped from the equation for most of the countries as the nominal exchange rate remained fixed during the assessment period, except for some devaluation or revaluation which have occurred in some countries. The second term refers to the interest rate differential multiplied by its weight. Δ R is the change in international reserves. Each weight is set as the inverse of each country-specific series' variance. Nevertheless, since the sample contains countries which experienced an exchange rate system shift, the weight is assigned to the time when the exchange rate is classified fixed.

We link these two credibility measures to a number of macroeconomic determinants of market expectations selected on the basis of the monetary strand of balance of payments theory and related empirical work on currency crises. The macrofundamentals included are: inflation differential (ID), ratio of debt to GDP (D), ratio of current account to GDP

[43] Data on Treasury Bills (TB) for many fixed exchange rate targeters were not found. In some countries, the facility of TB began a few years ago. However, the differences between TB, available for some countries in the study, and that of the anchor country is higher than that between deposit interest rates and US'TB. Although a more positive interest rate differential would be more informative in reflecting the feedback from the macrofundamentals, we think that the negative consequences of using the interest rate on deposit is unlikely to be substantial.

(CA), foreign reserves (R), money growth (Ms), ratio of import to GDP (M) and adequacy (Ad).[44] Unfortunately, it was not possible to obtain data on unemployment, labour costs, and fiscal deficit among many others. All the macro indicators are measured at yearly frequency, which better reflects the changes in interest rates cycle, as explained by Bernhardsen (2000). Furthermore, data on macro indicators for the examined countries cannot be obtained at shorter frequencies.

Essentially, inflation differential, among all macrofundamentals, is extremely substantial in determining the credibility of pegs, since it reflects the type of government in power. Theoretically, it is argued that a tough government pledges to maintain inflation down (Holden and Vikøren, 1996) and tracks closely inflation rates of the country to which the exchange rate is anchored (Frankel et al., 2004). The increase in domestic prices widens the differential which necessarily feedbacks to nominal interest rates. Many empirical studies on explaining the market agents' devaluation expectations have found a significant impact of inflation differential on interest rate differential prior to currency crises. The relation is supposed to be positive with the measure of devaluation expectations and negative with the credibility.

As noted earlier, due to data limitation, data on fiscal balance could not be found, but the ratio of debt to GDP is a reflection of fiscal imbalances. This indicator has been widely incorporated in the literature to study the effect of government mismanagement and to empirically test the fiscal discipline of pegged exchange rates as implied by the theory.[45] Indeed, an increase in fiscal debt threatens the sustainability of a fixed exchange rate system and lowers its credibility. The demand management also entails that money supply growth, as marked in the literature review section, must remain constant. In fact, the inability to control money supply endangers the re-controllability over the system stability. In addition, the literature emphases that current account imbalances is a major reason for financial crises (Lane and Milesi-Ferretti, 2012) as the deterioration in current account decreases the level of foreign reserves stock and increases the external debt (Krugman, 1996).

We also consider the foreign reserves as a main determinant of realignment expectations, Since the foreign reserves, under the fixed exchange rate system, is a main instrument

[44] We did not include any reputational factors, although many countries in our sample were successful at keeping their exchange rate fixed. This is to consider the increased risk of pegging continuation. The few observations on unemployment rates available on the World Bank database indicate that the unemployment rate amounts around 20% in many countries; it even goes beyond 30% in some countries like Jordan, Bahamas and Egypt. Furthermore, in some cases, the country's credit rating might get downgraded financially, see for instance, Standard and Poor's-Jordan in years 2010-2012.

[45] See for example Amato and Tronzano (2000), Tornell and Velasco (2000), Marini and Piersanti (2003), Vuletin (2004) and El-Shagi (2011).

to maintain the stability of the regime and hold off speculative attacks. Hence, we include the changes in reserves as a possible determinant which might affect the credibility positively. In addition, we incorporate a ratio relating reserves to domestic money growth, that is, an adequacy ratio of the foreign reserve level. A high adequacy ratio indicates that money supply grows relatively faster than international reserves, which lowers the credibility of the peg.

4.4 Data

The main sources of the data are the IMF international financial statistics and the World Bank database.[46] The data consists of annual observations from 1996 through 2012 for eleven emerging markets and developing economies: Bahamas, Bahrain, Barbados, Belize, Egypt, Jordan, Oman, Kuwait, Lebanon, Qatar and Venezuela. The countries are selected based on their exchange rate classification and data availability.

Data on international foreign reserves, nominal exchange rate, annual interest rate on deposit, annual interest rate on Treasury Bill of Federal Reserve bank and inflation for all countries but Lebanon and Oman, are extracted from the IMF/international financial statistics.[47] Whereas, the ratio of debt to GDP, current account to GDP, money growth, import to GDP indicators and inflation for Lebanon and Oman are imported from the World Development Indicators database. The table below shows the number of observations and the basic statistics of each indicator used in the analysis.

Table 33: Panel Data Properties

Macro-indicator	Obs	Mean	S.D	Min	Max
IR	183	3.8	4.7	-1.76	30.02
EMP	182	-2.14	6.78	-36.25	20.59
ID	187	3.24	10.11	-6.81	96.94
D	170	54.93	39.64	4.72	177.01
CA	187	1.92	15.1	-31.71	45.02
R	187	9.47	24.24	-80.76	69.63
Ms	184	14.14	12.93	-2.04	75.28
AD	183	0.66	0.39	0.09	1.79
M	182	45.21	18.44	16.72	94.2

[46] The codes of the data are provided in Table 34

[47] Data on treasury bills could not be found for the majority of countries. Yet, for countries whose TB rates are available, the differential is positive and even higher then that of domestic annual deposit.

Table 34: Data Identification Codes and Sources

Macro-indicator Macro-indicator	Data source	Code
IR	IMF-IFS	60L..ZF
TB	IMF-IFS	60C–ZF
ID, except Oman and Lebanon	IMF-IFS	64..XZF
D	WEI	GC.DOD.TOTL.GD.ZS
CA	WEI	BN.CAB.XOKA.GD.ZS
R	IMF-IFS	1..DZF
Ms	WEI	FM.LBL.BMNY.ZG
M	WEI	NE.IMP.GNFS.ZS
ID for Oman and Lebanon	WEI	FP.CPI.TOTL.ZG
Nominal ER	IMF-IFS	DG.ZF

4.5 Exchange rate classification

Prior to selecting the countries, we scrutinise the exchange rate classification for a wide range of countries to include those which target the exchange rate in practice. In fact, it has been observed that $defacto$ nominal exchange rates of countries might differ from the announced regime. Therefore, the literature on $defacto$ exchange rate classification, e.g., Reinhart and Rogoff (2002) and Levy-Yeyati and Sturzenegger (2005), has drawn the distinction between official exchange rates and real exchange rate policies. In this study, we utilise the IMF $defacto$ classification of exchange rate regimes and monetary policy framework of different years. The IMF classification is build upon specific statistical criteria, set on the basis of the backward-looking approach, and is composed of different arrangements: exchange rate with no separate legal tender, currency board, floating, free floating, conventional pegged, stabilised, crawling peg, crawling-like, pegged exchange rate within horizontal bands. Our set of countries is classified under the conventional pegged arrangement, which is also described as 'soft'. In effect, adopting a soft peg entails that monetary authorities have the freedom to alter the exchange rate at their own discretion, i.e., to devalue or revalue, but countries are classified $defacto$ pegged as long as their exchange rate's central parity fluctuates around a narrow margin of 1%. In general, central banks with a soft peg do not announce any margins for the exchange rate, and that what distinguishes a soft peg from a pegged exchange rate with a band, where a small band is allowed and declared officially. Nevertheless, it is important for market agents to acquire a publicly announced pledge of exchange rate fixity from monetary authority itself. From this point, it is intended to combine both $dejure$ and $defacto$ arrangements to define the year in which the fixed exchange rate was effectively adopted. We think that having an official announcement of the peg would certainly make the exchange rate policy a more transparent and stronger signalling device. However, due to the lack of evidence on exchange rate classification and the mixed information we obtain from related researches,

our *defacto* and *dejure* classification is likely to be inaccurate. Nonetheless, even when the classification does not match the two exchange rate criteria, each country maintains being at least a *defacto* pegger.

The 2013 IMF report on *defacto* exchange rate classification indicates that *defacto* conventional pegs classification encompasses the *dejure* arrangements. However, owning to the absence of the IMF reports from the beginning of our assessment period, namely before 1999, we base our *defacto* classification on the changes in international reserves and nominal exchange rates, which is similar to the criteria of Levy-Yeyati and Sturzenegger (2005). We also revise all the available information from the exchange rate related studies and monetary history of each country published on central banks' website.

The countries which are considered in the study are: Bahamas, Bahrain[48], Barbados, Belize, Egypt[49], Jordan[50],Oman, Kuwait[51], Lebanon[52], Qatar[53] and Venezuela[54].

According to the stern classification adopted in this study of combing the *dejure* and *defacto* classifications of exchange rate, some of the countries are considered exchange rate fixers after the start date of the study, i.e., after 1996, while two others, namely Egypt and Kuwait, opted out during the analysis period. Some countries devalued in one year or more, e.g., Venezuela in 2005. All the changes in nominal exchange rates are taken into account by employing the EMP index, albeit not through the interest rate differential.

[48]It is not clear when the country has officially announced the peg. So, the fixing start year is taken from the first year in our sample.

[49]Egypt followed a fixed, adjustable peg to the US dollar from 1948 till 2003. Adjustments to the exchange rate took place in 1979, 1989 and 1990. The devaluations occurred between 1991 and 1992, but after that the Egyptian Pound was kept fixed until 2000 (Kamar and Bakardzhieva, 2005). In 2001, however, the government announced a new parity to the US dollar and shifted gradually to a crawling peg system. Given these adjustments, the IMF 1999 *defacto* classification assorted Egypt under the " conventional fixed" category. However, according to Karam and Fund (2001), an adjustable currency band was adopted against the U.S. dollar in January 2001. During 2000, to strengthen its external position, the authority departed from the *defacto* peg to the U.S. dollar adopted in early 1991. This band was subsequently depreciated and widened in mid-2001, resulting in a cumulative depreciation of about 25% relative to the U.S. dollar. During the last years of the peg, Egypt was hit by a series of external shocks. The political turmoil in the region and sudden stops led to an enormous fiscal deficit which pressured the currency. The central bank of Egypt devalued several times during the pegged system despite its *dejure* classification (Selim et al., 2010) and the IMF's *defacto* classifications. However, the pegged system, as consequences of high accumulated depreciations, was broken in January 2003. For a detailed description on the exchange rate arrangement in Egypt, the reader is referred to Selim et al. (2010).

[50]Jordan has devalued twice over the financial crisis. As a result, the JOD depreciated slightly against the dollar by 0.11%.

[51]Kuwait adopted the pegged regime in January 2003 in an attempt to control inflation. Nevertheless, its exchange rate kept appreciated over the targeted parity, and thereby it opted out with the outset of the financial crisis.

[52]The Lebanese Pound was fixed to US dollar in December 1997.

[53]The central bank of Qatar has been effectively fixing the exchange rate since 1979 (Karam and Fund (2001)). However, the central bank did not officially announce the peg until January 2001.

[54]The Bolivar was fixed to US dollar in 2003. Depreciation occurred once in 2005.

4.6 Methodology

In order to examine the overall credibility of the fixed exchange rate system, data of eleven countries with a soft peg to the US dollar are pooled and the analysis is built on panel linear models. In fact, the unavailability of many macro variables for developing countries at different frequencies, and the missing data for others released, pose a challenge to make a separate regression at individual level. In addition, it is thought that pooling the data across emerging markets and developing countries committed to a fixed exchange rate to the US dollar, might be more important in drawing a general conclusion about the credibility of the pegged exchange rate anchor.

We start with a panel model which assumes exogeneity of explanatory variables. This exogeneity assumption works theoretically with the Krugman model on demand mismanagement, where money supply is assumed to be determined by the monetary authority.

As our sample consists of oil-producing countries, non-oil producers and import-reliant economies, the economic heterogeneity should be considered. Applying the pooled OLS approach, without inserting country specific dummy variables, will inevitably provide biased estimates. Hence, to eliminate all the countries-unobserved heterogeneity, the fixed effects model is employed. The specified linear representation is as follows.

$$RealignmentExpectations = X_{it}\beta_\kappa + \alpha_i + \varepsilon_{it} \tag{17}$$

$$U_{it} = \alpha_i + \epsilon_{it} \tag{18}$$

Where the regressand is either proxies of market agents' realignment expectations: interest rate differential or exchange rate market pressure index. X_{it} is a vector of regressors, which either change over time but remain constant at country level, or vary across both time and countries. β_k is the $\kappa \times 1$ vector of coefficient on X. α_i and ε_{it} are random country-specific effects and idiosyncratic disturbances, respectively. Whereas, the makeup of the two, U_{it}, is called the composite errors. In this model, the country-unobserved component is presumed to be correlated with the set of regressors. The correlation with the time-invariant component of the error permits the explanatory variables to enter the equation in the very limited feature of endogeneity (Cameron and Trivedi, 2010).

As stated earlier, employing the OLS allows to accept implicitly the restrictive assumption that the regressors are uncorrelated with the latent variables, which necessities using the within estimator. However, unlike the within estimator, random effects assume

that a country heterogeneity is orthogonal to regressors.

As a first step, it is crucial to test for group-wise homoscedasticity in the variances of individual heterogeneity. Breusch and Pagan (1980) build a statistic test based on Lagrange Multiplier (LM) fundamental set under the normality assumption of the composite errors. In later work, Wooldridge (2010)'s LM test adds an advantage of not limiting the distribution of the errors to normality. As the panel sample at hand is unbalanced, the autocorreclation-heterokedasticity panel related tests are cautiously opted. Therefore, we follow the LM test for unbalanced panels, which is constructed by Greene (2003) and modified for empirical work in STATA package to take account of the distribution of composite errors and the variation in the number of observation across individual units. The test is developed under the assumption of cross sectional dependence. Hence, the rejection of the homoscedasticity is likely to be, in addition to the reasons related to unobserved components and idiosyncratic errors correlation, due to contemporaneous correlations across individuals. Subsequently, the test can be utilised to identify the presence of cross sectional dependence based on the squared pair-wise correlation coefficients in long panels, where T is sufficiently larger than N. Nevertheless, the size distortions get bigger when N increases, and thereby LM statistic provides invalid inferences. Pesaran (2004) develops a Cross-sectional Dependence (CD) test which depends upon the pair-wise correlation coefficient when the cross sectional dimension is much larger than the time series dimension. In his spatial dependence Monte Carlo simulation based on a comparison with Breusch and Pagan test, generated under different setups, he finds that the LM test is only effective when N is considerably smaller than T. However, based on this simulation and with the consideration of our study's panel dimensional properties, where the number of countries is slightly smaller than that of the time dimension, the CD test is nearly as powerful as the LM test. In the presence of the spatial patterns, Driscoll and Kraay (1998) propose a spatial correlation standard errors for pooled OLS and fixed effects estimator in finite samples, which make the estimator feasible regardless of the cross sectional dimension at hand. Their simulations and empirical examples reflect the necessity to account for spatial dependence in order to avoid incorrect statistical inferences.

The autocorrelation test used in this study is derived by Wooldridge (2010) which detects the existence of first order serially correlated errors. The test is introduced to empirical usage by Drukker et al. (2003) to be performed after the estimation of pooled OLS and fixed effects models, and is workable whether the explanatory variables are endogenous or exogenous. A final specification test we run is the Hausman (1978) test to compare which of the two estimators, fixed or random effects, is more consistent under

the null hypothesis of countries correlated effects.

Nevertheless, the fixed or random effects models do not allow for dynamic settings and assume that regressors protrude exogenously. In effect, assuming endogeneity is of important interest in the study as the marofundamentals cannot be determined away from the money market dynamics.

Inserting lagged regressend in equation 17 revokes the inconsistency of the within estimator due to the correlation with the idiosyncratic errors. Moving further to assume that some or all the regressors are endogenously determined would violate the condition of no correlation between the errors and regressors. One way to control for heteroskedasticity and autocorrelation associated with this dynamic specification is to use a set of moments assumed to be orthogonal to the error process, or in another term, exogenous. Hence, to allow for endogenous regressors in the linear specification, the First Difference-Generalised Method of Moments (FD-GMM) is performed considering the appropriate lag length in regressors.

The general model that represents all the above features is,

$$\Delta y_{it} = \Delta\delta_1 y_{i,t-1} + ... + \delta_q \Delta y_{i,t-q} + \beta \Delta x_{it} + \Delta U_{it} \tag{19}$$

Δ is the difference operator, $y_{i,t-q}$ denotes the lagged dependent variable up to time q, x_{it} is the exogenous, predetermined or endogenous regressors.

We decide to apply the FD-GMM, put forward by Arellano and Bond (1991), rather than the system GMM in an attempt to minimise the number of instruments, as the size of the sample at hand is small. Moreover, since all the variables considered in the study are in level, the lagged differenced instruments are more likely to be powerful. However, the critical concern is to acquire valid instruments. Sargan test with an asymptotic Chi-squared distribution under the homoscedasticity assumption tests the validity of instruments or overriding restrictions, which refers to the difference between the number of instruments employed and that of estimated parameters. Although the rejection of the null hypothesis implies the need to reconsider either the model setup or the instruments, the test does not work when the errors are heteroskedastic. It also over-rejects the null of instruments invalidity as stated by Arellano and Bond (1991). In the last step, Arellano and Bond's test for autocorrelation is carried out, in which the errors must be uncorrelated at the second order.

4.7 Results

As mentioned in the previous sections, the fixing start year differs across countries. Some countries are assigned as exchange rate targeters, with the strict characteristics of having an official announcement of peg and *defacto* behaviour, after the start date of our sample, i.e., 1996, while some others, either opted out of the pegged exchange rate system or adopted it during the study period. In order to account for such shifts in exchange rate regimes, a constant binary variable for the exchange rate arrangement along a set of slope dummies interacted with the time-varying macrofundamentals are inserted.[55]

In addition, the fundamentals are divided into four 'projection-equations'.[56] In the first equation, we include inflation differential, debt, current account, foreign reserves, money growth and their related slope dummy variables. In the second equation, all the above indicators are kept but the current account is replaced by the ratio of import to GDP.[57] Then in the third setup, we exclude both the money growth and import and employ the current account alongside the other variables. Finally, the adequacy measure is incorporated to act for the dual impact of money growth and foreign reserves. We intend to split the indicators into these sorts of groups for two reasons.[58] First, our sample size is relatively small, so it is likely to obtain weak power results when the number of regressors increases. Second, to take into account the negative relation between the stock of money supply and reserves, as implied by the monetary approach to the balance of payments theory.[59] The basic idea of the theory is that when central banks issue more domestic money supply, the public expenditure goes above the national income, which, consequently, leads to a balance of payments deficit (Blejer (1979)). In other words, the current account deficit can be interpreted as an outcome of excrescent growth of domestic money.[60]

However, along the previously mentioned indicators, other setups, not reported, were estimated through incorporating other variables, considered in the empirical studies of currency crises models, like the exchange rate misalignment, calculated by estimating the deviation of the actual real exchange rates from their trend component, pressure index, that is, the ratio of international reserves to import, output and real exchange rate. The

[55] Other dummies were incorporated to consider the 2008 financial crisis. However, the dummies were found insignificant.

[56] The variables are lagged one period to avoid simultaneity bias.

[57] Due to data unavailability, neither data on export nor openness were found for many countries in the sample. We sought to consider the trade-effect on the realignment expectations, but the choice to include the ratio of import to GDP came from the inability to acquire a reliable measure for the degree of openness.

[58] See Frankel and Rose (1996) for more relevant variables on currency crashes in emerging markets.

[59] See Frenkel and Johnson (2013).

[60] We also remove the reserves in other setups, but the outcomes remain unchanged.

latter factor is vital in determining the competitiveness, which represents a main temptation for realignment. Indeed, this fundamental receives much concerns in the literature mainly since the appreciation in real exchange rate was the main reason for devaluation in many previous currency crises (Dornbusch et al., 1995).

Nonetheless, employing the relative PPP-based measure may to a large extent induce collinearity with the inflation differential, especially as many cases in the sample kept their nominal exchange rate fixed. With the difficulty to incur data on other real exchange rate indexes, namely the traded-goods index, the results with relative PPP-based index would be inaccurate. More importantly, the sample contains five oil-producing countries, where their export sectors rely mainly upon crude oil whose prices are determined in the world market, as well as some import-reliant economies, the thing which makes the supposition of realignment to improve the external position unlikely.[61] Nevertheless, all the unreported indicators are found to be constantly insignificant.

To ensure that our setups are not prone to multicollinearity, we apply the Variance Inflation Factor (VIF) test after the pooled OLS regression. The test hypothesises that a percentage of 10 or above is an evidence of collinearity among regressors. The results, shown in Table 35, suggest that our setups are not subject to multicollinearity.

The following equations represent the different constructed setups.

$$\Delta IR_{i,t)} = era_{i,t} + \beta_1 \Delta ID_{i,t-1} + \beta_2 D_{i,t-1} + \beta_3 CA_{i,t-1} + \beta_4 R_{i,t-1} + \beta_5 Ms_{i,t-1} + \beta_6 pduumy_{i,t-1} + \beta_7 ddummy_{i,t-1} + \beta_8 cadummy_{i,t-1} + \beta_9 rdummy_{i,t-1} + \beta_{10} mdummy_{i,t-1} + \alpha_i + \varepsilon_{i,t} \tag{20}$$

$$\Delta IR_{i,t)} = era_{i,t} + \beta_1 \Delta ID_{i,t-1} + \beta_2 D_{i,t-1} + \beta_3 M_{i,t-1} + \beta_4 R_{i,t-1} + \beta_5 Ms_{i,t-1} + \beta_6 pduumy_{i,t-1} + \beta_7 ddummy_{i,t-1} + \beta_8 tdummy_{i,t-1} + \beta_9 rdummy_{i,t-1} + \beta_{10} mdummy_{i,t-1} + \alpha_i + \varepsilon_{i,t} \tag{21}$$

$$\Delta IR_{i,t)} = era_{i,t} + \beta_1 \Delta ID_{i,t-1} + \beta_2 D_{i,t-1} + \beta_3 CA_{i,t-1} + \beta_4 R_{i,t-1} + \beta_5 pduumy_{i,t-1} + \beta_6 ddummy_{i,t-1} + \beta_7 cadummy_{i,t-1} + \beta_8 rdummy_{i,t-1} + \alpha_i + \varepsilon_{i,t} \tag{22}$$

$$\Delta IR_{i,t)} = era_{i,t} + \beta_1 \Delta ID_{i,t-1} + \beta_2 D_{i,t-1} + \beta_3 CA_{i,t-1} + \beta_4 AD_{i,t-1} + \beta_5 pduumy_{i,t-1} + \beta_6 ddummy_{i,t-1} + \beta_7 cadummy_{i,t-1} + \beta_8 addummy_{i,t-1} + \alpha_i + \varepsilon_{i,t} \tag{23}$$

[61] Egypt represents a special case, though. Two years before the abandonment of the peg, the central bank devalued several times in an attempt to support the price competitiveness. Even though, its IMF classification did not change until the peg was abandoned.

$$\Delta EMP_{i,t)} = era_{i,t} + \beta_1 \Delta ID_{i,t-1} + \beta_2 D_{i,t-1} + \beta_3 CA_{i,t-1} + \beta_4 Ms_{i,t-1} + \beta_5 pduumy_{i,t-1} + \beta_6 ddummy_{i,t-1} + \beta_7 cadummy_{i,t-1} + \beta_8 mdummy_{i,t-1} + \alpha_i + \varepsilon_{i,t} \quad (24)$$

$$\Delta EMP_{i,t)} = era_{i,t} + \beta_1 \Delta ID_{i,t-1} + \beta_2 D_{i,t-1} + \beta_3 M_{i,t-1} + \beta_4 Ms_{i,t-1} + \beta_5 pduumy_{i,t-1} + \beta_6 ddummy_{i,t-1} + \beta_7 tdummy_{i,t-1} + \beta_8 mdummy_{i,t-1} + \alpha_i + \varepsilon_{i,t} \quad (25)$$

$$\Delta EMP_{i,t)} = era_{i,t} + \beta_1 \Delta ID_{i,t-1} + \beta_2 D_{i,t-1} + \beta_3 CA_{i,t-1} + \beta_4 pduumy_{i,t-1} + \beta_5 ddummy_{i,t-1} + \beta_6 cadummy_{i,t-1} + \alpha_i + \varepsilon_{i,t} \quad (26)$$

Where the regressand is either of the two credibility proxies: interest rate differential or exchange rate market pressure index, era is the exchange rate arrangement constant dummy variable, which takes the value of one when the exchange rate system is fixed, and zero otherwise, ID is the inflation differential, D and CA are the ratio of debt to GDP and current account to GDP, respectively, Ms is the money growth, M refers to the percentage of imported goods on GDP, R denotes the log of changes in international reserves, in US dollar, AD is the ratio of money growth to foreign reserves, pdummy (inflation differential), ddummy (debt), mdummy (money growth), cadummy(current account), tdummy (import), addummy (adequacy), rdummy (foreign reserves) are the interactive dummy variables, calculated by multiplying each related regressor with exchange rate arrangement.[62]

The estimation of the fixed effects model, when the credibility is measured by the interest rates differential, indicates that the individuals' heterogeneity is significant. Expectedly, the F-test reported in Table 35 implies a rejection of the null hypothesis that all dummy parameters except one are zero, and thereby assures the inefficiency of pooled OLS estimates of coefficients.

Nevertheless, the specification tests for autocorrelation and heteroskdasticity indicate that the results of fixed effects, reported in Table 35 are inefficient. In fact, with autocorrelated and heteroskedastic errors, relying on the default errors is misleading. Therefore, we first apply the White (1980)'s robust standard errors.[63] The results are presented in Table 36. We modify the Hausman test to consider the usage of robust standard errors following the procedures set by (Hoechle (2007)). The within estimator according to the test

[62] The credibility proxies are regressed on the lagged values of the expectations determinants.

[63] The results using cluster robust errors are found indistinguishable from those using the robust standard errors.

is more efficient than random effects. The results, shown in Table 36, reflect that inflation differentials in all setups account roughly for 20% of the spread. However, some of the other indicators appear either significant in their interactive dummy or with a wrong sign, such as international reserves in equation 22. Nevertheless, the homoscedasticity tested by the LM test for unbalanced panels may also indicate the presence of cross sectional dependence. In addition, the CD test, developed by Pesaran (2004), can also be used to examine whether the cross sections are independent. Both tests, as reported in Table 35, confirm that we cannot presume independence across countries. Therefore, we utilise the Driscoll and Kraay (1998) corrector for standard errors. In principle, this is built upon Newey-West autocorrelation and heteroskedasticity correction for cross-sections averages of moment conditions (Hoechle, 2007). Consequently the lag length needed to correct for autocorrelation is specified by the default plug-in procedures, that is,

$$L(T) = floor[4(\frac{T}{100})^{(\frac{2}{9})}] \tag{27}$$

where T is the number of time dimension.[64] In accordance, the Hausman specification test is corrected in the way defined by Hoechle (2007). The test's p-value rejects the hypothesis that random effect provides consistent estimates.

The results, presented in Table 37, provide evidence that inflation differential is the main driving fundamental that affects the credibility of the peg. On average, 20% of interest rate differential is explained by the difference in inflation between the domestic economies and the base country. This reflects why anchoring interest rates is not possible in the exchange rate targeters considered in this study. In fact, inflation differential increases the prices of traded goods, and, consequently, deteriorates the competitive position of an economy. It also triggers higher inflationary expectations, which affect the long-run interest rates (Bernhardsen, 2000). In addition, in the words of Andersen and Chiriaeva (2007):

"a fixed exchange rate policy also implies an inflation target in the sense that the peg to be credible, the domestic rate of inflation has to equal, in the medium to long term, inflation in the country to which the exchange rate is pegged".

The impact of inflation differential on realignment expectations is also confirmed by the results of FD-GMM, shown in Table 41, where the coefficient of inflation differential appears with the same magnitude and significance. The deterioration in current account,

[64] See Hoechle (2007) for more details.

in the first equation of Table 37, also affects the credibility negatively by 3%. In the same equation, however, reserves appear with a low effect and a wrong sign. Nonetheless, when we apply the non-linear test to examine whether the total effect is not different from zero, the assumption is not rejected. It is possible, as emphasised by Rose and Svensson (1994), that the changes in international reserves do not precisely measure the ability of central banks intervention. Unfortunately, coupled with the absence of data on intervention for our set of countries, the capability of central bank to intervene in foreign exchange rate markets has not been captured. Further, the reserves effect might not be clear with the possibility of borrowing reserves during the episodes of unsuccessful speculative attacks (Holden and Vikøren, 1996). When current account is replaced by import in equation 21, the money growth becomes significant, but appears in a wrong sign. Likewise, the ratio of imported good to GDP significantly influences the credibility of the peg, but with an incorrect sign. Whether this ratio is seen as a measure for the vulnerability to external shocks that is, the inflation shocks, namely in import-reliant countries, or as a composition of current account, the coefficient should appear in a positive sign. This inaccuracy might be attributed to unavailability of data on export for all countries, the factor which weakens the setup structure of equation 21. According to the results of setups 21 and 23, debt to GDP ratio appears significant, regardless of the exchange rate arrangement.

Similarly, we apply the same procedures to equations 24 to 26 where the EMP is incorporated as the credibility measure. The test of heteroscedasticity and autocorrelation prove that we cannot accept the null, as shown in Table 38. However, Pesaran (2004)'s CD test is rejected, which implies that the individuals can be assumed independent. Using the White (1980) corrector, the results are unsatisfactory. None of the significant indicators appear in the correct sign. When we carry on to estimate the equations with DK's standard errors relying on the LM test, no fundamental, as can be seen from Table 40, explains the pressure on the exchange rate, but only 5% is attributed to the positive constant. These results are consistent with Mouratidis (2008), who finds that the fundamentals, when the EMP is employed, play no informative role, while they are more powerful in explaining the interest rate differential.

The within estimator results for the EMP setups are confirmed when we allow for autoregressive and endogenous explanatory variables. The FD-GMM results show that the constant in equation 24, presented in Table 42 remains significant with correct sign and the same magnitude.[65] The only difference is placed to the current account, which is found to

[65] We attempted to incorporate different instruments such as: forward inflation, naive forecasts of inflation, but the results with the realised values of inflation differential were more informative.

be highly significant and powerful for all countries regardless of their exchange rate regime.

In general, the sample might be highly heterogeneous with the poolability of low and high income countries. In particular, some countries are characterised either with high interest rates such as Venezuela, or with positive current account and low debt, e.g., Qatar and Kuwait. Hence, we exclude such countries and examine the credibility for six countries which have been fixing the exchange rate during the study period: Bahamas; Bahrain, Barbados, Belize, Jordan, Oman. We investigate the relation using the within estimator approach.[66] The results, shown in Table 43, manifests that inflation differential has a dominant impact on expectations. Moreover, current account deteriorations affect the credibility by 3% across the setups.[67] Interestingly, the domestic currencies are expected to realign when the money supply growing faster than foreign reserves. The plausible explanation for this strong effect of the adequacy ratio is that the adequacy of reserves in these countries might not be enough to repel the realignment expectations. The EMP results, unreported, for these countries fail again to detect any significant effect of fundamentals on exchange rate pressure.

The difference in results between the two credibility measures could be attributed to three main reasons. First, the interest rate differential is one of the EMP index components, which could be seen as a fixed exchange rate defense mechanism, i.e, the interest rate defense of the parity. Hence, although domestic interest rates changes are not generated away of fundamentals, fundamentals cannot detect a pressure on the exchange rate, given the role of the monetary authority in resisting speculative attacks via the interest rate defence. Second, During episodes of low credibility of the system or a surge of a speculative attacks, the monetary authority would borrow international reserves; these borrowed reserves are not captured by the EMP and thereby the changes in foreign reserves are not sufficient to reflect low credibility. Third, the index has a drawback concerning its weighting scheme; that is, although the index is set to make the variance of each part equal, the volatility of exchange rates changes are small and thus, in cases of revaluation or devaluation, the weight of these changes becomes extremely large, while changes in foreign reserves are assigned with a neglected weight.

[66] The sample became smaller with the exclusion of some countries, so we did not proceed to the FD-GMM.

[67] We also estimate the random effects for setup 22 as suggested by the Hausman test under spatial dependence. All the determinants remain with the same significance and magnitude but the current account turns to be insignificant.

4.8 Conclusion

The study underlines the relationship between the realignment expectations and macroeconomic fundamentals, which reflects the overall credibility, in eleven countries adhered to the fixed exchange rate to the US dollar. The exchange rate fixers are assumed to preserve a very low interest rate differential which, according to the UIP, is supposed to equal the expected changes in exchange rate. We adopt two measures to study the market expectations: the interest rate differential and the exchange rate market pressure index constructed by Eichengreen et al. (1994).

We build our study on the empirical works of the currency crises generations models, which generally imply assessing the consistency of macro fundamentals under a fixed exchange rate system. Essentially, studies on the first generation models, built on the Krugman (1979)'s hypothesis of demand mismanagement, have shown that the fall of a fixed regime happens due to feeble macroeconomic pillars that support pegs. The second strand of literature on currency crises addresses the importance of market agents' animal spirits in generating speculative attacks while all the macroeconomy behaves well. This, however, has been challenged by many economists. It is argued that self-fulfilling expectations can be generated and turn into successful speculations only when macro fundamentals are weak. In that sense, we follow the projection approach of first generation models, as in the work of Rose and Svensson (1994), and model different setups with linkage to macrofundamentals in an attempt to shed light on the credibility of the conventional peg to the US dollar. Accordingly, we gather and pool data of eleven exchange rate targeters to the US dollar over the yearly span 1996-2012.

Different setups are constructed to consider the small sample size and to account for the relation between current account and money stock in the principle implied by the monetary approach to balance of payments. Periods with the soft peg under examination are assigned carefully depending on the official declaration of the system and the IMF $defacto$ classification. However, the IMF reports are not available, namely for the years before 1999, thereby, the behaviour of nominal exchange rate and international reserves along with the official announcement are assessed on the basis of Levy-Yeyati and Sturzenegger (2005). Countries in some cases, due to the mismatches between the $dejure$ and $defacto$ classification or the late adoption or abandonment of the peg, are assigned as exchange rate targeters in certain periods. To take account of this, a constant dummy variable and interactive dummies are inserted in the model setups.

We first employ the fixed effects model to remove the countries specific heterogeneity, where the explanatory variables are assumed to be exogenous. However, to allow for endogeneity in the macroeconomic setting, as addressed by the second generation models, we utilise the Arellano and Bond (1991)'s first difference GMM.

Overall, under the strict assumption of regressors exogeneity, the specification tests imply that relying on the estimates obtained from the default standard errors is misleading. In accordance, we use the White (1980) procedure to correct for heteroscedasticity and autocorrelation. Nevertheless, the groupwise heteroscedasticity test also indicates that the countries might be spatially correlated. This is ensured by performing the Pesaran (2004)'s cross sectional dependence test. The inferences from both tests confirm that independence across countries cannot be assumed when the interest rate differential is used as a measure of credibility. Subsequently, the Hausman specification test is estimated under different procedures to consider the use of robust standard errors and cross sectional dependence. The estimations provide evidence that, in all setups, the within estimator is more consistent than random effects. On average, the results are stronger when the interest rate differential is used to measure the market expectations.

The inflation differential appears to be the main driving force for generating realignment expectations. In all the four setups modelled, its influence is found to be highly significant, and account for around 20%, reflecting the spread between the exchange rate fixers and the United States. This is in line with other studies where inflation differential acts as a prominent explanatory fundamental for the majority of collapsed exchange rate regimes prior to crises, which partially explains the difficulty to anchor interest rates. However, the other macro indicators in the study are found to be either insignificant or significant with a wrong sign and/or negligible magnitude. On balance, the results are similar to the finding of earlier work on credibility of the EMS at time proceeding the crisis. Nonetheless, when the exchange rate market index is used, the fundamentals are not valuable in explaining the pressure on fixed exchange rate currencies. Moreover, the cross sectional tests provide mixed inferences about whether to reject the spatial dependence among countries. Thus, assuming independence across countries, none of the significant indicators appear in the correct sign. Even when we correct the default standard errors in the manner of Driscoll and Kraay (1998), the constant in one setup explains only 5% of the expected pressure on the domestic currencies. Nevertheless, these results are, in principle, consistent with Mouratidis (2008)'s study on the 1994 Mexican currency crisis, where the pressure over the currency was not captured by the fundamentals. On the other hand, Li et al. (2006) argue that the exchange rate market index cannot capture unsuccessful at-

tacks on a fixed exchange rate currency. Particularly, they criticise the "variance-weighted scheme", since the volatility of changes in exchange rates are small and thus, in cases of revaluation or devaluation as in our study, the weight of these changes becomes extremely large, while reserves changes are given a neglected weight.

The results, based on the interest rate differential as a proxy for the system credibility suggests that the inflation differential remains one critical fundamental in explaining why an exchange rate parity to the US dollar is expected to realign. Investors ask for inflation premium to bear the risk of holding assets denominated in domestic currencies. Since the interest rate considered in the study is on annual deposit, risk aversion must be closely related to the currency risk and deregulation of financial intermediaries whose well-function is a responsibility of central banks.

When we split the countries to only include those which did not experience any shift in exchange rate regime during the study period, the fixed effects model shows that inflation differential remains a vital factor. The deterioration in current account also appears to be an important indicator for expecting realignment in these countries. Interestingly, the reserve adequacy is highly significant and imposes strong impacts on expectations. This might reflect the economic nature of these countries, where four of them are oil-importers; even the two oil producing countries, Bahrain and Oman, produce less crude oil compared to their neighbours: Kuwait and Qatar.[68]

Broadly speaking, exchange rate fixity in these countries does not provide the credibility of low inflation. A country with our examined peg, which is described in the literature as 'soft', is expected to realign from its predetermined parity when it is hit by real shocks (Stone et al., 2008). So, it is not surprising that a soft peg among all exchange rate regimes are more prone to currency crises Bubula and Otker-Robe (2003). This might take us back to the principle of choice to fix or float, where a fixed exchange rate regime is a better choice when shocks are of monetary nature (Garber and Svensson, 1994). Financially, anchoring inflation, according to our results, through pegging the currency is dubious, but it is possible to be more serving to international trade as the dollar is the currency used in pricing petroleum. However, this is beyond the scope of our study. It is also likely that the seemingly prolonged successful exchange rate targeting in such countries, except in Egypt, Venezuela and Kuwait, reflects their economic nature of being either oil-producers or reliant importers.

[68] The US energy information administration.

It is evident that having a fixed exchange rate is not enough to bring the credibility of low inflation into domestic economies. This undoubtedly indicates that credibility of low inflation must be domestically built and set on microfoundations. As addressed by Svensson (1994), the monetary credibility can be built domestically by consolidating "institutional reforms". These reforms entail the integrated cooperation of monetary and exchange rate policies including central bank independence. Indeed, the exchange rate as a quantitative anchor cannot inherently bring credible economic policies without having harmonious domestic collaboration and preferences as well as well-armed institutions to hold the responsibility of fixing the exchange rate.

Nonetheless, it is worth noting that the study suffers from limitations, which might affect the power of the results. These could fundamentally be attributed to the less homogeneity across developing countries and their poor quality of data or data insufficiency, as highlighted by Schiavo and Vaona (2008). Principally, due to the small sample size, it was not possible to consider socio or political factors. However, the study span is not heavily vulnerable to political turbulence; even in some exceptions like the Hariri assassination in Lebanon, the overall state of macroeconomy remained stable. It could also be argued that countries tend not to change the monetary regime during the political unrest periods (Tamgac, 2013). Yet, examining the effect of economic instability and political disturbances, namely the influence of corrupt regimes, is vital and it would have been preferred if our sample was larger.

Table 35: Within estimators with default standard errors. Measure of realignment expectations: Interest rate differential.

	equation 20	equation 21	equation 22	equation 23
	coefficient	coefficient	coefficient	coefficient
ID	0.576***	0.556***	0.615***	0.642***
D	0.033*	0.041**	0.037*	0.034*
CA	0.034		0.023	0.022
R	-0.023	-0.001	-0.031*	
Ms	-0.065	-0.155**		
eradummy	2.244	-4.068	1.68	0.656
pdummy	-0.369***	-0.318***	-0.416***	-0.448***
ddummy	0.01	0.006	0.014	0.011
cadummy	-0.065*		-0.063*	-0.067*
rdummy	0.036**	0.009	0.035**	
mdummy	0.000	0.103		
M		-0.185***		
tdummy		0.136*		
AD				-0.733
addummy				2.243
cons	-0.794	7.213***	-1.586	-1.104
VIF	4.23	5.08	4.15	5.07
Fixed effect[F-test]	F(5,83)=6.96	F(5,5)=23.46	F(4,86)=7.39	F(4,74)=9.72
P-F(11,141)	(0.000)	(0.000)	(0.000)	(0.000)
LM test: Chi2 (11)	-359.77	-280.66	-1,222.46	-530.4
Prob > Chi2	(0.000)	(0.000)	(0.000)	(0.000)
Autocorrelation, F(1,10)	-133.43	-96.118	-76.072	-83.148
Prob > F(1,10)	(0.000)	(0.000)	(0.000)	(0.000)
CD test	-6.506	-6.611	-9.168	-6.672
CD test: probability	(0.000)	(0.000)	(0.000)	(0.000)
Hausman: Prob>Chi2 (9)	-0.023	-0.1	-0.081	-0.011

Note: VIF is the variance inflation factor that tests whether multicollinearity exists. Greene (2003)'s LM test for unbalanced panel: H_0: $\sigma_i^2 = \sigma^2$ for all I. Wooldridge (2010)'s autocorrelation H_0: no first order autocorrelation. Pesaran (2004)'s CD test: H_0: errors are cross sectional independence. ***, **, * denote significance at 1%, 5% and 10%, respectively. Standard Errors are between parenthesis. Probability is between brackets.

Table 36: Within estimators with robust standard errors. Measure of realignment expectations: Interest rate differential.

	equation 20	equation 21	equation 22	equation 23
	coefficient	coefficient	coefficient	coefficient
ID	0.576***	0.556***	0.615***	0.642***
D	0.033	0.041	0.037	0.034
CA	0.034		0.023	0.022
R	-0.023	-0.001	-0.031**	
Ms	-0.065	-0.155***		
eradummy	2.244	-4.068	1.68	0.656
pdummy	-0.369***	-0.318***	-0.416***	-0.448***
ddummy	0.01	0.006	0.014	0.011
cadummy	-0.065*		-0.063	-0.067
rdummy	0.036*	0.009	0.035**	
mdummy	0.000	0.103		
M		-0.185		
tdummy		0.136		
AD				-0.733
addummy				2.243
cons	-0.794	7.213**	-1.586	-1.104
Hausman-robust SE: Prob>F	(0.000)	(0.000)	(0.000)	(0.000)

Note: ***, **, * denote significance at 1%, 5% and 10%, respectively. Probability is between brackets.

Table 37: Within estimators with spatial correlation standard errors. Measure of realignment expectations: Interest rate differential.

	equation 20	equation 21	equation 22	equation 23
	coefficient	coefficient	coefficient	coefficient
ID	0.576***	0.556***	0.615***	0.642***
D	0.033	0.041**	0.037*	0.034*
CA	0.034*		0.023	0.022
R	-0.023*	-0.001	-0.031***	
Ms	-0.065	-0.155***		
eradummy	2.244	-4.068*	1.68	0.656
pdummy	-0.369***	-0.318***	-0.416***	-0.448***
ddummy	0.01	0.006	0.014	0.011
cadummy	-0.065***		-0.063**	-0.067***
rdummy	0.036**	0.009	0.035***	
mdummy	0.000	0.103**		
M		-0.185**		
tdummy		0.136*		
AD				-0.733
addummy				2.243
cons	-0.794	7.213**	-1.586	-1.104
Hausman-Spatial dependence	(0.000)	(-0.009)	(0.000)	(0.000)

Note: ***, **, * denote significance at 1%, 5% and 10%, respectively. Probability is between brackets.

Table 38: Within estimators with default standard errors. Measure of realignment expectations: EMP

	equation 24	equation 25	equation 22	equation 26
	coefficient	coefficient	coefficient	
ID	0.061***	0.008***	0.225***	
D	0.133*	0.122**	0.145*	
CA	-0.231		-0.285	
Ms	-0.183	-0.266		
eradummy	18.85	19.859**	16.446	
pdummy	-0.205	-0.167	-0.388	
ddummy	-0.163***	-0.141***	-0.141***	
cadummy	-0.015		-0.017	
mdummy	-0.036*	-0.023		
M		0.242		
tdummy		-0.14		
cons	-14.039	-20.144***	-16.696	
Fixed effect[F-test]	93.4	80.41	134.47	
P-F(11,141)	(0.000)	(0.000)	(0.000)	
LM test: Chi2 (11)	114.172	76.953	93.197	
Prob > Chi2	(0.000)	(0.000)	(0.000)	
Autocorrelation, F(1,10) 114.172	76.953	93.197		
Prob > F(1,10)	(0.000)	(0.000)	(0.000)	
CD test	-0.599	-1.316	-0.019	
CD test: probability	(0.000)	(0.000)	(0.000)	
Hausman: Prob>Chi2 (9)	0.003	0.024	0.022	

Note: Greene (2003)'s LM test for unbalanced panel: H_0: $\sigma_i^2 = \sigma^2$ for all I. Wooldridge (2010)'s autocorrelation H_0: no first order autocorrelation. Pesaran (2004)'s CD test: H_0: errors are cross sectional independence. ***, **, * denote significance at 1%, 5% and 10%, respectively. Probability is between brackets.

Table 39: Within estimators with robust standard errors. Measure of realignment expectations: EMP

	equation 24	equation 25	equation 22	equation 26
	coefficient	coefficient	coefficient	
ID	0.061***	0.008***	0.225***	
D	0.133*	0.122**	0.145*	
CA	-0.231		-0.285	
Ms	-0.183	-0.266		
eradummy	18.85	19.859**	16.446	
pdummy	-0.205	-0.167	-0.388	
ddummy	-0.163***	-0.141***	-0.141***	
cadummy	-0.015		-0.017	
mdummy	-0.036*	-0.023		
M		0.242		
tdummy		-0.14		
cons	-14.039	-20.144***	-16.696	
Hausman test: Prob>F	(0.000)	(0.000)	(0.000)	

Note: ***, **, * denote significance at 1%, 5% and 10%, respectively. Probability is between brackets.

Table 40: Within estimators with spatial standard errors. Measure of realignment expectations: EMP

	equation 24	equation 25	equation 26
	coefficient	coefficient	coefficient
ID	0.061	0.008	0.225
D	0.133**	0.122*	0.145**
CA	-0.231*		-0.285**
Ms	-0.183	-0.266**	
eradummy	18.850***	19.859***	16.446***
pdummy	-0.205	-0.167**	-0.388***
ddummy	-0.163**	-0.141	-0.141*
cadummy	-0.015		-0.017
mdummy	-0.036	-0.023	
M		0.242*	
tdummy		-0.14	
cons	-14.039***	-20.144***	-16.696***
Hausman: Prob>F	(0.000)	(0.000)	(0.000)

Note: ***, **, * denote significance at 1%, 5% and 10%, respectively. Probability is between brackets.

Table 41: First difference GMM.
Measure of realignment expectations: Interest rate differential.

	equation 24	equation 25	equation 22	equation 26
	coefficient	coefficient	coefficient	coefficient
L.IR	0.254**	0.183*	0.222	0.208
ID	0.472***	0.453***	0.508***	0.544***
Ms	-0.177*	-0.214***		
D	0.021	0.03	0.041	0.034
CA	0.058*		0.021	0.005
R	-1.565	2.474	-6.417**	
pdummy	-0.265**	-0.199**	-0.289***	-0.318***
ddummy	-0.002	-0.009	-0.005	0.003
mdummy	0.08	0.132*		
cadummy	-0.082**		-0.062	-0.043
rdummy	5.006	0.077	7.044***	
eradummy	2.88	-2.809	2.622	2.348
M		-0.153		
tdummy		0.107		
AD				-0.003
addummy				0.003
cons	-0.317	7.232***	-2.327	-2.047
Sargan test: Chi2	(128)=147.37	(128)=139.47	(132)=171.67	(132)=176.46
Sargan test: Prob>Chi2	0.115	0.225	0.011	0.005
Arellano and Bond	0.654	0.718	0.156	0.151

Note: ***, **, * denote significance at 1%, 5% and 10%, respectively. Sargan test tests the validity of overriding restrictions under homoscedasticity assumption. Arellano and Bond tests whether errors are independent at second order.

Table 42: First difference GMM.
Measure of realignment expectations: EMP.

	equation 24	equation 25	equation 26
	coefficient	coefficient	coefficient
L.EMP	-0.133*	-0.081	-0.092
ID	-0.019	0.015	0.134
Ms	-0.072	-0.228	
D	0.152	0.154*	0.153
CA	-0.331***		-0.366***
pdummy	-0.120*	-0.174	-0.300***
mdummy	-0.141**	-0.047	
ddummy	-0.169	-0.167**	-0.146
cadummy	0.051		0.047
eradummy	18.276***	19.315*	14.243**
M		0.161	
tdummy		-0.059	
cons	-14.707**	-20.215	-15.110**
Sargan test: Chi2	125.579	130.253	132.078
Sargan test: Prob>Chi2	0.64	0.403	0.579
Arellano and Bond	0.815	0.926	0.685

Note: ***, **, * denote significance at 1%, 5% and 10%, respectively. Sargan test tests the validity of overriding restrictions under homoscedasticity assumption. Arellano and Bond tests whether errors are independent at second order.

Table 43: Within estimators with default standard errors. Measure of realignment expectations: Interest rate differential. Six countries: Bahamas, Bahrain, Barbados, Belize, Jordan and Oman.

	equation 20	equation 21	equation 22	equation 23
	coefficient	coefficient	coefficient	coefficient
ID	0.244***	0.272***	0.242***	0.222***
D	0.018	0.013	0.023**	0.032**
CA	-0.025**		-0.026***	-0.031*
R	1.91	0.834	1.307	
Ms	-0.023	-0.007		
M		-0.037***		
AD				3.096***
cons	1.122	3.657***	0.627	-1.38
LM test: Chi2 (6)	37	54.01	48.28	40.19
Prob > Chi2	(0.000)	(0.000)	(0.000)	(0.000)
Autocorrelation, F(1,5)	87.14	74.933	94.042	72.079
Prob > F(1,5)	(0.000)	(0.000)	(0.000)	(0.000)
Hausman: Prob>F(5,5) (9)	0	0	0.399	0

Note: Greene (2003)'s LM test for unbalanced panel: H_0: $\sigma_i^2 = \sigma^2$ for all I. Wooldridge (2010)'s autocorrelation H_0: no first order autocorrelation. ***, **, * denote significance at 1%, 5% and 10%, respectively. Standard Errors are between parenthesis. Probability is between brackets.

Chapter 5

Inflation Targeting or Exchange Rate Targeting: Which Framework Supports The Goal of Price Stability in Emerging Market Economies?

5.1 Introduction

Since the introduction of fiat money, inflation has become an important topic in the modern economy. This is because inflation has adverse impacts on economic resources, nominal wages and the intertemporal decisions of market agents. However, the historical evidence of inflation from the last century revealed that the discretionary money standard which are bound to a fixed exchange rate regime and that with an independent central bank were less exposed to high inflation (Bernholz, 2015).[69] Hence, inflationary trends have not been observed before the twentieth century, but with the abandonment of the metallic money standards.[70] Therefore, the inflationary bias that might be created in the absence of monetary rules has highlighted the need for monetary regimes with a clear monetary constitution. Nevertheless, over the last century, monetary regimes that anchor exchange rate to fulfil a certain level of prices have failed to ensure the goal of price stability. Indeed, the success and the prolonged use of exchange rate to fix prices have been questioned after the failure of past fixed exchange rate systems. As a consequence, many countries have moved to adopt different forms of Inflation Targeting (IT), which presupposes an announcement of an inflation rate to achieve the price stability.[71] In effect, IT framework has come virtually as a result of the tenet that monetary policy could achieve the price stability as a prominent goal.[72] Nevertheless, pegged exchange rate regimes with less rigidity, i.e., soft-pegs, are still being widely adopted by some countries.[73]

Nonetheless, despite having a quantitative target to anchoring prices, there is a consensus among economists that the social and financial costs attributed to inflation result mainly from the uncertainty about future inflation. Hence, monetary regimes should be an active tool not only to curb inflation rates, but also to eliminate the uncertainty about future inflation, the role which is essential to ensure the objective of price stability.

In fact, the linkage between inflation and inflation uncertainty have gained attention in the recent literature after the Nobel lecture of Friedman (1977), in which he argues that inflation causes higher inflation uncertainty. The positive relationship between the two variables is theoretically concreted by Ball (1992), who shows that weak policy makers are more likely to permit inflation during high-inflation episodes, generating more inflation

[69] Bernholz (2015) argues that the hyperinflation in the 20^{th} century has not occurred because of Wars as pointed by Capie (1986), but as a results of the movement to adopt discretionary paper money standards.

[70] An inflationary development has become more pronounced after the great depression and later at the outbreak of the World War II.

[71] Note that some central banks also moved to IT after relinquishing the monetary aggregates.

[72] See Thornton (2012) for more details on monetary policy effectiveness.

[73] Pegged exchange rates with 'less rigidity' or soft fixed exchange rates refer to the monetary regime with prices linked to a foreign currency, but the domestic central bank preserves the right to devalue or revalue at its own discretion.

uncertainty. Cukierman and Meltzer (1986), on the other hand, reveal that inflation uncertainty leads to higher inflation. However, it is argued that the causality from inflation uncertainty to inflation might turn negative. Holland (1995) states that central banks could respond to inflation uncertainty through lowering the money stock, and thereby, a negative nexus might appear as a sign of stabilising reaction of monetary policy. Consequently, over the last three decades, questioning the relationship between inflation and inflation uncertainty has encouraged a large number of empirical studies, which attempted to assess the validity of Freidman-Ball (F-B) and Cukierman and Meltzer (C-M) hypotheses. However, an initial difficulty emerged with measuring inflation uncertainty. Early studies on the topic measured inflation uncertainty either as the dispersion of individual forecasts drawn from surveys or as the moving standard deviation of inflation. Nonetheless, it was pointed out that the stress should only be placed on the unpredictable component of inflation uncertainty, which requires a time varying measure of volatility (Ball et al., 1990). The move to use such a measure comes with the development of the Auto Regressive Conditional Heteroskedasticity (ARCH) and Generalised ARCH (GARCH), by Engle (1982) and Bollerslev (1986), respectively.

Therefore, more studies have been conducted to examine the direction of the causality, making use of ARCH and GARCH models to acquire a time-varying measure for the volatility. Nevertheless, empirical studies have failed short to account for the influences of monetary regimes on the relationship between inflation and inflation uncertainty. Indeed, while there has been considerable studies on the relationship between inflation and inflation uncertainty, there has been a few studies, e.g., Chang and He (2010), Kontonikas (2004), Caporale et al. (2010), that have considered the role of monetary regimes on the nexus, but the attention has been given to IT and the euro regime. On the other hand, as far we know, no study, other than Khan et al. (2013), has attempted to compare between two quantitatively-based monetary regimes. Khan et al. (2013) studied the relationship between inflation and inflation uncertainty for Eastern European countries which are either currency boards followers or inflation targeters. However, they fail to address distinctions between the two regimes, and thus, to specify which regime works better at reducing the nominal and real inflation uncertainty. Furthermore, far too little attention has been paid to the cases with soft fixed exchange rates. Even when some cases were considered in the studies, e.g., Daal et al. (2005) and Samimi et al. (2012), researchers have not investigated the relationship between inflation and uncertainty in much detail, i.e., the impact of monetary regimes on the nexus has been ignored.

Hence, with a similar comparison objective of Khan et al. (2013), this chapter attempts

to fill a void in the empirical literature, by investigating the nexus between inflation and inflation uncertainty in emerging market economies under two monetary anchors: a fixed exchange rate (FER) regime to the US dollar and inflation targeting. The aim of this chapter is twofold. Firstly, to validate the F-B and C-M hypotheses under the two regimes. Secondly, to evaluate the plausible effects of adopting a certain quantitative target on inflation uncertainty.

Different GARCH in Mean (GARCH-M) models are constructed to investigate the relationship in two countries adherent to the fixed exchange rate to the US dollar (FER): Jordan and Egypt, and three inflation targeters: South Africa, Brazil and Poland.[74] These countries have experienced a shift in monetary regime. For example, some countries have shifted from monetary aggregates to a FER regime or from a FER system to IT. So, the chapter also highlights how the economy of the examined countries has benefited from the regime under investigation. The GARCH-M model used in our study allows examining the relationship between inflation and inflation uncertainty simultaneously, by incorporating a measure of volatility in the inflation equation. Using an asymmetric GARCH-M type model, we also attempt to assess the response of inflation uncertainty to inflation shocks. In addition, by performing the component GARCH-M model, we capture the impact of monetary regimes, conducted by the above-mentioned countries, on the long-run inflation uncertainty.

Our findings are in the line with F-B and C-M hypotheses. Inflation and inflation uncertainty affect each other positively. Both IT and FER regime appear effective in reducing inflation uncertainty. This suggests the importance of monetary regimes as signalling devices for inflation expectations. The FER regime has no impact on average inflation and inflation persistence, while IT has been successful at lowering average inflation and inflation persistence of its followers. Nevertheless, the results provide evidence that inflation targeting countries have not benefited equally from IT.

The plan of this study is as follows: Section two provides the literature review. Section three discusses the methodology applied. Section four represents the data. The results and concluding remarks are provided in section five and six, respectively.

[74]Poland, South Africa and Brazil are classified as emerging markets by the IMF, Columbia university, FTSE, MSCI and S and P among other lists. Egypt is also considered an emerging market by the FTSE (secondary market), S and P, MSCI and BBVA, while Jordan is labelled by a few lists, e.g., BBVA. Note that Egypt opted out from the fixed exchange rate system, so our study compares between the time during the fixed and after abandoning it.

5.2 Literature Review

It has been widely thought that inflation is a crucial threat to the economic and social stability. Indeed, inflation reduces the value of real income and makes official nominal interest rates a pseudo indicator of monetary policy (Brunner and Meltzer, 1981). Saving and investment decisions are also affected by inflation; savers and investors alike are uncertain about how to avoid being taxed on cash balances and how to minimise the cost of unneeded demand and supply (Sandmo, 1970) (Fischer and Summers, 1989). In addition to the misallocation of economic resources, inflation redistributes the wealth of creditors and debtors and discourages the engagement in long-run contracts.

Nevertheless, it is believed that the costs can be small if inflation is fully anticipated. This notion indicates that the emphasis should be placed on what makes inflation volatile and unpredictable. Hence, the real costs of inflation should be linked to uncontrolled inflation, which affects both the supply and demand sides of the economy, as implied by (Ackley, 1978). Due to unanticipated demand shocks, inflation may increase interest rates, which thereby, impedes investment decisions, reduces the real value of wealth, lowers households spending and encourages imported goods and services. In the absence of indexed inflation wages, inflation can have more adverse impacts on real incomes. On the supply side, inflation distorts the management of economic resources, and adds additional costs to acquire accurate information, which could potentially be costly for small industries. The effect of inflation is also tremendously important in financial markets. This is because it influences both ex-ante and ex-post financial decisions. In fact, as high inflation raises uncertainty about future inflation, market agents tend to ask for higher returns or higher nominal interest rates, while trying at the same time to hedge their wealth by spending more resources to forecast inflation. The forecasts, however, might mispredict the real inflation, leading to inferior redistributive impacts on agents' real balances (Golob, 1994).

Some policy makers and economists suggest that the costs of a predicted low and moderate inflation rate are acceptable and supported by the economic theory. However, Okun (1971) shows that an anticipated rate of steady inflation as implied by accelerationists would be ideal to wind down the social and redistributive costs of inflation, but such steady price level is difficult to achieve due to inflation expectations, which hinge substantially upon the type of government in power and the trade-off between employment and inflation. Consequently, he points out that the acceptance of moderate and steady inflation would trigger higher inflation expectations, which eventually leads to a

higher inflation rate. Furthermore, he hypothesises, by analysing the inflation behaviour for different OECD countries, that high inflation may lead to higher inflation variability, and that high inflation countries experienced higher inflation variability. However, the link between inflation and its uncertainty has gained much interest after the Nobel lecture of Friedman (1977). Friedman states that the relationship between unemployment and nominal wage changes is not stable owning to inflation uncertainty, which increases with level of inflation.[75] Ball (1992) supports the hypothesis suggested by Friedman that high inflation leads to higher inflation uncertainty. He bases his argument on a monetary policy-time inconsistency game theoretical model of Barro and Gordon (1983), where market agents are uncertain about the type of government in power. As long as inflation remains low, both weak and strong types of policy makers will keep it low. Yet, the dilemma appears when inflation could be permitted by the weak policy maker, during high inflation episodes, and thereby, inflation uncertainty will tend to be high when inflation is high. On the other hand, on the basis of the same time inconsistency model, Cukierman and Meltzer (1986) argue that, as central bankers are motivated to create surprise inflation to stimulate the economic activity, an increase in inflation variability raises the level of inflation rate.[76] In other words, for Friedman and Ball, higher inflation creates higher inflation uncertainty, while for Cukieman-Meltzer, the link goes in the other direction, that is, inflation uncertainty increases inflation. Holland (1995), however, shows that a negative link could be an indicator of stabilising effects of monetary framework conducted by central banks.

Therefore, a large number of empirical works has attempted to examine the nexus between inflation and inflation uncertainty using different measures of inflation uncertainty. Glezakos and Nugent (1984) and Pourgerami and Maskus (1987) study the nexus for Latin American countries. While the former suggests that market agents update their inflation expectations adaptively, the latter bases their investigation on rationality of agents, in which responses to changes in inflation happen over shorter horizons. Pourgerami and Maskus (1987) find that, by regressing the absolute value of expected inflation errors on realised inflation, higher inflation hinders the predictability of prices changes. However, their results are weaker compared to Glezakos and Nugent (1984), in which the latter uses the difference between expected and realised inflation as a measure of unpredicted inflation. Nevertheless, as it is not possible in reality to determine the inflation expectations

[75] He further argued that inflation-inflation uncertainty leads to lower output growth; however, this impact is unsettled in the literature and depends on whether money is considered neutral; see e.g., Tobin (1965), Sidrauski (1967), Stockman (1981). However, the recent studies have shown that the link exists in practice, but the effect of inflation on economic growth comes through inflation uncertainty, see Chang and He (2010), Grier et al. (2004). Fountas (2010), on the other hand, finds that output growth is not affected by inflation uncertainty.

[76] Policy makers may increase an optimal inflation rate to benefit from low unemployment, see Tobin (1972), or to lower the public debt, see Fischer and Summers (1989) for further detail.

formation process, employed by market agents, such estimations for the nexus could be misleading (Ungar and Zilberfarb, 1993). Hence, other studies have attempted to investigate the relationship by utilising inflation forecasts gathered from surveys of inflation expectations. Cukierman and Wachtel (1982) use the mean square of inflation forecast error to proxy for inflation uncertainty, whereas (Ungar and Zilberfarb, 1993) adopt two other measures of inflation unpredictability along the mean squared error: the absolute forecast error of Glezakos and Nugent (1984) and the squared forecast error of Pagan et al. (1983). Both studies confirm the existence of a positive relationship between inflation and its unpredictability. Golob (1994) employs the standard deviation of survey participants' inflation forecasts and proves that uncertainty increases with inflation.[77]

Although the survey-based measures were believed to be good proxies for inflation uncertainty, such measures were unable to distinguish between transitory and permanent shocks to inflation, where the latter has a much stronger effect on the intertemporal decision making of individuals and businesses. Thus, Ball et al. (1990) claim that the effect of control errors lasts temporarily and decays over short times, whereas inflation has a severe effect on uncertainty at longer horizons, where permanent shocks dominate. Engle (1982) was the first to measure inflation uncertainty as the conditional variance of inflation to study the relationship between inflation and uncertainty in the United States. In fact, the introduction of Autoregressive Conditional Heteroscedasicity (ARCH) and General Autoregressive Conditional Heteroscedasicity (GARCH) approaches by Engle (1982) and Bollerslev (1986), respectively, encourages a large number of recent empirical work examining the link between inflation and inflation uncertainty.

Evans (1991) constructs a model which allows for the changes in the structure of inflation to affect inflation uncertainty. This is performed by incorporating the different aspects of inflation uncertainty through the Kalman filter: the conditional variance of inflation, the conditional variance of expected inflation and the conditional variance of steady-state inflation. He applies the model to the US during the period 1960:01-1988:06 and concludes that inflation raises inflation uncertainty. Grier and Perry (1998) examine the relationship utilising a GARCH model to produce a proxy for inflation uncertainty in the G7 countries. Their findings from the Granger causality tests suggest that the nexus is positive as implied by F-B, but little evidence is found in favour of the C-M hypothesis. Fountas (2001) and Kontonikas (2004), who apply GARCH and GARCH-M, respectively, find evidence that the F-B hypothesis, for different examined periods, held true for the UK. In fact, most studies have used either GARCH or GARCH-M to investigate the rela-

[77] See also Wachtel (1977) and Carlson (1977).

tionship between inflation and uncertainty, in different countries, reporting mixed results concerning the causality between inflation and uncertainty; whether it goes from inflation to uncertainty or the opposite; others even find the link to be bi-directional. Conrad and Karanasos (2005) find evidence for the Friedman hypothesis in the US and the UK, while the results for Japan show that uncertainty affected the level of inflation as suggested by C-M.

Most of the studies on the link between inflation-inflation uncertainty, e.g., Daal et al. (2005), Grier and Grier (2006), Hwang (2001), Thornton (2007), Payne (2008), Keskek and Orhan (2010), Jiranyakul and Opiela (2011), Hartmann and Herwartz (2012), Fountas and Karanasos (2007), support the Friedman hypothesis. Similarly, Grier and Grier (2006), who apply an augmented multivariate GARCH-M to study the nexus in Mexico, find that high inflation increases inflation uncertainty. On the other hand, Berument et al. (2012) and Fountas (2010) suggest that innovations to uncertainty increases inflation. Some studies, e.g., Thornton (2007), Fountas (2010), Daal et al. (2005), find mixed results for the relationship in some countries, while Balcilar et al (2011) supported both hypotheses for G3 countries. Nevertheless, Hwang (2001) finds, using ARFIMA-GARCH model, no causal nexus between inflation and its uncertainty in the United Stated over the period 1926-1992.

One drawback of GARCH model is that it is unable by its construction to capture the asymmetric responses to positive and negative shocks to inflation. Hence a new family of asymmetric GARCH has evolved to consider the fact that bad news in financial markets has deeper effects than good news (Grier and Perry, 1998). Subsequently, many studies have constructed different models of asymmetric GARCH. Jiranyakul and Opiela (2010) examine the nexus, for five Asian countries: Indonesia, Malaysia, Philippines, Singapore and Thailand, using EGARCH, and find evidence in favour of both the F-B and C-M hypotheses. They note that inflation is a threat, even in low inflation countries, as it leads to increase uncertainty. In a similar vein, Nazar et al. (2010) use the same model to generate a measure for inflation uncertainty in Iran and find that inflation granger causes inflation uncertainty. The same conclusion is reached by Rizvi and Naqvi (2009) and Daal et al. (2005), who study the relationship for Pakistan and a number of emerging market economies and the G7, respectively. However, Daal et al. (2005) show that positive shocks to inflation have more powerful impacts on inflation uncertainty than negative ones, especially in Latin American countries, while Rizvi and Naqvi (2009) find that the opposite is true for Pakistan. Yeh et al. (2011) also found that positive inflation shocks have stronger effects on uncertainty. Wilson (2006) employs EGARCH-M to investigate the link between

inflation-inflation uncertainty-output growth in Japan. His findings are in the line with Friedman (1977), that is, high inflation leads to higher inflation uncertainty and lower productivity. He also finds that negative shocks increase inflation uncertainty more than positive shocks. Fountas et al. (2004) reveal that the relationship between inflation and uncertainty, in five of the six European countries considered in their analysis, over the period 1960-1999, is consistent with the Friedman hypothesis.

A few studies have applied Markov regime switching AutoRegressive Heteroscedastic (SWARCH) model to take account of the monetary regime shifts in investigating the relationship between inflation and inflation uncertainty. For Peru, Castillo et al. (2012) show that the shift to adopt inflation targeting is characterised with less inflation volatility, and that inflation raises inflation uncertainty. Tas and Ertugrul (2013) utilise the SWARCH model to study the impact of inflation targeting on inflation uncertainty for a number of developed and emerging market countries. According to their findings, IT lowers the variance of inflation in most of the countries examined; however, this positive advantage increases with high level of central bank transparency and the institutional arrangements.

In fact, the adoption of inflation targeting across many developed and developing central banks has increased the appetite to discover the benefit of the new framework. Fountas (2001) suggests that the announcement of an explicit inflation target has a prominent effect on lowering inflation persistence and uncertainty at long horizon. Kim (1993) also supports the Friedman hypothesis for the United States as the nexus is found to be positively correlated during high inflation periods. Likewise, Tas and Ertugrul (2013) find that the relationship between inflation and inflation uncertainty is positive and inflation variance has been decreased after IT in most inflation targeters investigated in his study. Similar findings were obtained by Kontonikas (2004) for the UK. Bhar and Mallik (2013) also point out that IT is an optimal anchor for the UK, however, they find that the relationship between inflation and uncertainty has turned to be negative after inflation targeting. Furthermore, Bhar and Mallik (2012) Bhar and Mallik (2013) claim that adopting IT in New Zealand and Australia grant monetary authorities more flexibility in setting the nominal interest rates.[78] Other studies; Neanidis and Savva (2011), Caporale and Kontonikas (2009), Caporale et al. (2010), show that adopting the Euro played a major positive role in affecting the nexus between inflation and uncertainty. The only study which compared between two different monetary regimes: currency boards and inflation targeting, for Eastern European countries, is Khan et al. (2013), who apply EGARCH model and

[78] See also Mallik and Bhar (2011) on the relationship between inflation uncertainty and interest rates for five inflation targeters, and Wright (2011) for the effect of inflation targeting on interest rates.

find support for the Friedman hypothesis. However, the study fails to underline which monetary anchor worked better at reducing inflation uncertainty.

5.3 Methodology

GARCH type models have been widely employed to investigate the relationship between inflation and inflation uncertainty, as they provide a time-varying measure for the volatility.[79] Nevertheless, a standard GARCH model does not allow examining the effect of inflation and inflation uncertainty simultaneously. So, the previous statistical technique to study the direction of the nexus, conducted by some studies, was the two stage approach, under which the conditional variance of inflation is estimated in the first stage, then the Granger causality tests are performed to determine the causal direction of the relationship.[80]

However, GARCH-M, developed by Engle et al. (1987), permits inflation to be specified by inflation uncertainty. Therefore, to investigate the relationship simultaneously, we allow the conditional variance of inflation to be influenced by the mean, and the inflation rate to be determined by the conditional variance. These specifications can be represented as follows:

The mean equation:[81]

$$\pi_t = \alpha_0 + \sum_{t=1}^{p} \alpha_i \pi_{t-i} + \sum_{j=1}^{q} \beta j \varepsilon_{t-j} + \delta \sqrt{h_t} + \varepsilon_t \tag{28}$$

The variance equation:[82]

$$\pi_t = \phi + \sum_{t=1}^{p} \alpha_i \varepsilon_{t-1}^2 + \sum_{j=1}^{q} \beta j h_{t-j} + \lambda Z t - 1 \tag{29}$$

[79] GARCH model is " a weighted average of past squared residuals, but it has declining weights that never go to zero" Engle (2001), and was developed as a solution to shrink the number of ARCH estimated parameters required to capture the dynamic of the conditional variance.

[80] See Nas and Perry (2000) and Grier and Perry (1998). Fountas (2010) incorporates 'in mean coefficients' to capture the effect of inflation uncertainty on inflation. When the effect is found, for some countries, insignificant, he estimates the standard GARCH model, and from the estimated conditional variance he performs Granger causality tests. In the mean equation, he includes lags of inflation uncertainty to consider the inertia of money supply in responding to inflation. The influence of money supply was suggested by Holland (1995), who argues that central banks will respond to inflation uncertainty by reducing money supply and, consequently, decreasing the inflation rate.

[81] In our study, as explained in details in the results section, the mean equation is built on AR specifications rather than ARMA process, so the lagged error terms are excluded.

[82] GARCH model estimates a time-varying variance of residuals which acts as a proxy for unexpected inflation volatility (Daal et al., 2005). The GARCH regression model is built on an autoregressive moving average of a known variable, where the conditional variance is a linear function of its past values and past squared shocks. This model has an ARMA construction which makes the model soluble; however, given its quadratic specification, the model equalises the effect of positive and negative innovations (Zakoian, 1994). Inserting a one-period lagged inflation in the variance equation allows examining the hypothesis of Friedman (1977) and Ball (1992).

Where π_{t-i} is the lagged inflation rate; ε_{t-j} is the lagged errors and ε_t is the error term, which has conditional and unconditional mean of zero and conditional variance, h_t, given by equation 29. The conditional variance is determined by the lagged squared residuals, the lagged conditional variance and Z_{t-1}, which includes only lags of inflation. Stationarity restrictions of the model entail that α_i and βj, the non-negative parameters, must be less that unity. If the sum of the parameters is equal to one, the conditional variance must be modelled by Integrated GARCH (Harvey, 2013).

If δ in the mean equation is significantly positive, higher inflation uncertainty generates higher inflation, as argued by C-M. On the other hand, when the coefficient is significantly negative, the Holland's hypothesis of monetary policy stabilising effect holds true. λ in equation 29 determines the effect of inflation on inflation uncertainty. Obtaining a positive and significant coefficient indicates that inflation uncertainty increases with inflation, as suggested by F-B.

Nevertheless, the conditional variance of inflation estimated by GARCH-M is formed to consider only the magnitude of inflation shocks, ε_{t-1}^2, and thereby the sign of innovations is ignored by the model construction. Hence, to account for possible asymmetric responses to positive and negative inflation shocks, an asymmetric GARCH model, i.e., Exponential GARCH, is used.

The conditional variance in the EGARCH model, put forward by Nelson (1991), is set in an algorithmic form, which does not require imposing artificially non-negativity constraints on the parameters to ensure a positive variance. The model representation can be seen as follows:

$$\log h_t^2 = \varphi + \beta_1[|\frac{\varepsilon_{t-1}}{h_{t-1}}|] + \beta_2[\frac{\varepsilon_{t-1}}{h_{t-1}}] + \beta_3 \log h_{t-1}^2 + \lambda Z_{t-1} \tag{30}$$

In this case, an asymmetric response to inflation shocks exists if $\beta_2 \neq 0$. A significantly positive β_2 implies that the inflation uncertainty increases more when the economy is hit by a positive shock, i.e., $\varepsilon_{t-1}>0$, than a negative inflation shock, i.e., $\varepsilon_{t-1}<0$ (Wilson, 2006).

Nevertheless, as policy makers are more concerned about the long-run impact of inflation uncertainty, and more importantly the impact of monetary anchor on reducing inflation uncertainty in the long-run, we utilise the Component GARCH (CGARCH), developed by Lee and Engle (1993). This model separates the long-run from short-run

components of inflation uncertainty by allowing the mean of the conditional variance to vary around a time varying level, φ.

$$h_t = \varphi_t + \alpha_1(e^2_{t-1} - \varphi_{t-1}) + \beta_1(h_{t-1} + \varphi_{t-1} \tag{31}$$

φ.

$$h_t = \varphi + \rho\varphi_{t-1} + \mu(e^2_{t-1} - h_{t-1}) + \lambda Z_{t-1} \tag{32}$$

Equation 31 represents the transitory component, which approaches zero with the power of $\alpha_1 + \beta_1$. ρ in the long run component, shown in equation 32, is usually close to one, as the time varying trend converges to the mean very slowly. If, $1>\rho>\alpha_1+\beta_1$, the short run component of inflation uncertainty will die out rapidly more than the trend. This indicates that the forecasts of the conditional variance will depend essentially upon the trend (Kontonikas, 2004).

5.4 Data

Monthly data on Consumer Price Index (CPI) for the period from 1980:01 to 2014:06 are extracted from the International Financial Statistics of the International Monetary Fund for the two FER countries: Jordan and Egypt, and the three inflation targeters: South Africa, Brazil and Poland. The monetary regime shift experienced by all the countries allows to spot the benefits of the examined regime in terms of inflation and inflation uncertainty.

Inflation is computed as 'π_t = [log cpi$_t$ - log cpi$_{t-1}$]'. The inflation series is then adjusted to remove the seasonality by executing the Census Bureaus X12 in an additive default mode. Table 44 shows the summary statistics of the inflation series properties for each respective country. The statistics of the average inflation, displayed in Table 44-Panel(a), reveal that inflation targeting countries have experienced a marked lower average inflation after shifting to IT. However, this direct effect of the monetary anchor on inflation process is not obvious for the two fixed exchange rate targeters.[83]

The statistics, reported in Table 44-Panel(b), indicate that the distribution of inflation is heavy-tailed. For all the countries, the distribution is positively skewed and leptokurtic, and inflation series failed to satisfy Jarque and Bera (1980) for normality. This asymmetry and peakness of the distribution are considered in modelling the relationship between inflation and inflation uncertainty by using a Generalised Error Distribution (GED) with

[83]This cannot be attributed to the recent economic and political disturbances in the Middle East region. The two countries have been reeling from unstable political and social conditions for the full period of the study.

normalised density of zero mean and unity variance, in which the normal distribution is a special case Nelson (1991).[84]

The seasonally adjusted inflation series for each country exhibits stationary process, as shown in Table 45. According to Dickey and Fuller (1979) (ADF) and Phillips and Perron (1988) (PP) tests, with and without a trend, the null hypothesis that inflation contains a unit root is rejected at a high level of significance. However, the two tests have been challenged since they ignore treating structural breaks in the data, the drawback which might result in a bias for nonrejection the null hypothesis. Hence, we perform Zivot and Andrews (2002) (ZA) test, which accounts for the presence of a structural break, where a data dependent algorithm is utilised to proxy Perron (1989)'s subjective procedure in order to select the break points (Waheed et al., 2006).[85]We select to perform the model (C), which permits a one-time change in the constant and slope of the trend function of the seasonally adjusted inflation. The null hypothesis of a unit root without a break is rejected for all the countries analysed against the alternative of a stationary series with a break.

Breusch and Godfrey test for serial correlation is first executed to ensure the whiteness of residuals before testing for ARCH effect. The results, presented in Table 44-Panel(b), imply that the inflation series' residuals are serially independent and conditionally heteroskedastic. We also assess whether inflation exhibits a structural change due to monetary regime shift. For this, Chow test for stability is applied to the point when the regime is supposed to commence. All the countries examined, except Poland, show a structural break during the shift time as the Chow breakpoint's F-statistics significantly rejects the null of no structural break in inflation at 1%.[86]

5.5 Results

The conditional mean of inflation is specified by constructing several ARMA models. Given that inflation is seasonally adjusted, it is found that including only the autoregressive terms yields the best model specifications, which is the common case in modelling inflation in the empirical literature (Kontonikas, 2004). For each country, we begin by

[84]This cannot be attributed to the recent economic and political disturbances in the Middle East region. The two countries have been reeling from unstable political and social conditions for the full period of the study.

[85]The determination of the exact time of the break is an endogenous function of the estimation, so the critical values of Zivot and Andrews (2002) is different from those of Perron (1989) (Glynn et al., 2007).

[86]The structural break is found to start in 1990 not 1998 when IT was adopted. This goes back to the economic structure of the Polish economy, which was subject to different monetary regimes during 1990s. The country moved from a firm fixed exchange rate to the US dollar, adopted in 1990, to a crawling peg a year later, then IT was adopted in September 1998. For more details, see Horská et al. (2001) and Jonas and Mishkin (2004).

incorporating up to twelve AR specifications to allow capturing the persistence of the data. The length of AR components is shortened on the basis of Akaike and Schwartz information criteria and by ensuring that all autocorrelation coefficients up to twelve lags fall inside the non-rejection region, which is also confirmed by the Q-statistics of Box and Pierce (1970). Accordingly, the selected AR process forms the following benchmark-mean specifications:

Jordan:

$$\pi_t = \gamma_0^{JO} + \gamma_1^{JO}\pi_{t-2} + \gamma_2^{JO}\pi_{t-5} + \gamma_3^{JO}\pi_{t-9} + \gamma_4^{JO}\pi_{t-12} + u_t \tag{33}$$

Egypt:

$$\pi_t = \gamma_0^{EG} + \gamma_1^{EG}\pi_{t-1} + \gamma_2^{EG}\pi_{t-9} + \gamma_3^{EG}\pi_{t-12} + u_t \tag{34}$$

South Africa:

$$\begin{aligned}\pi_t = \gamma_0^{SA} + \gamma_1^{SA}\pi_{t-1} + \gamma_2^{SA}\pi_{t-2} + \gamma_3^{SA}\pi_{t-3} + \gamma_4^{SA}\pi_{t-7} \\ +\gamma_5^{SA}\pi_{t-8} + \gamma_6^{SA}\pi_{t-11} + \gamma_7^{SA}\pi_{t-12} + u_t\end{aligned} \tag{35}$$

Brazil:

$$\pi_t = \gamma_0^{BR} + \gamma_1^{BR}\pi_{t-1} + \gamma_2^{BR}\pi_{t-2} + \gamma_3^{BR}\pi_{t-8} + u_t \tag{36}$$

Poland:

$$\pi_t = \gamma_0^{PO} + \gamma_1^{PO}\pi_{t-1} + \gamma_2^{PO}\pi_{t-2} + \gamma_3^{PO}\pi_{t-5} + \gamma_4^{PO}\pi_{t-9} + \gamma_5^{PO}\pi_{t-11} + u_t \tag{37}$$

For each country, we split the inflation series between the time before and after adopting the monetary regime of interest. The preliminary evidence from the OLS regression of the benchmark models, shown in Tables 46 to 50, suggests that IT has been successful at reducing the volatility of inflation as ARCH effect turned insignificant after adopting IT. Interestingly, for Egypt, inflation volatility has become stable not during the fixed exchange rate system but after opting out, while for Jordan, the impact of the exchange rate targeting is unclear as the volatility for the period after exchange rate targeting is found at high lags.

For our motivation to examine the simultaneous relationship between inflation and inflation uncertainty, we incorporate the standard deviation in the mean equation as a volatility measure and augment the variance equation with lagged inflation.[87] Furthermore, to model the impact of monetary regime on inflation dynamics, slope dummies are plugged in the conditional mean equations, in which the dummy takes the value of one when the examined monetary regime is in effect, and zero otherwise. We first attempt to introduce the regime slope dummies via different lags, but only two interactive dummies

[87] Inserting S.D in the mean equation is used by Baillie et al. (1996) and Kontonikas (2004).

are selected to interact with their corresponding inflation lags based upon a significant improvement in the fit of the model. We also employ a constant regime dummy in the mean equation for the cases where doing so is found to substantially improve the overall statistical performance. In addition, we account for political circumstances in some countries. For the two exchange rate targeters, a dummy variable is added to the mean equation to capture the impact of the Arab Spring on average inflation, in which the dummy is assigned one for the period from 2011:01 onwards.[88] For South Africa, a constant dummy is included to consider the effect of apartheid on inflation, which takes the value of one for the period before January 1995, and zero for the months after. Hence, the augmented mean equations can be represented as follows:

Jordan:

$$\pi_t = (\delta_1^{JO} + \delta_3^{JO})\pi_{t-2} + \delta_4^{JO}\pi_{t-5} + \delta_5^{JO}\pi_{t-9} + (\gamma_2^{JO} + \delta_6^{JO})\pi_{t-12} + u_t \tag{38}$$

Egypt:

$$\pi_t = (\delta_1^{EG} + \delta_3^{EG})\pi_{t-1} + \delta_4^{EG}\pi_{t-9} + (\gamma_2^{EG} + \delta_5^{EG})\pi_{t-12} + u_t \tag{39}$$

South Africa:

$$\begin{aligned}\pi_t = (\delta_1^{SA} + \delta_3^{SA})\pi_{t-1} + \delta_4^{SA}\pi_{t-2} + \delta_5^{SA}\pi t - 3 + \delta_6^{SA}\pi_{t-7} \\ +\delta_7^{SA}\pi_{t-8} + \delta_8^{SA}\pi_{t-11} + (\delta_2^{SA} + \delta_9^{SA})\pi_{t-12} + u_t\end{aligned} \tag{40}$$

Brazil:

$$\pi_t = (\delta_1^{BR} + \delta_3^{BR})\pi_{t-1} + \delta_4^{BR}\pi_{t-2} + (\delta_2^{BR} + \delta_5^{BR})\pi_{t-8} + u_t \tag{41}$$

Poland:

$$\begin{aligned}\pi_t = (\delta_1^{PO} + \delta_3^{PO})\pi_{t-1} + \delta_4^{PO}\pi_{t-2} + (\delta_2^{PO} \\ +\delta_5^{PO})\pi_{t-5} + \delta_6^{PO}\pi_{t-9} + \delta_7^{PO}\pi_{t-11} + u_t\end{aligned} \tag{42}$$

A joint significance of the interactive regime dummies is confirmed by a Wald test of $\delta_1 = \delta_2 = 0$. For each country, Chi-quare statistics reject the hypothesis that the dummies are zero at 1% level of significance, as shown in the last row of Tables 51 to 57. The effect of the monetary regime on inflation inertia is reflected by the sum of the coefficients of the regime interactive dummy and that of their corresponding lags. A negative slope dummy indicates that inflation persistence has declined after adopting the examined regime.[89] The results, reported in Tables 51 to 57, imply that IT has been successful at reducing inflation

[88] The unrest and tensions across the Middle East spread to Jordan and had negative effects on the economy. For instance, the pipelines that carried gas from Egypt to Jordan were targeted and bombed several times during the uprising, resulting in oil supply shortage. As a consequence, Jordan was forced to deal with Israel to import Gas, as Israel has become a major gas exporter in the region. However, the pace to deal with Israel triggered more domestic opposition and increased the external debt; see the Daily Mail on 11^{th} December 2014 for more details. The Arab Spring countries are still, at the time of writing this, being affected by the adverse consequences of the social unrest.

[89] Note that, as stated by Kontonikas (2004), the effect of inflation regime on the inflation persistence is preferred to be analysed in the context of the kalman filter.

persistence at a high lag order, as the coefficients of the second interactive dummies, i.e., δ_2, appear with a negative sign. This, however, does not apply to Poland, where all the slope dummies are non-negative, but its regime constant dummy, D_t, plugged in the mean equation, shows that the mean of inflation was reduced by IT; this also applies to all the ITers in the sample.[90] For South Africa, the years of apartheid were associated with higher average inflation, as the constant dummy, APART, presented in Table 55, is significantly positive under all GARCH models. For Egypt and Jordan, the Arab Spring dummy is found insignificant as a constant, but its slope, pol, reported in Tables 51 and 53, has a positive and significant influence on the trend at 1%.[91] Unlike the ITers, the inflation mean of the FER targeters is not affected by the fixed exchange rate regime. The dummy appears insignificant for Jordan and positive for Egypt. Nonetheless, the FER system appears to be influential in lowering the inflation inertia in Egypt and Jordan at the first inflation lag.

The parameter estimates of the inflation uncertainty proxy, incorporated in the mean equation, have a significantly positive sign for all the countries, indicating that inflation uncertainty increases inflation, as argued by C-M. On the other hand, we find support for the F-B hypothesis; inflation does generate inflation uncertainty, irrespective of the regime followed. Remarkably, the coefficient of the inflation regime slope dummy, λ_1, employed in the variance equation, is significant and negative in all the respective countries; however, the magnitude of the effect is almost negligible for Egypt.[92] Nevertheless, the significance proves that both regimes could to a certain extent reduce inflation uncertainty, albeit not directly via decreasing the mean of inflation for FER targeters.

The results of asymmetric responses to increasing or falling in inflation are inconsistent for all the cases. For Jordan, the results imply that both negative and positive inflation shocks have the same influence on inflation uncertainty. The positive and significant β_2 for Egypt, presented in the second column, EGARCH, of Table 53, indicates that positive shocks trigger more conditional inflation uncertainty than negative shocks. Similarity, for Brazil, the asymmetric coefficient, presented in Tables 56, suggests that inflation uncertainty increases following a positive inflation shock. However, no asymmetry is found for the two other ITers, implying that inflation uncertainty process is not influenced by the

[90] We did not report the results with a constant dummy for the other ITers as the results were found to be better off, in terms of diagnostics, without adding the regime constant. However, the constant dummy appeared with a negative sign for all the IT cases. We also attempted to incorporate the regime dummy variable in the variance equations, but the dummy was insignificant for all the cases.

[91] Note that the ARCH effect exists in the estimated EGARCH-M model for Egypt, indicating that the model is not well specified. In general, for both countries, all GARCH-M models showed better results when the Pol-slope dummy and the regime constant dummy were dropped from the mean equation, see Table 51 and 53.

[92] Note that this ignores the models estimated for Egypt and Jordan with slope political dummy and regime constant dummy.

direction of inflation shocks.

Interestingly, the slope regime dummy, λ_1, incorporated in the mean equation, remains negative for all the countries after controlling for asymmetries. Even when CGARCH-M is used in modelling the inflation variance, the slope dummy has a significantly negative sign for all the countries, except for South Africa, where the dummy turns insignificant. This finding suggests that FER system and IT alike are effective in reducing inflation uncertainty in the long run. Generally, the inflation trend of the ITers approaches the mean quicker than that of the FER targeting countries. The power of the short-run component of inflation uncertainty is also higher in the FER targeters. The diagnostic statistics, reported below each estimated GARCH model, from Table 51 to Table 57, indicate that the GARCH models are well-specified. The 1^{st} and 12^{th} lag order of Ljung-Box and the 12^{th} lag squared residuals as well as the LM test for ARCH suggest neither remaining autocorrelation nor a non-constant variance for all the countries, except for Poland, where ARCH effect remains in the error terms.[93]

The findings of a positive bi-directional relationship between inflation and inflation uncertainty suggest the need for a monetary anchor to reduce both inflation and uncertain inflation. In general, inflation targeting countries enjoy lower average inflation and inflation persistence compared to the time before adopting IT and to the countries with FER regime. The two monetary regimes appear effective in reducing inflation uncertainty, even under the presence of asymmetries in some cases, like Brazil, Sweden and Egypt. The effect also remains in the long run, except for South Africa.

For FER countries, the benefits of the regime are not reflected in lower average inflation and inflation inertia and a stable volatility. The constant regime dummy variable, incorporated in the mean equation, is found to be insignificant for Jordan and positive for Egypt, and although the FER system appears effective in reducing uncertain inflation, the magnitude of the regime dummy coefficient is close to zero for Egypt. It could be argued that anchoring the exchange rate could still influence inflation uncertainty as long as the possibility to renege on FER commitment is not perceived by the market. The several depreciations in the Egyptian Pound affected the mechanism of the FER system and its credibility in the market. The weak economic institutions and dependency on political authority due to the absence of mutual and clear vision between the central bank

[93]Poland adopted different monetary regimes during the 1990s. Moreover, Cuestas et al. (2012) find that the Polish inflation rates are co-moved with that of the Euro Zone. When the sample is splitted to cover the time after IT, all GARCH models exhibit no remaining ARCH effect.

and government might hamper the role of FER as a device for decreasing inflation and inflation uncertainty. It could be argued that providing the market with a quantitative target for the price stability objective would not be optimal if it was not accompanied with a clear central bank's personality, roles and objectives, the features which distinguish IT framework.

The results provide evidence, represented by lower inflation and inflation persistence for inflation targeting countries, that the framework which has a direct quantitative target of prices could be a better signalling device than the soft peg. The institutional features which accompany adopting IT might uphold the economy to move from high inflation to low inflation levels, as the credibility of the system, and thereby the policy outcome, hinges upon the development of monetary constitutions and transparent policies. The differences in such institutional arrangements might explain why the advantages of the monetary framework differ across countries.

5.6 Conclusions

This chapter investigates the relationship between inflation and inflation uncertainty under two monetary regimes with a nominal price level target: inflation targeting and a soft fixed exchange rate regime. In fact, given the important monetary implications of the nexus between inflation-inflation uncertainty, a large number of studies have been carried out to examine whether inflation causes inflation uncertainty, as suggested by Friedman (1977) or inflation uncertainty leads to higher inflation as stated by Cukierman and Meltzer (1986). However, a few studies have shed light on the plausible influence of each regime on reducing inflation uncertainty. This study is carried out to fill the gap in the literature by empirically assessing the validity of the Friedman and Cukierman-Meltzer hypotheses under the two regimes and examining the effect of monetary regimes on the relationship between inflation and inflation uncertainty. In particular, it is aimed to investigate the impact of quantitative targets of monetary policy upon reducing inflation uncertainty. To do this, we utilise the monthly CPI data collected from the IMF-IFS database of two fixed exchange rate targeters: Jordan and Egypt, and three inflation targeting countries: South Africa, Brazil and Poland, over the span 01:1980-06:2014.

In order to examine the two hypotheses simultaneously, we apply GARCH-M model, which allows the inflation rate to be determined by the conditional variance. We incorporate the standard deviation as a proxy for inflation uncertainty in the mean equation and augment the variance equation with lagged inflation. Nevertheless, as inflation series

exhibit positive skewness and leptokurtosis, all the GARCH models are estimated with the assumption that the errors have a generalised error distribution. The impact of the regime is assessed by employing a constant and regimes slope dummy. For each country we start by constructing different ARMA structures. The general to specific approach leads to AR specifications which ensure the whiteness of the residuals. The regimes dummies are introduced to different lags of inflation, but only two interactive dummies are selected to be imposed on the mean equation, based on the improvement in the model fit. Furthermore, we account for the time of apartheid in South Africa and the political disturbances, due to the Arab Spring, in Jordan and Egypt. The results from the OLS of the conditional mean of inflation, run to the time before and after adopting the examined regime, reveal that inflation targeters, unlike fixed exchange rate countries, have experienced stable prices after IT. The "IT regime" constant dummy variable, plugged in the mean equation, is found significant and negative, reflecting the direct effect of the regime on lowering the average inflation.[94] This is confirmed by the statistics of average inflation, in which the ITers have enjoyed lower average inflation after shifting to IT. On contrary, such desirable effect is not found for exchange rate targeters, as the regime constant dummy appears significantly positive for Egypt, and insignificant for Jordan. Political dummies incorporated for the two exchange rate targeters and South Africa are found to positively affect the inflation trend and the mean.

As the construction of GARCH-M considers only the magnitude of inflation shocks, we apply asymmetric GARCH-M type model to account for the responses of the conditional inflation uncertainty to increasing or falling in inflation. More importantly, the long-run effect of inflation on inflation uncertainty is examined by the CGARCH-M, which allows decomposing the short-run from the long-run component.

The relationship between inflation and inflation uncertainty appear to be consistent with Friedman and Cukierman-Meltzer hypotheses. The parameters estimate of inflation uncertainty proxy and the one-period lagged inflation, from all the GARCH-M models and for all the countries, are significantly positive. The asymmetric GARCH specifications show that inflation affected the process of inflation uncertainty differently in Egypt and Brazil, while for Jordan, South Africa and Poland, the conditional inflation uncertainty is not influenced by the direction of inflation shocks.

The impact of the monetary regime on inflation uncertainty is examined by employing the slope inflation dummy in the conditional variance equation for all GARCH-M mod-

[94] The results with a regime constant dummy reported only for the case of Poland.

els. A negative and significant parameter indicates that inflation is reduced across all the countries, irrespective of the monetary regime followed by the central bank. The negative effect holds even when we account for asymmetries; the slope dummy remains with a negative sign. Nevertheless, the influence of the regime is not clear for Egypt, as the coefficient appears with weak magnitude. This could be due to the instability of the soft exchange rate regime in Egypt during the analysed period.[95]

The negative estimates of the slope dummy under the CGARCH-M reflects the ability of both regimes to reduce inflation uncertainty in the long-run; however, this effect is found to be insignificant for South Africa. It is also noted that the inflation trend of fixed exchange rate targeters converges to the mean slower that that of the ITers.

In general, the study has made a way towards enhancing the understanding of the effectiveness of announcing an explicit quantitative target on inflation uncertainty. Furthermore, the positive relationship found between inflation and inflation uncertainty in both directions underlines that a monetary regime with an ultimate goal of price stability is a necessity to keep inflation and inflation uncertainty constrained. Additionally, our findings add to the growing body of literature on the importance of inflation targeting as a framework for monetary policy. IT, according to our results, appears effective in lowering the inflation persistence and inflation uncertainty more than the soft fixed exchange rate regime. However, it is shown that ITers have not equally benefited from IT. One possible explanation for this might be due to the institutional differences among countries in terms of the level of central bank independence and transparency. Therefore, for further contributions, it would be of important interest to analyse the plausible impacts of independent monetary practices and constitutions on inflation and inflation uncertainty, under the two regimes, especially is that exchange rate fixers usually enjoy less institutional and economic independence.[96]

[95] Exchange rate devaluations occurred between 1991 and 1992. In 2001, the government announced a new parity to the US dollar and shifted gradually to a crawling peg system then the central bank abandoned the fixed system in January 2003.

[96] Note that countries under the fixed exchange rate lose monetary freedom, as they have to keep their monetary policies in tune with the base country, but they can still ensure institutional independence from the political authority.

Table 44: : Inflation Properties

	Jordan	South Africa	Egypt	Brazil	Poland
Panel (a)					
Average	2.12	3.88	4.6	33.95	4.44
Maximum	37.65	18.81	51.51	361.23	46.78
Minimum	-34.65	-3.87	-36.16	-2.66	-7.68
Average-New Anchor	3.43	1.83	4.92	2.77	2.32
Average-Before	2.62	4.91	3.96	58.04	6.25
Panel (b)					
Skewness	0.65	0.78	0.95	2.45	2.75
Kurtosis	9.22	4.57	9.575	10.31	15.59
ARCH effect	8.20***	23.01***	76.12***	27.36***	19.56***
Breusch-Godfrey LM	1.86	3.8	0.53	1.27	4.81
Jarque-Bera	1385.88	331.09	2226.67	7703.5	942.89
Chow Breakpoint	3.01**	3.07***	3.58***	3.68**	1.25

Note: Average-New anchor represents the average of inflation for each country for the adoption period of the monetary regime under investigation. Average-Before shows the average before adopting the examined regime. However, since Egypt opted out of the pegged exchange rate regime in January 2003, the average of the new anchor reflects the average during the exchange rate targeting, and hence, the Average-Before is the average after abandoning the fixed exchange rate system. Brazil was subject to hyperinflation during 1980s until March 1994 owning to the default related fear of the international government debt, see Garcia (1996) for more details. The statistics reported under the Breusch-Godfrey LM test shows the Obs*R-squared statistics with a chi-squared distribution. The null hypothesis of the test is that there is no autocorrelation up to lag order 'p'. ARCH effect test is a Lagrange multiplier test, by Engle (1982), in which the null hypothesis indicates homoskedasticity.

Table 45: : Unit Root Tests

	ADF constant	ADF constant/trend	PP constant	PP constant/trend	ZA t-statistics	ZA break
Jordan	-12.05***	-12.07***	-19.02***	-19.01***	-7.34**	1991:04
South Africa	-5.75***	-10.16***	-15.71***	-17.41***	-7.96***	1992:01
Egypt	-24.35***	-24.94***	-23.88***	-24.55***	-25.99***	1991:11
Brazil	-3.97***	-4.64***	-6.13***	-7.59***	-9.93***	1994:07
Poland	-3.52***	-3.91**	-14.21***	-14.94***	-6.95***	1989:12

Note: In the ADF test, the lag length is determined by Schwartz information criterion, while for the Phillips and Perron test, the default Bartlett Kernel and Newy-West bandwidth are used. In the Zivot-Andrews test, the optimal lag length is selected on the basis of Akaike information criteria. The asterisks ***, **, * denote rejection of the null hypothesis, i.e., inflation has a unit root for the ADF and PP tests and unit root with no break for the ZA test, at 1%, 5% and 10% levels of significance, respectively.

Table 46: OLS estimates of inflation conditional mean for Jordan 33

	full sample	**pre-target**	**post-target**
coefficient	1981:02-2014:06	1981:02-1995:09	1995:10-2014:06
γ_0^{JO}	0.003***	0.004***	0.003***
γ_2^{JO}	0.117**	0.154**	0.002
γ_5^{JO}	0.173***	0.259***	-0.031
γ_9^{JO}	0.099**	0.125*	0.019
γ_{12}^{JO}	-0.100**	-0.082	-0.174***
ARCH(1)	8.20***	5.68**	0.218
ARCH(2)	17.36***	13.70***	0.217
ARCH(12)	26.66***	20.25*	21.13**

Note: ARCH(1), ARCH(2) and ARCH(12) are ARCH test at 1^{st}, 2^{nd} and 12^{th} lag, respectively.

Table 47: OLS estimates of inflation conditional mean for Egypt 34

	full sample	**during-target**	**opting out**
coefficient	1981:02-2014:06	1981:02-2002:12	2003:01-2014:06
γ_0^{EG}	0.008***	0.009***	0.007***
γ_1^{EG}	-0.155***	-0.199***	0.380***
γ_9^{EG}	0.124***	0.142**	-0.098
γ_{12}^{EG}	-0.144***	-0.144***	-0.084
ARCH(1)	65.02***	38.68***	0.162
ARCH(2)	71.46***	42.85***	0.249
ARCH(12)	104.90***	62.33***	8.85

Note: ARCH(1), ARCH(2) and ARCH(12) are ARCH test at 1^{st}, 2^{nd} and 12^{th} lag, respectively.

Table 48: OLS estimates of inflation conditional mean for South Africa 35

	full sample	**pre-target**	**post-target**
coefficient	1981:02-2014:06	1981:02-2000:01	2000:02-2014:06
γ_0^{SA}	0.007***	0.008***	0.004***
γ_1^{SA}	0.231***	0.139**	0.397***
γ_2^{SA}	0.213***	0.228***	0.048
γ_3^{SA}	0.134***	0.108*	0.176
γ_7^{SA}	0.131***	0.173***	-0.032
γ_8^{SA}	0.100***	0.106*	0.07
γ_{11}^{SA}	0.106***	0.114**	0.003
γ_{12}^{SA}	-0.124***	-0.089	-0.214***
ARCH(1)	34.47***	12.82***	0.27
ARCH(2)	34.90***	13.16***	1.77
ARCH(12)	56.67***	26.60***	18.12

Note: ARCH(1), ARCH(2) and ARCH(12) are ARCH test at 1^{st}, 2^{nd} and 12^{th} lag, respectively.

Table 49: OLS estimates of inflation conditional mean for Brazil 36

	full sample	**pre-target**	**post-target**
coefficient	1981:02-2014:06	1981:02-1999:06	1999:07-2014:06
γ_0^{BR}	0.063**	0.110***	0.005***
γ_1^{BR}	0.462***	0.447***	0.741***
γ_2^{BR}	0.367***	0.358***	-0.062
γ_8^{BR}	0.085**	0.065	0.035
ARCH(1)	25.58***	13.08***	1.29
ARCH(2)	25.69***	13.13***	4.36
ARCH(12)	29.16***	14.63	8.3

Note: ARCH(1), ARCH(2) and ARCH(12) are ARCH test at 1^{st}, 2^{nd} and 12^{th} lag, respectively.

Table 50: OLS estimates of inflation conditional mean for Poland 37

	full sample	**pre-target**	**post-target**
coefficient	1981:02-2014:06	1981:02-1998:08	1998:09-2014:06
γ_0^{PO}	0.008***	0.013***	0.003***
γ_1^{PO}	0.218***	0.181***	0.294***
γ_2^{PO}	0.232***	0.221***	0.136*
γ_5^{PO}	0.138***	0.118*	0.128*
γ_9^{PO}	0.114**	0.099	0.093
γ_{11}^{PO}	0.181***	0.177***	0.113
ARCH(1)	19.96***	8.34***	0.02
ARCH(2)	20.61***	9.79***	0.03
ARCH(12)	36.78***	18.46	1.4

Note: ARCH(1), ARCH(2) and ARCH(12) are ARCH test at 1^{st}, 2^{nd} and 12^{th} lag, respectively.

Table 51: : GARCH-M models for Jordan 38 (with dummies)

Coefficients	GARCH-M	EGARCH-M
Conditional mean		
D_t	-3.97E-04	-3.20E-04
Pol	0.176***	0.187***
δ_1^{JO}	-0.148***	-0.125***
δ_2^{JO}	0.091***	0.077***
δ_3^{JO}	0.116***	0.081***
δ_4^{JO}	0.061**	0.047**
δ_5^{JO}	0.036	0.019
δ_6^{JO}	-0.207***	-0.208***
δ	0.328***	0.337***
conditional variance		
ϕ	7.47E-06**	-1.590***
α_1	0.027	
β_1	0.810***	0.127
β_2		0.142
λ_0	0.003***	19.19
λ_1	-0.002***	-25.67***
diagnostic statistics		
	$Q(1)$=2.15	$Q(1)$=1.27
	$Q(12)$=13.22	$Q(12)$=13.70
	$Q^2(12)$=14.05	$Q^2(4)$=13.94
	$TR^2(12)$=14.6	$TR^2(12)$=14.28
Wald test	20.7***	

Note: δ tests the validity of Cukierman and Meltzer (1986) hypothesis, where a positive δ indicates that inflation uncertainty increases inflation. λ_0 is the one-period lagged inflation and tests the validity of Friedman (1977)-Ball (1992) hypothesis, where a positive λ_0 means that inflation raises inflation uncertainty. D_t is the constant-monetary regime, i.e., fixed exchange rate system, dummy variable. Pol is the slope dummy that acts for the effect of Arab Spring on average inflation. Wald test examines the significance of the interactive regime dummy, i.e., $\lambda_1 = \lambda_2 = 0$.

Table 52: : GARCH-M models for Jordan 38 (without dummies)

Coefficients	GARCH-M	EGARCH-M	CGARCH-M
Conditional mean			
δ_1^{JO}	-0.143***	-0.131***	-0.139***
δ_2^{JO}	0.063*	0.026	0.051
δ_3^{JO}	0.095**	0.085***	0.117***
δ_4^{JO}	0.059**	0.113***	0.063**
δ_5^{JO}	0.058**	0.045***	0.044*
δ_6^{JO}	-0.194***	-0.153***	-0.179***
δ	0.361***	0.341***	0.338***
conditional variance			
ϕ	7.95E-06**	-2.493**	4.74E-05
α_1	0.034		0.005
β_1	0.785***	0.121	0.764
β_2		0.052	
λ_0	0.003***	28.851*	0.003***
λ_1	-0.002**	-24.709*	-0.003**
τ			
μ			0.025
ρ			0.823***
diagnostic statistics			
	$Q(1)$=2.21	$Q(1)$=2.34	$Q(1)$=2.27
	$Q(12)$=12.23	$Q(12)$=17.85	$Q(12)$=13.01
	$Q^2(12)$=14.71	$Q^2(12)$=21.18	$Q^2(12)$15.26
	$\text{TR}^2(12)$=15.22	$\text{TR}^2(12)$=21.05	$\text{TR}^2(12)$=15.82
Wald test	10.58***		

Note: δ tests the validity of Cukierman and Meltzer (1986) hypothesis, where a positive δ indicates that inflation uncertainty increases inflation. λ_0 is the one-period lagged inflation and tests the validity of Friedman (1977)-Ball (1992) hypothesis, where a positive λ_0 means that inflation raises inflation uncertainty. Wald test examines the significance of the interactive regime dummy, i.e., $\lambda_1 = \lambda_2 = 0$.

Table 53: : GARCH-M models for Egypt 39 (with dummies)

Coefficients	GARCH-M	EGARCH-M
Conditional mean		
D_t	0.002***	0.0003*
Pol	0.999***	0.999***
δ_1^{EG}	-0.223***	-0.131***
δ_2^{EG}	-0.008	-0.137***
δ_3^{EG}	0.151***	-0.008***
δ_4^{EG}	-0.033	-0.001***
δ_5^{EG}	-0.083	0.002***
δ	0.621***	0.679***
conditional variance		
ϕ	9.29E-09	0.170***
α_1	0.399***	
β_1	0.664***	0.265***
β_2		0.956***
λ_0	3.65E-06	-59.505***
λ_1	4.43E-04*	30.83***
diagnostic statistics		
	$Q(1)$=3.29	$Q(1)$=2.78
	$Q(12)$=40.10	$Q(12)$=14.54
	$Q^2(12)$=4.43	$Q^2(12)$=24.69
	$TR^2(12)$=4.16	$TR^2(12)$=26.19**
Wald test	16.39***	

Note: δ tests the validity of Cukierman and Meltzer (1986) hypothesis, where a positive δ indicates that inflation uncertainty increases inflation. λ_0 is the one-period lagged inflation and tests the validity of Friedman (1977)-Ball (1992) hypothesis, where a positive λ_0 means that inflation raises inflation uncertainty. D_t is the constant-monetary regime, i.e., fixed exchange rate system, dummy variable. Pol is the slope dummy that acts for the effect of Arab Spring on average inflation. Wald test examines the significance of the interactive regime dummy, i.e., $\lambda_1 = \lambda_2 = 0$.

Table 54: : GARCH-M models for Egypt 39 (without dummies)

Coefficients	GARCH-M	EGARCH-M	CGARCH-M
Conditional mean			
δ_1^{EG}	-0.282***	-0.263***	-0.161**
δ_2^{EG}	-0.068	-0.047	-0.034
δ_3^{EG}	0.189***	0.204***	0.138***
δ_4^{EG}	-0.105***	-0.071**	-0.05
δ_5^{EG}	-0.159***	-0.166***	-0.151***
δ^{EG}	0.986***	0.987***	0.984***
conditional variance			
ϕ	3.18E-07	-0.062	9.88E-05**
α_1	0.091***		0.149***
β_1	0.892***	0.244***	0.276
β_2		0.100***	
λ_0	0.0003**	-5.647*	2.45E-05
λ_1	-0.0004***	-1.545	-0.0004***
τ			
μ			0.032***
ρ			0.991***
diagnostic statistics			
	$Q(1)$=0.0004	$Q(1)$=0.544	$Q(1)$=0.18
	$Q(12)$=5.91	$Q(12)$=5.604	$Q(12)$=5.71
	$Q^2(12)$=20.35	$Q^2(12)$=14.74	$Q^2(12)$=12.94
	$TR^2(12)$=18.44	$TR^2(12)$=13.48	$TR^2(12)$=12.53
Wald test	10.39***		

Note: δ tests the validity of Cukierman and Meltzer (1986) hypothesis, where a positive δ indicates that inflation uncertainty increases inflation. λ_0 is the one-period lagged inflation and tests the validity of Friedman (1977)-Ball (1992) hypothesis, where a positive λ_0 means that inflation raises inflation uncertainty. Wald test examines the significance of the interactive regime dummy, i.e., $\lambda_1 = \lambda_2 = 0$.

Table 55: : GARCH-M models for South Africa 40

Coefficients	GARCH-M	EGARCH-M	CGARCH-M
Conditional mean			
APART	0.003***	0.004***	0.003***
δ_1^{SA}	0.305***	0.348***	0.300***
δ_2^{SA}	-0.112*	-0.104	-0.107*
δ_3^{SA}	0.042	0.003	0.032
δ_4^{SA}	0.131**	0.165***	0.135**
δ_5^{SA}	0.129***	0.159***	0.115***
δ_6^{SA}	0.001	-0.009	0.005
δ_7^{SA}	0.077**	0.064*	0.079**
δ_8^{SA}	0.037	0.03	0.036
δ_9^{SA}	-0.166***	-0.147***	-0.160***
δ	1.557***	1.467***	1.546***
conditional variance			
ϕ	5.89E-6**	-7.736**	7.14E-06
α_1	0.038		0.001***
β_1	0.135	0.034	-0.001***
β_2		0.158	
λ_0	0.001***	31.769	-0.073
λ_1	-0.001**	-70.414**	-0.131
τ			
μ			0.028**
ρ			0.870***
diagnostic statistics			
	$Q(1)$=1.02	$Q(1)$=1.25	$Q(1)$=1.27
	$Q(12)$=13.00	$Q(12)$=15.21	$Q(12)$=14.06
	$Q^2(12)$=25.96	$Q^2(4)$=20.27	$Q^2(12)$=25.53
	$TR^2(12)$=21.50	$TR^2(12)$=18.87*	$TR^2(12)$=21.16*
Wald test	10.82***		

Note: δ tests the validity of Cukierman and Meltzer (1986) hypothesis, where a positive δ indicates that inflation uncertainty increases inflation. λ_0 is the one-period lagged inflation and tests the validity of Friedman (1977)-Ball (1992) hypothesis, where a positive λ_0 means that inflation raises inflation uncertainty. APART is a constant dummy variable capturing the effect of apartheid on average inflation. Wald test examines the significance of the interactive regime dummy, i.e., $\lambda_1 = \lambda_2 = 0$.

Table 56: : GARCH-M models for Brazil 41

Coefficients	GARCH-M	EGARCH-M	CGARCH-M
Conditional mean			
APART	0.003***	0.004***	0.003***
δ_1^{BR}	0.223***	0.848***	0.227***-
δ_2^{BR}	-0.294***	-0.228***	-0.031***
δ_3^{BR}	0.532***	0.344***	0.777***
δ_4^{BR}	0.321***	0.228***	-0.192***
δ_5^{BR}	0.069***	0.093***	-0.042***
δ	0.063***	0.456***	0.464***
conditional variance			
ϕ	0.006***	5.321***	0.004***
α_1	6.861***		0.174***
β_1	0.142***	-0.041	0.167***
β_2		0.225***	
λ_0	0.256***	9.919***	0.054***
λ_1	-0.427***	-100.193***	-0.080***
τ			
μ			0.169***
ρ			0.812***
diagnostic statistics			
	$Q(1)$=0.593	$Q(1)$=6.18	$Q(1)$=1.577
	$Q(12)$=13.267	$Q(12)$=46.93	$Q(12)$=202.72
	$Q^2(12)$=0.453	$Q^2(12)$=0.135	$Q^2(12)$=1.72
	$\text{TR}^2(12)$=0.432	$\text{TR}^2(12)$=1.51	$\text{TR}^2(12)$=1.65
Wald test	1163.90***		

Note: δ tests the validity of Cukierman and Meltzer (1986) hypothesis, where a positive δ indicates that inflation uncertainty increases inflation. λ_0 is the one-period lagged inflation and tests the validity of Friedman (1977)-Ball (1992) hypothesis, where a positive λ_0 means that inflation raises inflation uncertainty. Wald test examines the significance of the interactive regime dummy, i.e., $\lambda_1 = \lambda_2 = 0$. The sum of α_1 and β_1 in the conditional variance is larger than one. This is because Brazil was subject to hyperinflation during 1980s to March 1994.

Table 57: : GARCH-M models for Poland 42

Coefficients	GARCH-M	EGARCH-M	CGARCH-M
Conditional mean			
D_t	-0.001*	-0.004***	
δ_1^{PO}	0.141*	0.272***	0.142*
δ_2^{PO}	0.185***	0.264***	0.192***
δ_3^{PO}	0.182***	0.114**	0.054
δ_4^{PO}	0.001	-7.51E-05	0.026
δ_5^{PO}	-0.012	-0.061**	-0.12
δ_6^{PO}	0.072***	0.064**	0.068
δ_7^{PO}	0.071**	0.081***	0.133***
δ	1.439***	1.690***	1.722***
conditional variance			
ϕ	2.14E-06**	-3.227***	6.15E-06***
α_1	0.024		0.047***
β_1	0.693***	0.035	0.004
β_2		0.017	
λ_0	0.001***	29.109***	0.001***
λ_1	-0.001***	-19.046**	-0.001***
τ			
μ			0.052***
ρ			0.562***
diagnostic statistics			
	$Q(1)$=0.01	$Q(1)$=0.002	$Q(1)$=13.15
	$Q(12)$=9.38	$Q(12)$=2.89	$Q(12)$=60.50
	$Q^2(12)$=27.85	$Q^2(12)$=59.30	$Q^2(12)$=69.59
	$TR^2(12)$=26.21***	$TR^2(12)$=53.59***	$TR^2(12)$=56.38***
Wald test	12.46***		

Note: δ tests the validity of Cukierman and Meltzer (1986) hypothesis, where a positive δ indicates that inflation uncertainty increases inflation. λ_0 is the one-period lagged inflation and tests the validity of Friedman (1977)-Ball (1992) hypothesis, where a positive λ_0 means that inflation raises inflation uncertainty. D_t is the monetary regime-constant dummy variable. Wald test examines the significance of the interactive regime dummy, i.e., $\lambda_1 = \lambda_2 = 0$.

Chapter 6

Thesis Conclusions

Inflation targeting and fixed exchange rate regime are two polar monetary regimes with a quantitative declared target for the goal of price stability. Both regimes are thought to be a strong medium to anchor inflation expectations of market agents. The fixed exchange rate regime is a device to import the credibility of monetary policy from abroad, while inflation targeting requires a domestically built monetary reputation. The thesis is composed of three chapters with issues related to inflation targeting and a conventional fixed exchange rate regime to the US dollar. In the first study, we address the institutional challenges to build a domestic reputation for the goal of price stability for Jordan, where domestic monetary policy credibility is brought from abroad.

The second study assesses the credibility of monetary policy under the fixed exchange rate system for the case of Jordan. The third study examines the imported foreign credibility for the recent conventional peggers to the US dollar. The fourth study sheds light on the role of active monetary regimes in reducing inflation and inflation uncertainty and investigates the causality between inflation and inflation uncertainty under inflation targeting and a fixed exchange rate regime.

The first study underlines the challenges to move from a fixed exchange rate system to the US dollar to inflation targeting, where the latter requires a strong institutional bases of central bank independence and transparency. Hence we assess the level central bank independence, transparency under the fixed exchange rate system. To support the analysis, we opt two advanced inflation targeters, and compare the two institutional monetary bases to their experience in the first year of implementing inflation targeting; i.e., 1990 for New Zealand and 1992 for the UK.

The level of central bank independence and transparency are assessed by employing the index of Mathew (2003) and Eijffinger and Geraats (2006), respectively. The results for central bank independence reveal that more coordinations between the central bank and government are needed in order to deliver more consistent policies and enhance the accountability of achieving the goal of price stability. The government should also follow a programme of fiscal consolidation, which entails a separation of its balance sheet from the central bank's. In this respect, more conservative financial legislations must be imposed to limit advances to the central government as well as the beneficiaries of securitised

and non-securitised advances. The assessment of central bank transparency suggests that the challenge to provide the market with more transparent policies are not fundamental. However, ensuring central bank independence is essential to deliver more transparent policies. The central bank of Jordan should also prioritise its objective and explain changes to policy and preferences.

In the second study, we examine the interest rate pass-through, using data on official interest rates and retail interest rates obtained from the central bank of Jordan's Statistical Database for the monthly span from 1995 to 2012. We assess the effectiveness of monetary policy under the fixed exchange rate system and highlight the impact of monetary policy decisions on market agents' investment and saving decisions. The cointegration results between the official interest rates and retail interest rates provide evidence that the interest rate pass-through in Jordan is sluggish and weak, and the magnitude varies from incomplete pass-through to overshooting. We employ the full system of Hendry and Doornik (1994) which connects the short run with the long run adjustments under symmetric and asymmetric market response. A non-competitive pricing behaviour is observed the loan market where banks are quicker to decrease their interest rates on loan. However, as no information is released by the central bank of Jordan concerning the market structure, it is not possible to infer to what extent market power exists. In this respect, further investigation is required to determine the level and leverage of bank concentration. In addition, the relationship between inflation and exchange rate needs to be addressed to determine if a full-fledged inflation targeting can be adopted. The general finding suggests that Jordan needs a transition period and programme of fiscal consolidation as well as a more resilient exchange rate arrangement to build a domestic reputation for the goal of price stability.

In the third study, we assess the foreign credibility of the recent conventional pegged exchange rate to the US dollar over the period 1996-2012. Recent and past evidence has revealed that a fixed exchange rate system is more prone to crises owning to demand mismanagement. We build a projection exercise, based on the the first generation models of currency crisis and the empirical work of the European Monetary System, to examine the credibility of a fixed exchange rate regime to the US dollar in a number of eleven countries: Bahamas, Bahrain, Barbados, Belize, Egypt, Jordan, Oman, Kuwait, Lebanon, Qatar and Venezuela. The first generation models of currency crises, led by Krugman (1979), illustrate that the fall of the fixed exchange rate regime comes as a result of the inconsistency between fiscal and monetary policies. The empirical works on past currency crises have shown that fixed exchange rate countries were not successful at bringing the

foreign credibility into their economies prior to the collapse of the system (Svensson, 1994). The countries are classified according to the IMF de facto exchange rate classification and de jure arrangement to define the year in which the fixed exchange rate was effectively adopted. A regime constant binary variable as well as interactive dummy variables are plugged into the model to account for shifts in exchange rate regimes. The credibility is measured either as interest rate differential or by employing the exchange rate pressure index. The two proxies are regressed on a set of macro fundamentals which reflects the determinants of market agents realignment expectations: inflation differential, ratio of debt to GDP, ratio of current account to GDP, foreign reserves, money growth, ratio of import to GDP and adequacy ratio.

Our analysis is built on linear unbalanced panel data models which assume exogeneity and endogeneity of the market structure. The limitation of the data found for emerging market economies with a fixed exchange rate system does not allow considering political and social factors in the model setups. To consider the small size of the sample at hand and the relationship between current accounts and international reserves, implied by the monetary approach to the balance of payments theory, we set up four projection-equations.

The chapter clarifies why anchoring interest rates is not possible for countries with conventional fixed exchange rate systems. In all estimated setups, inflation differential appears a main factor for generating realignment expectations on fixed exchange rates. Although our finding suggests that the credibility of the pegged exchange rate is not different from the past collapsed exchange rate systems, more studies could provide better understanding of why building a domestic reputation of low prices is not possible in oil producing and import-reliant economies, and how the benefits of fixing the domestic exchange rate to the main trading partner outweigh the costs of building a domestic credible policy for the goal of price stability.

The fourth study investigates the relationship between inflation and inflation uncertainty under inflation targeting and a conventional fixed exchange rate system and the impact of each regime on inflation and inflation uncertainty. In fact, the linkage between inflation and inflation uncertainty have gained attention in the recent literature after the Nobel lecture of Friedman (1977), in which he argues that inflation causes higher inflation uncertainty. Likewise, Ball (1992) reveals that weak policy makers are more likely to permit inflation during high-inflation episodes generating more inflation uncertainty. However, according to Cukierman and Meltzer (1986), inflation uncertainty leads to higher inflation.

We contribute to the literature by comparing between two quantitatively-based monetary regimes in terms of inflation and inflation uncertainty. The role of fixed exchange rate in affecting inflation rate and inflation uncertainty has not been considered in the literature. Two fixed exchange rate countries: Jordan and Egypt and three inflation targeters: South Africa, Brazil and Poland are selected. The countries have experienced a regime shift, which allows identifying the benefits gained from adopting the regime under investigation.

Monthly data on consumer price index for the period from 1980:01 to 2014:06 are extracted from International Financial Statistics of International Monetary Fund. The basic statistics of the average inflation, show that inflation targeting countries have experienced a marked lower average inflation after shifting to inflation targeting. However, this direct effect of monetary anchor is not observed in the two fixed exchange rate countries.

The results from the benchmark model of each country show that inflation targeting has been successful at reducing the volatility of inflation. While for Jordan and Egypt, the fixed exchange rate regime has no clear effect on inflation volatility. Interestingly, Egypt exhibits a more stable volatility not during the fixed exchange rate system, but after opting out of the system.

The results from GARCH in mean models reveal that under the two monetary regimes inflation increases inflation uncertainty, as suggested by Friedman (1977) and Ball (1992), and inflation uncertainty raises inflation, as hypothesised by Cukierman and Meltzer (1986). The interactive dummy variables, incorporated in the mean and variance equations, provide evidence that inflation inertia has been lowered only in inflation targeting countries, except in Poland, and that both regimes have impacts on reducing inflation uncertainty. However, the magnitude of the dummy for Egypt is close to zero, which might indicate that the fixed exchange rate regime loses its leverage upon inflation uncertainty when the market perceives that a shadow exchange rate might dominate. The regime constant dummy variable, employed in the mean equation, shows that inflation targeting lowers the mean of inflation, whereas the fixed exchange rate effect is found either positive for Egypt, which means that the regime increases average inflation, or insignificant for Jordan. This leads to conclude that although the fixed exchange rate system has an impact on reducing inflation uncertainty, this effect does not happen through decreasing average inflation rates. Moreover, it is found that all the countries under both regimes affect inflation uncertainty in the long run, except South Africa, and that the impact holds

under asymmetry.

In general, the findings of a positive bi-directional relationship between inflation and inflation uncertainty provide evidence of the importance of non-discretionary monetary policies. The study highlights that the benefits of inflation targeting have not generated equally across the adopters. A further analysis is required to examine the role of institutional factors in improving the impact of monetary regimes of quantitative targets, and to explain why the influence of a nominal anchor could be weakened in the absence of institutional arrangements, credible monetary policy in the past and adequate fiscal management. This could also imply how building the credibility of monetary policy domestically strengthens the credibility of low prices imported from abroad.

Overall, the thesis contributes to the existing body of literature on monetary regimes in different aspects. First, it seeks to highlight the challenges facing a small developing country to move towards domestically-built policies to pursue price stability. Implicitly, it aims to highlight the weaknesses of monetary policy concealed by following a credible anchor currency. Second, it shows that the current experience of a soft peg does not differ from the past experience of collapsed fixed exchange rate regimes. The inflation differential between the domestic economies and their anchor country manifests why anchoring interest rate is not possible to implement. Third, the positive relationship between inflation and inflation uncertainty, found for inflation targeters and exchange rate peggers, reflects the need for inflation expectations anchors. The fixed exchange rate system has no effect on average inflation and volatility and its impact on inflation uncertainty hinges upon the market agents realignment expectations. Inflation targeting appears as a more stable and powerful quantitative target in affecting average inflation and inflation uncertainty.

Appendix A: The Modified Central Bank Independence Index of Mathew (2003)

A: **Political Independence or Personnel Independence (PI)**

A1. Appointment of the Governor

1. The Governor is appointed by the Central Bank (CB) Board or two different bodies, which really balance one another, respectively nominate and appoint the Governor, for instance, the board or ministry of finance nominates and the legislature appoints (1 point).

2. The Government or the minister of finance nominate the Governor and the head of the state appoint or the opposite (0.5 point).

3. The Government both nominates and appoints the Governor, for instance, ministry of finance nominates and the cabinet appoints the Governor (0 point).

A2. Terms of the Governor

1. The term is longer than 5 years but not exceed 8 years (1 point).

2. The term is 5 years (0.5 point).

3. The term is 4 or less than 4 years (0 point).

A3. Dismissal of the Governor.

1. The dismissal of the Governor is possible only in the case of breach of qualification, misconduct, or poor performance; the procedures are very transparent, and with the approval of the legislature (1 point).

2. The dismissal of the Governor is possible only in the case of breach of qualification, misconduct, or poor performance; but the procedures are not transparent, and not with the approval of the legislature (0.5 point).

3. Unconditional dismissal of the Governor by the Government and/or the head of the state (0 point).

A4. Appointment of Governor Deputy

1. The Deputy is nominated and appointed by the Governor and the CB Board (1 point).

2. The Government nominates the Governor and the head of the state appoints or the opposite (0.5 point).

3. The Government both nominates and appoints the Governor, for instance, ministry of finance nominates and the cabinet appoints the Governor (0 point).

A5. Term of the Deputy

1. The term is longer than 5 years but not exceed 8 years (1 point).

2. The term is 5 years (0.5 point).

3. The term is 4 or less than 4 years (0 point).

A6. The Presence of Government Nominees in the Bank Board

1. There is no mandatory participation of Government representative in the bank board or the bank monetary policy commission (1 point).

2. There is mandatory participation of Government representative in the bank board or the bank monetary policy committee (0point).

[Maximum score for PI = 6]

B: **Monetary Policy Independence (MPI)**

B1. The degree of conservativeness of the CB or Independence in setting effective objectives

1. The objective of monetary policy is only price stability or price stability is the principal and overriding, long run goal of monetary policy (1 points).

2. The objective of monetary policy includes price stability and other aspects like financial stability-both exchange rate stability and banking sector stability (0.5 point).

3. The objective of monetary policy includes price stability, financial stability and other conflicting concerns like stimulating economic growth and employment output stability (0 point).

B2. The degree of Goal or Target Independence

1. The CB alone sets the numerical goals or targets for its objectives, for instance, exchange rates, monetary aggregates, interest rates or inflation (1 points).

2. The CB and the Government jointly set the goals or targets for its objectives, for instance, through a policy targets agreement (0.5 point).

3. The Government alone sets the targets for the objectives (0 point).

B3. The degree of Instrument Independence

1. The CB alone sets the instruments of monetary policy to achieve its objectives (1points).

2. The CB and the Government jointly set the instruments of monetary policy (0.5 point).

3. The Government alone decides on setting instruments (0 point).

B4. General policy conflicts

1. The CB absolutely prevails over the Government in case of policy conflicts (1 point).

2. The Government prevails over the CB, subject to due process and possible protest from the latter (0.5 point).

3. The Government absolutely prevails over the CB (0 point).

B5. Exchange Rate Policy Co-ordination

1. CB formulates and implements exchange rate and foreign exchange policy consistent with objectives of monetary policy, and bank's view prevails over the Government in case of policy inconsistency (1 point).

2. CB formulates, and implements exchange rate and foreign exchange policy on basis of instructions given by the Government, or Government's view prevail over (0 point).

[Maximum Score for MPI =5]

C: **Fiscal Independence or Financial Independence (FI)**

C1. Limitations on advances (non-securitised lending)

1. CB advances to the Government prohibited (1 points).

2. CB advances permitted, but with strict limits in terms of absolute cash amounts (0.80 point).

3. CB advances permitted with loose and accommodative limits (0.5 point).

4. No legal limits on CB advances to the Government (0 point).

C2. Specification of the limits of CB lending

1. CB advances to the Government prohibited (1 point).
2. CB lending defined in absolute currency amounts (1 point).
3. CB lending defined in shares of Government revenue (0.5 point).
4. CB lending defined in shares of Government expenditure (0 point).

C3. Maturity of loans

1. CB advances permitted (1 point)
2. The maturity of CB loans cannot exceed 6 months (1 point).
3. The maturity of CB loans above 6 months but cannot exceed 1 year (0.5 point).
4. No legal limit on the maturity of CB loans (0 point).

C4. Restrictions on Interest rates

1. CB advances permitted (1 point).
2. CB lends to the Government at market interest rate (1 point).
3. CB lends to the Government at below market interest rates, but positive rates (0.5 point).
4. CB lends to the Government at zero interest rates (0 point).

C5. Beneficiary of (non-securitized lending)

1. CB advances to the Government prohibited (1 point).
2. The central government is the only beneficiary (0.5 point).
3. The central government and the public corporations or the local or provincial government (0 point).

C6. CB's participation in the primary market for Government securities

1. The CB is prohibited from buying Government securities from the primary market (exclude purchasing government bonds for monetary policy purposes) or if not prohibited, CB's activity in the primary market is discretionary or voluntary (1points).
2. The CB is an active and involuntary buyer in the primary market for Government securities (0 point).

[Maximum score for FI = 6] [Maximum score of CBI = MPI+PI+FI = 17]

Appendix B: Central Bank Transparency Index of Eijffinger and Geraats (2006)

A: **Political Transparency**

a. Is there a formal statement of the objective(s) of monetary policy, with an explicit prioritization in case of multiple objectives?

1. No formal objective(s) = 0.
2. Multiple objectives without prioritization = 0.5.
3. One primary objective, or multiple objectives with explicit priority = 1.

b. Is there a quantification of the primary objective(s)?

1. No = 0.
2. Yes = 1.

c. Are there explicit institutional arrangements or contracts between the monetary authorities and the government?

1. No central bank, contracts or other institutional arrangements = 0.
2. Central bank without explicit instrument independence or contract = 1/2.
3. Central bank with explicit instrument independence or central bank contract (although possibly subject to an explicit override procedure) = 1.

B: **Economic Transparency**

a. Is the basic economic data relevant for the conduct of monetary policy publicly available? The focus is on the following five variables: money supply, inflation, GDP, unemployment rate and capacity utilization.

1. Quarterly time series for at most two out of the five variables = 0.
2. Quarterly time series for three or four out of the five variables = 1/2.
3. Quarterly time series for all five variables = 1.

b. Does the central bank disclose the formal macroeconomic model(s) it uses for policy analysis?

1. No = 0.

2. Yes = 1.

c. Does the central bank regularly publish its own macroeconomic forecasts?

1. No numerical central bank forecasts for inflation and output = 0.

2. Numerical central bank forecasts for inflation and/or output published at less than quarterly frequency = 0.5.

3. Quarterly numerical central bank forecasts for inflation and output for the medium term (one to two years ahead), specifying the assumptions about the policy instrument (conditional or unconditional forecasts) = 1.

C: **Procedural Transparency**

a. Does the central bank provide an explicit policy rule or strategy that describes its monetary policy framework?

1. No = 0.

2. Yes = 1.

b. Does the central bank give a comprehensive account of policy deliberations (or explanations in case of a single central banker) within a reasonable amount of time?

1. No, or only after a substantial lag (more than eight weeks) = 0.

2. Yes, comprehensive minutes (although not necessarily verbatim or attributed) or explanations (In case of a single central banker), including a discussion of backward and forward-looking arguments = 1.

c. Does the central bank disclose how each decision on the level of its main operating instrument or target was reached?

1. No voting records, or only after a substantial lag (more than eight weeks) = 0.

2. Non-attributed voting records = 0.5.

3. Individual voting records, or decision by single central banker = 1.

D: **Policy Transparency**

a. Are decisions about adjustments to the main operating instrument or target promptly announced?

1. No, or after a significant lag = 0.

2. Yes, at the latest on the day of implementation = 1.

b. Does the central bank provide an explanation when it announces policy decisions?

1. No = 0.

2. Yes, when policy decisions change, or only superficially = 0.5.

3. Yes, always and including forwarding-looking assessments = 1.

c. Does the central bank disclose an explicit policy inclination after every policy meeting or an explicit indication of likely future policy actions (at least quarterly)?

1. No = 0.

2. Yes = 1.

E: **Operational Transparency**

a. Does the central bank regularly evaluate to what extent its main policy operating targets (if any) have been achieved?

1. No, or not very often (at less than annual frequency) = 0.

2. Yes, but without providing explanations for significant deviations = 0.5.

3. Yes, accounting for significant deviations from target (if any); or, (nearly) perfect control over main operating instrument/target = 1.

b. Does the central bank regularly provide information on (unanticipated) macroeconomic disturbances that affect the policy transmission process?

1. No, or not very often = 0.

2. Yes, but only through short-term forecasts or analysis of current macroeconomic developments (at least quarterly) = 0.5.

3. Yes, including a discussion of past forecast errors (at least annually) = 1.

c. Does the central bank regularly provide an evaluation of the policy outcome in light of its macroeconomic objectives?

1. No, or not very often (at less than annual frequency) = 0.

2. Yes, but superficially = 0.5.

3. Yes, with an explicit account of the contribution of monetary policy in meeting the objectives = 1.

Appendix C: Parameters Constancy Tests

This appendix provides the α and β parameters constancy tests, based on the means of recursive estimation, of the short-run symmetric model, given that official interest rates are weakly exogenous. R1-form represents the re-estimation of the long-run parameters α and β.

In addition, the appendix contains CUSUM test for model stability. The instability is detected if the cumulative sum of the recursive residuals lies outside the area between the 5% critical lines. The two tests are conducted for Jordan and the two inflation targeters.

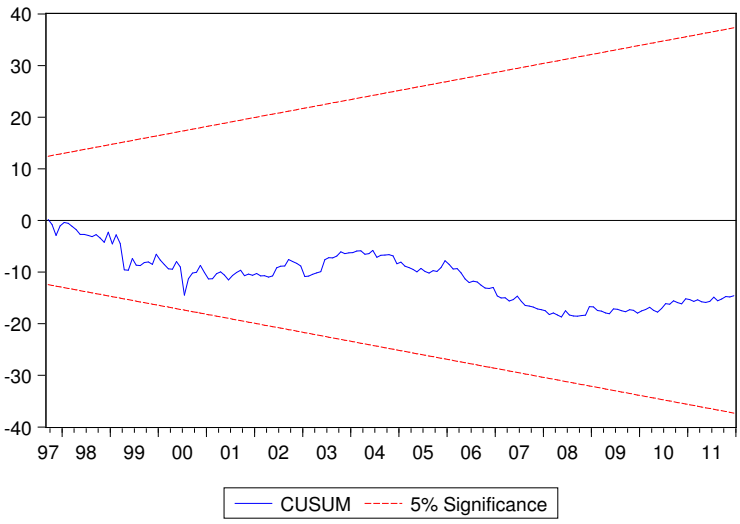


Figure 4: : Jordan: CUSUM test for the symmetric model of rediscount and loan

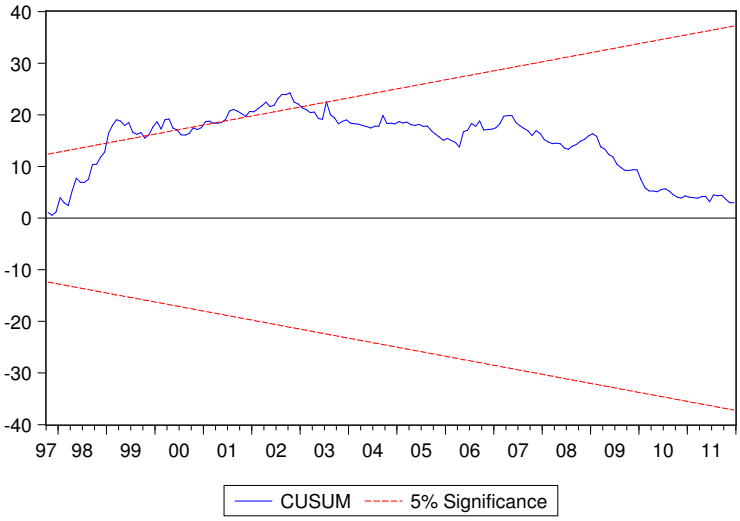


Figure 5: : Jordan: CUSUM test for the symmetric model of rediscount and deposit

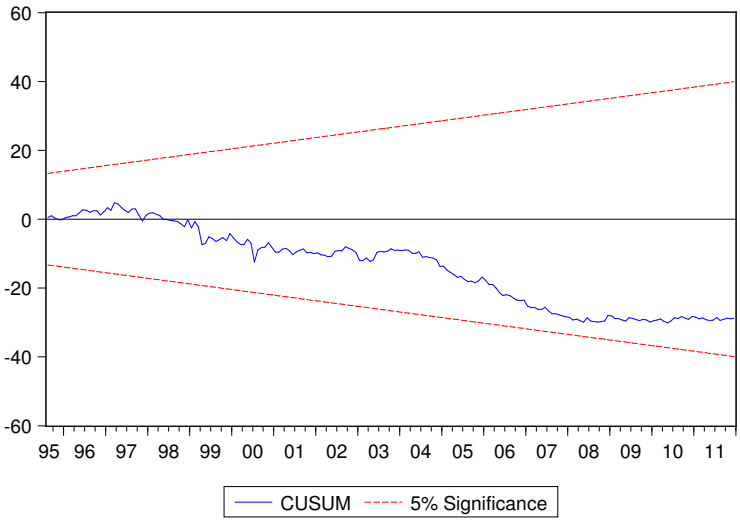


Figure 6: : Jordan: CUSUM test for the symmetric model of repo and loan

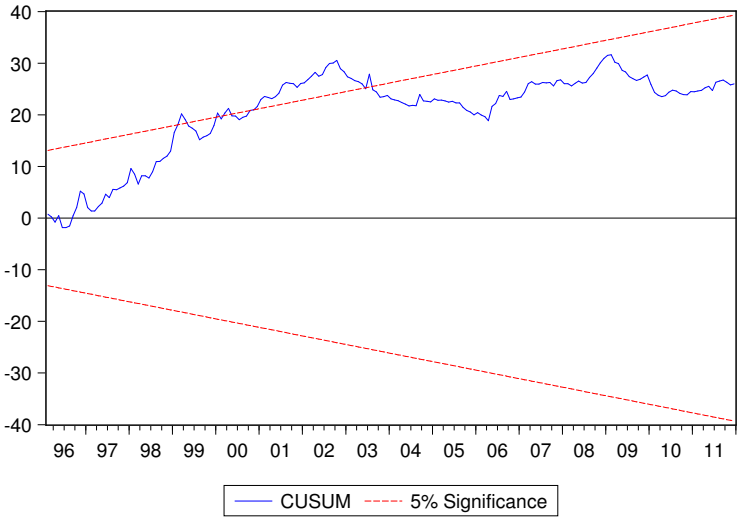


Figure 7: : Jordan: CUSUM test for the symmetric model of repo and deposit

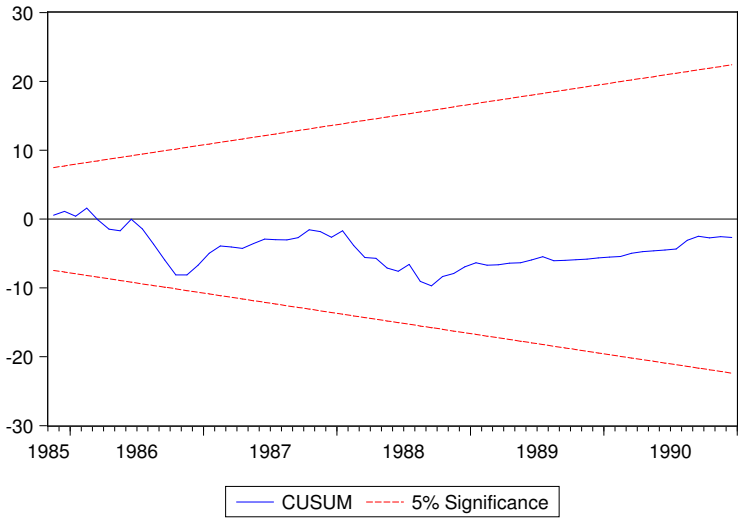


Figure 8: : New Zealand: CUSUM test for the symmetric model of TB-30 and housing

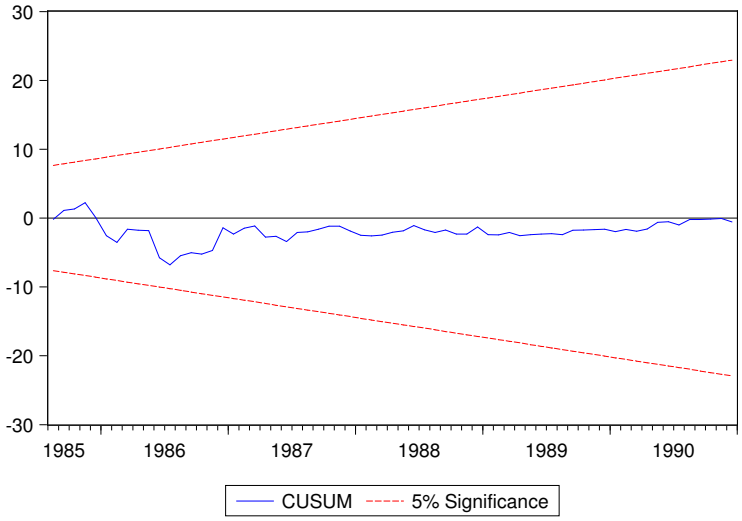


Figure 9: : New Zealand: CUSUM test for the symmetric model of TB-30 and deposit

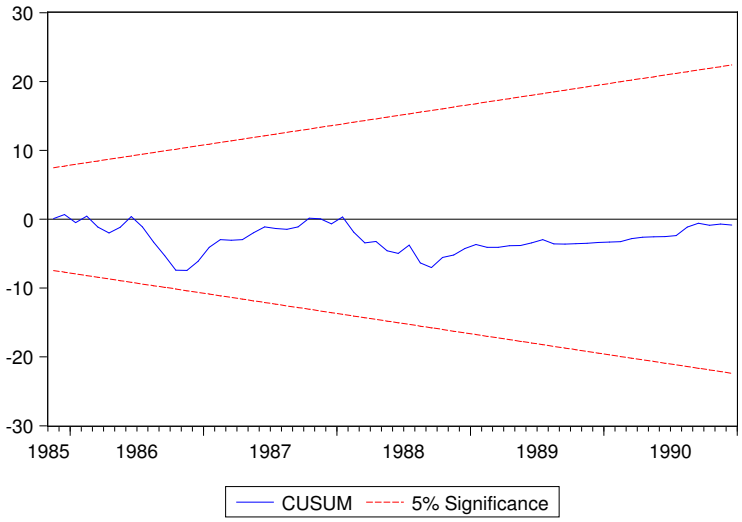


Figure 10: : New Zealand: CUSUM test for the symmetric model of TB-60 and housing

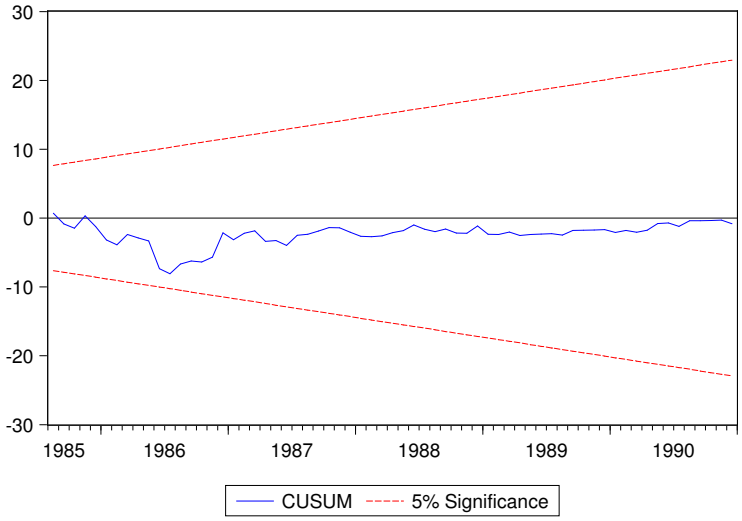


Figure 11: : New Zealand: CUSUM test for the symmetric model of TB-60 and deposit

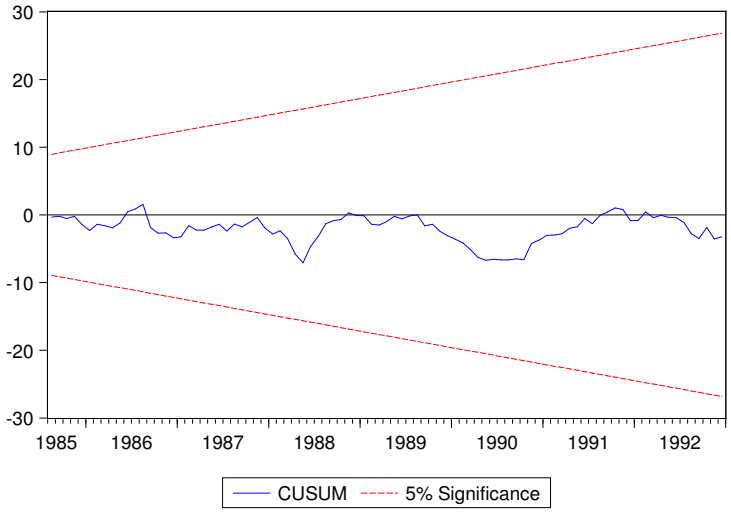


Figure 12: : UK: CUSUM test for the symmetric model of CD and lending

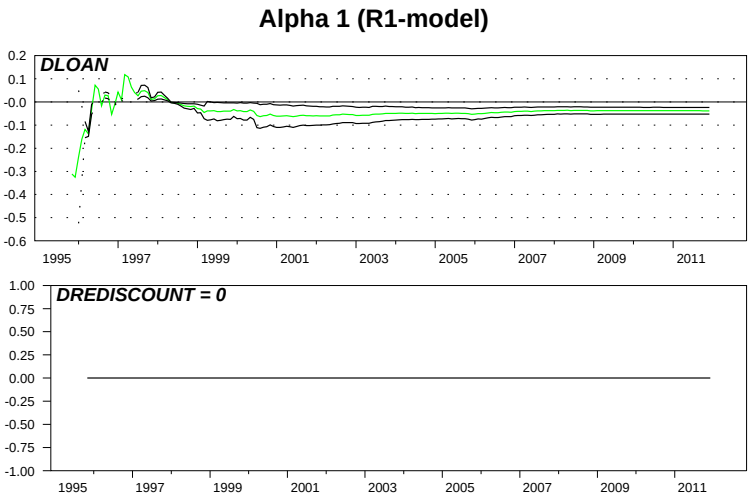


Figure 13: : Jordan: Alpha parameter constancy test for rediscount and loan

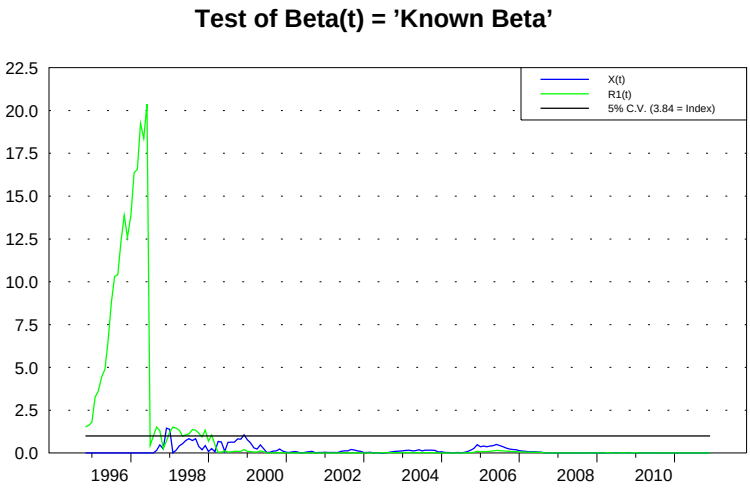


Figure 14: : Jordan: Beta constancy test for rediscount and loan

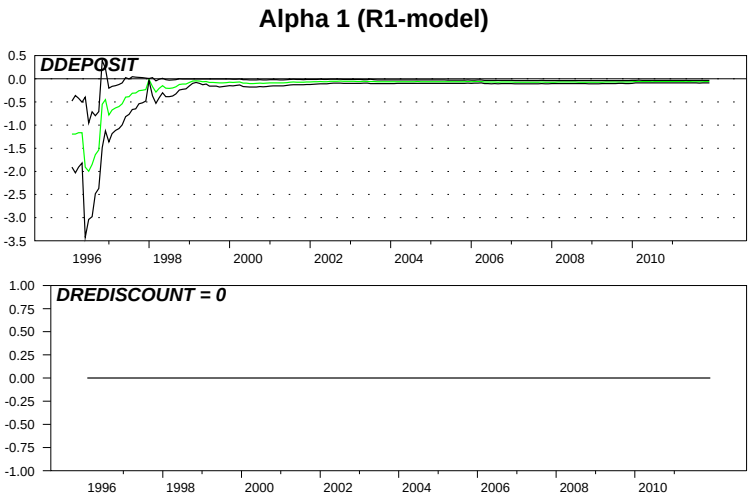


Figure 15: : Jordan: Alpha parameter constancy test for rediscount and deposit

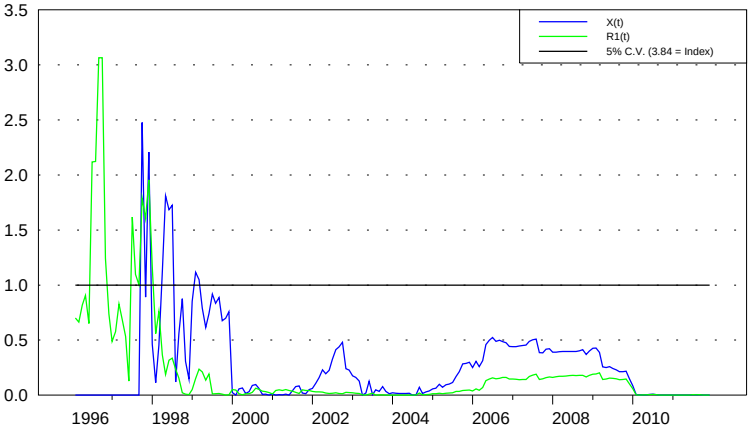


Figure 16: : Jordan: Beta constancy test for rediscount and deposit

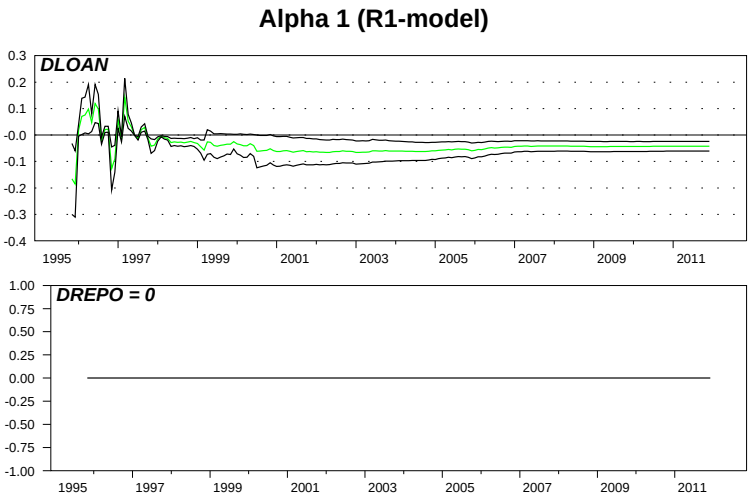


Figure 17: : Jordan: Alpha parameter constancy test for repo and loan

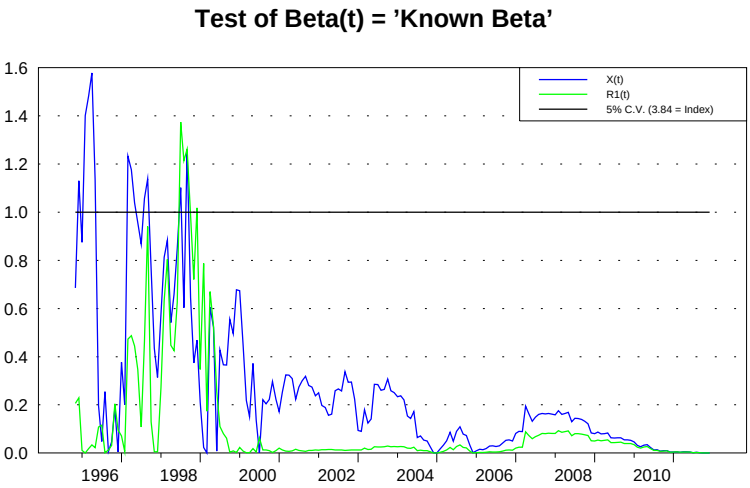


Figure 18: : Jordan: Beta constancy test for repo and loan

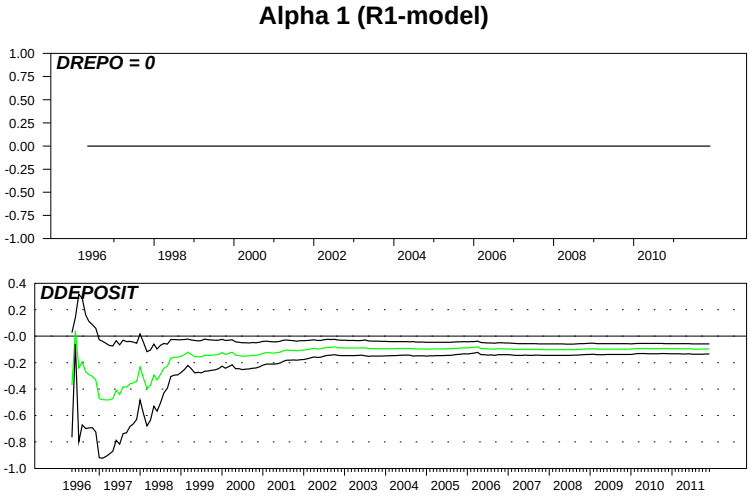


Figure 19: : Jordan: Alpha parameter constancy test for repo and deposit

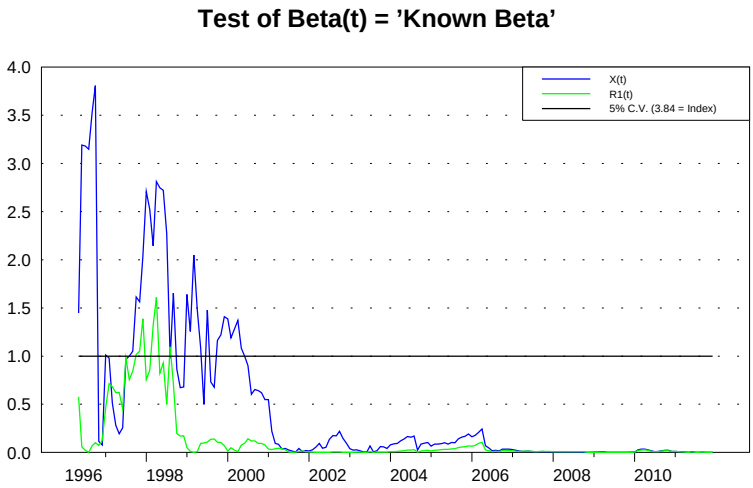


Figure 20: : Jordan: Beta constancy test for repo and deposit

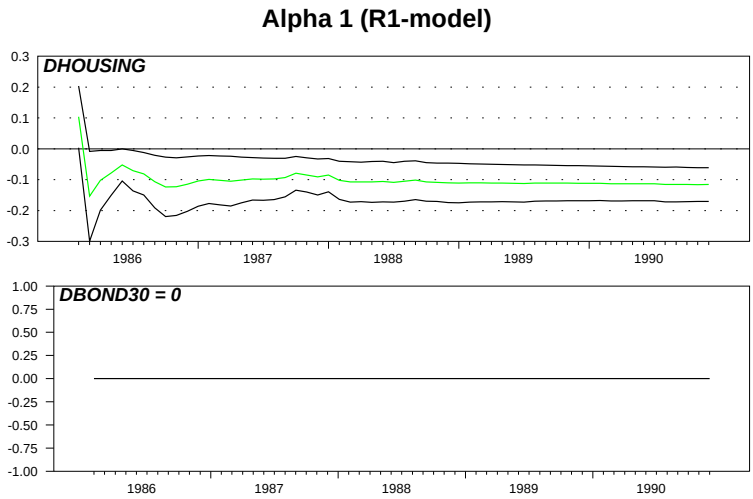


Figure 21: : New Zealand: Alpha parameter constancy test for TB-30 and housing

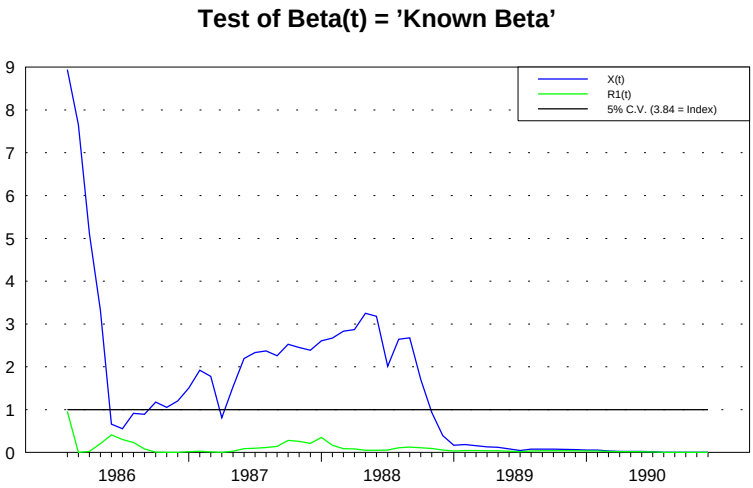


Figure 22: : New zealand: Beta constancy test for TB-30 and housing

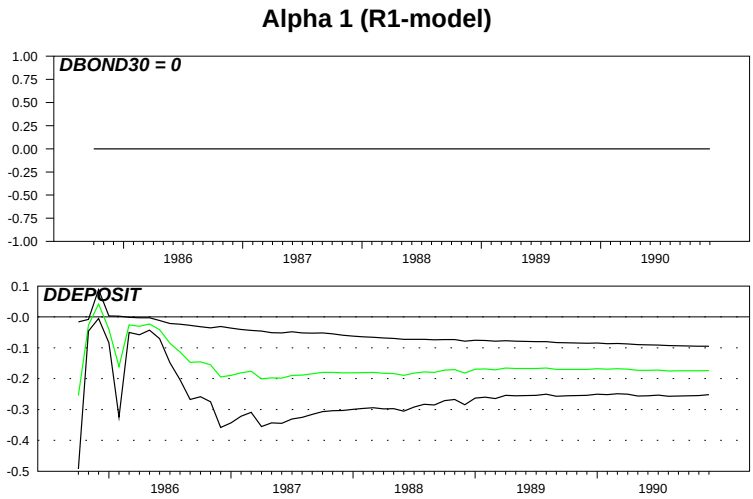


Figure 23: : New Zealand: Alpha parameter constancy test for TB-30 and deposit

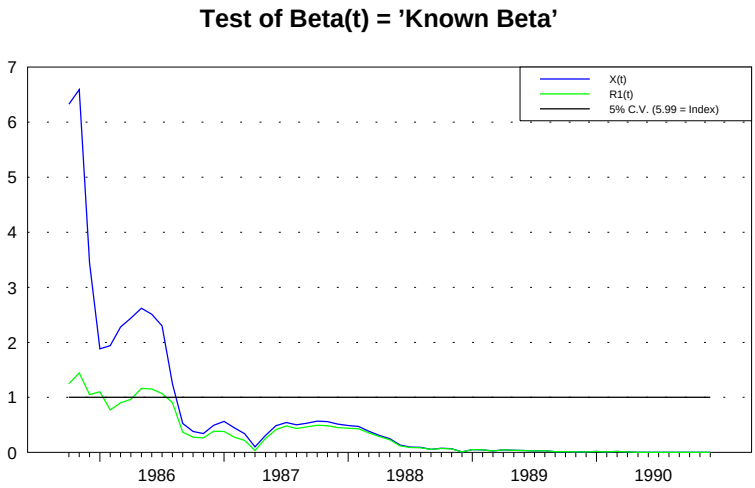


Figure 24: : New Zealand: Beta constancy test for TB-30 and deposit

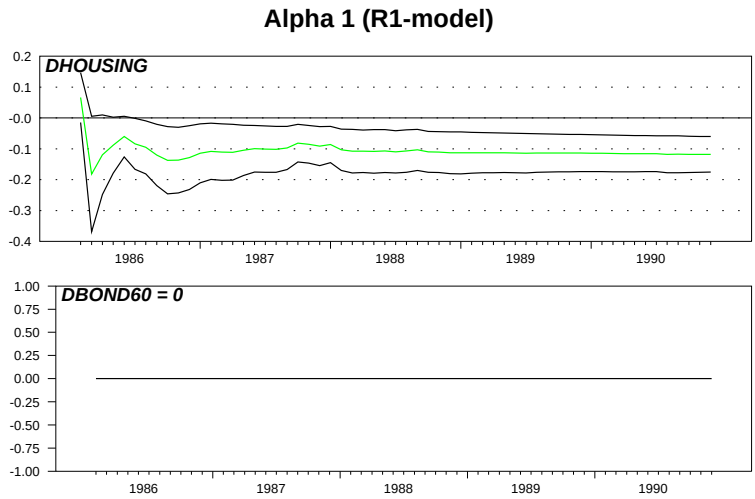


Figure 25: : New Zealand: Alpha parameter constancy test for TB-60 and housing

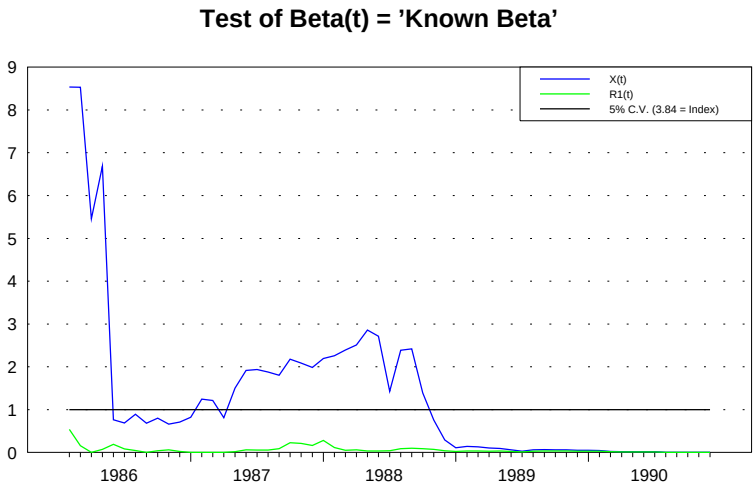


Figure 26: : New Zealand: Beta constancy test for TB-60 and housing

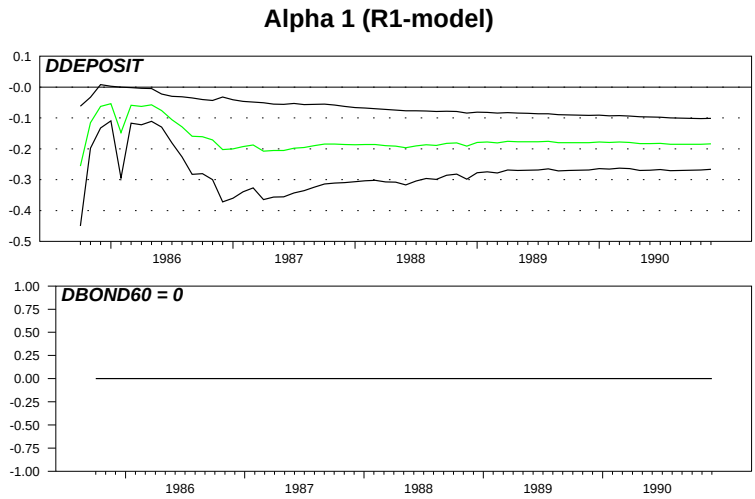


Figure 27: : New Zealand: Alpha parameter constancy test for TB-60 and deposit

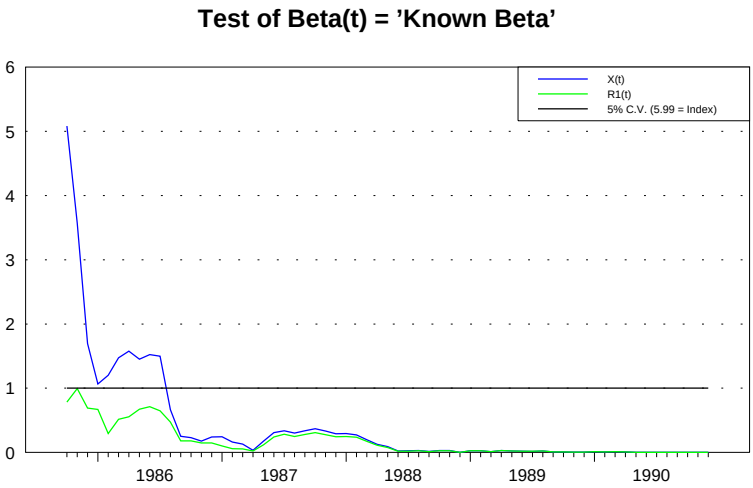


Figure 28: : New Zealand: Beta constancy test for TB-60 and deposit

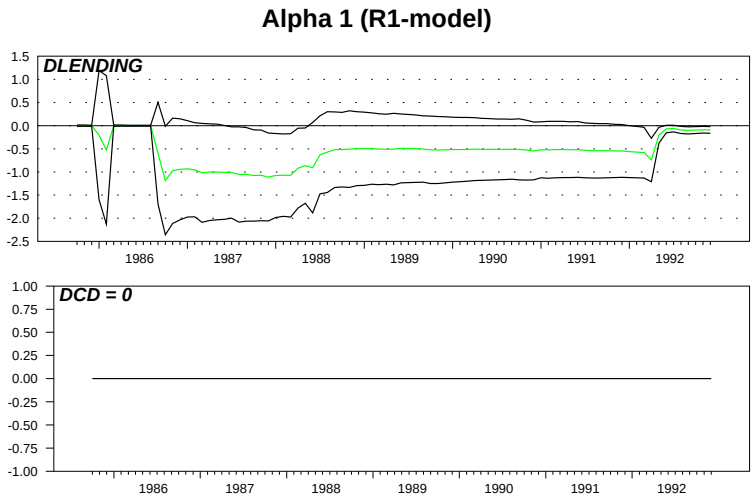


Figure 29: : UK: Alpha parameter constancy test for CD and lending

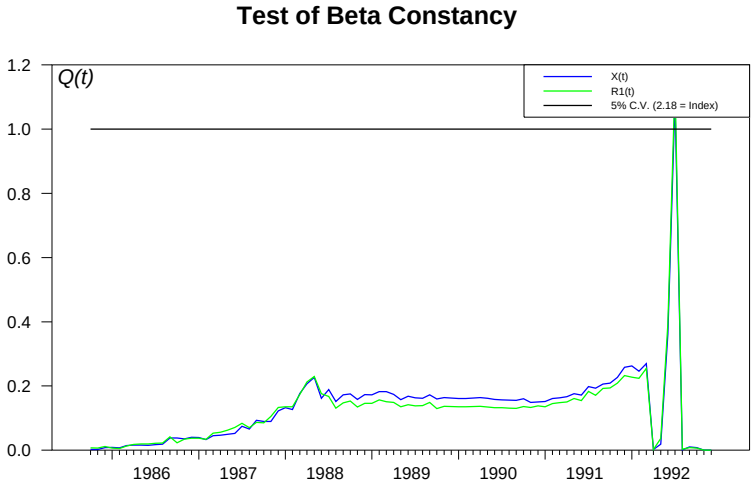


Figure 30: : UK: Beta constancy test for CD and lending

Appendix D: Average Inflation and Conditional Standard Deviation

Figure 31: Jordan: Average Inflation and Conditional Standard Deviation)

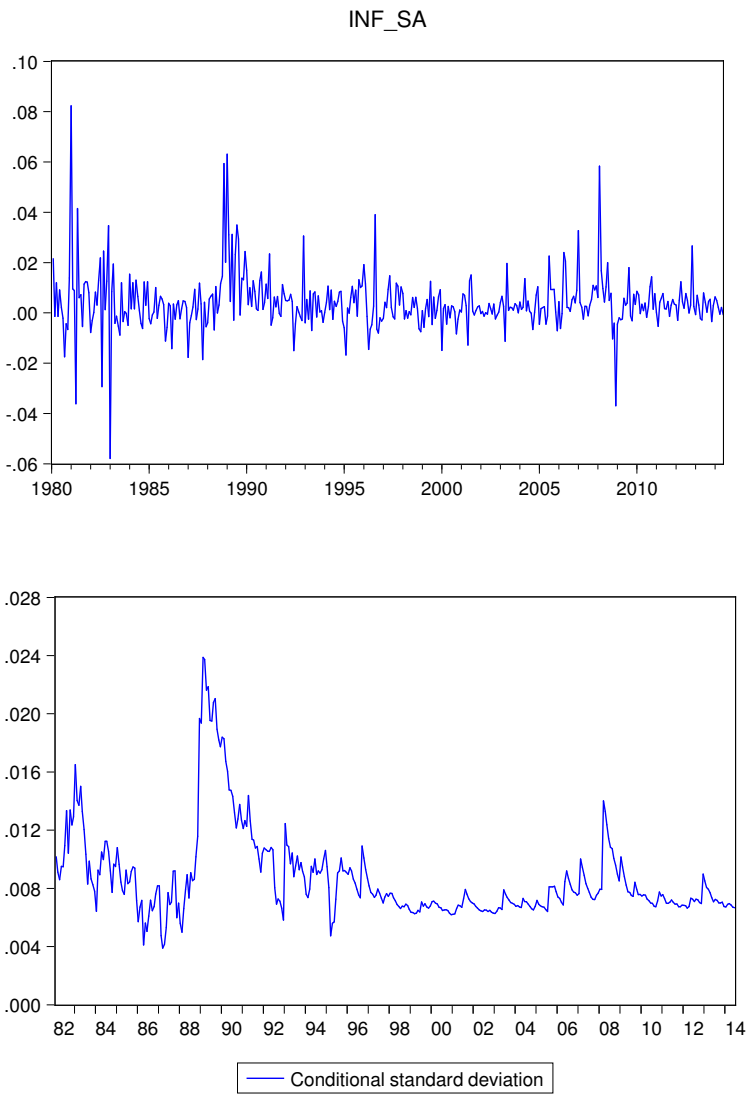


Figure 32: Egypt: Average Inflation and Conditional Standard Deviation)

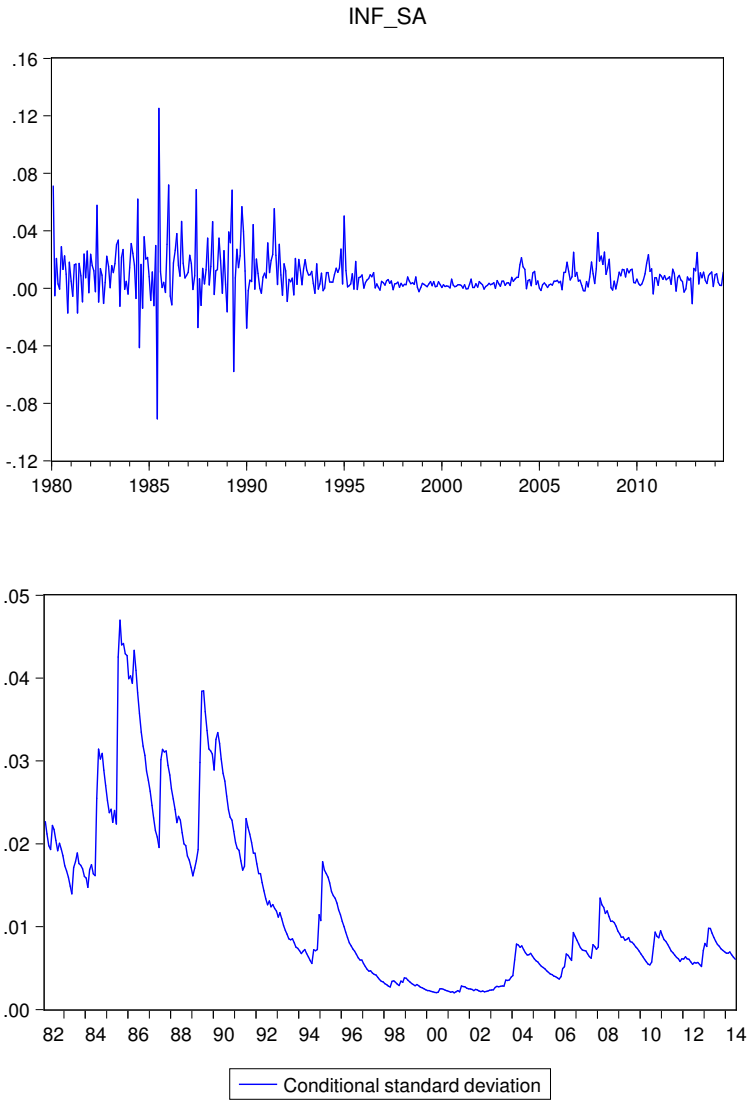


Figure 33: South Africa: Average Inflation and Conditional Standard Deviation)

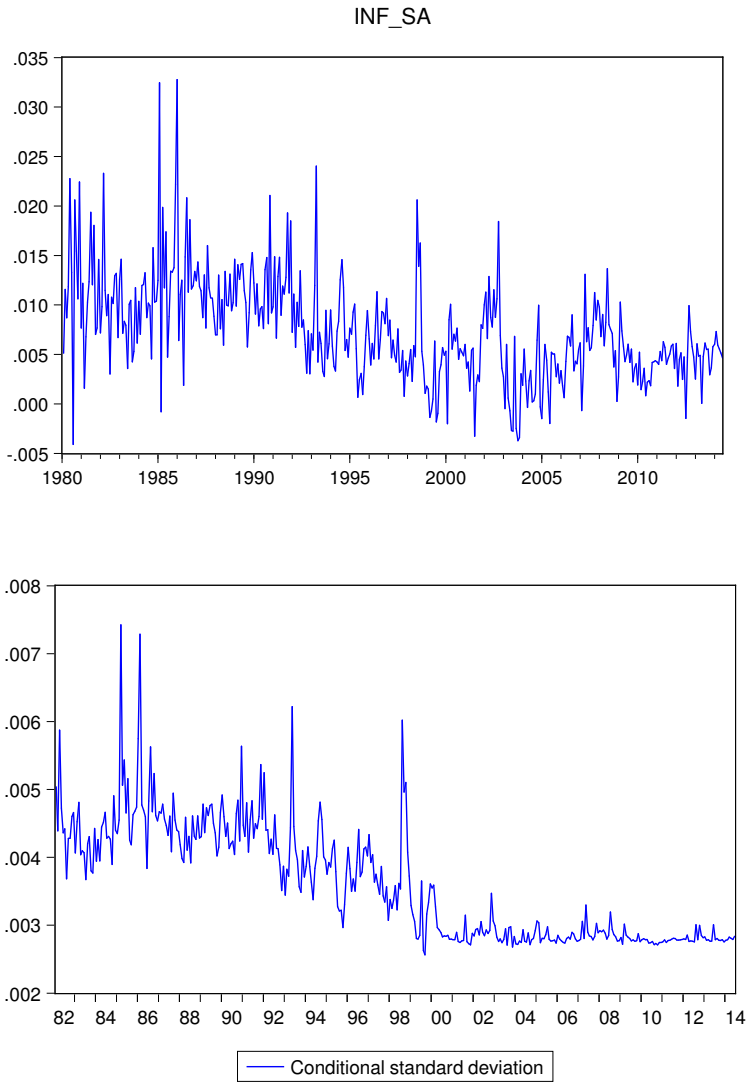


Figure 34: Brazil: Average Inflation and Conditional Standard Deviation)

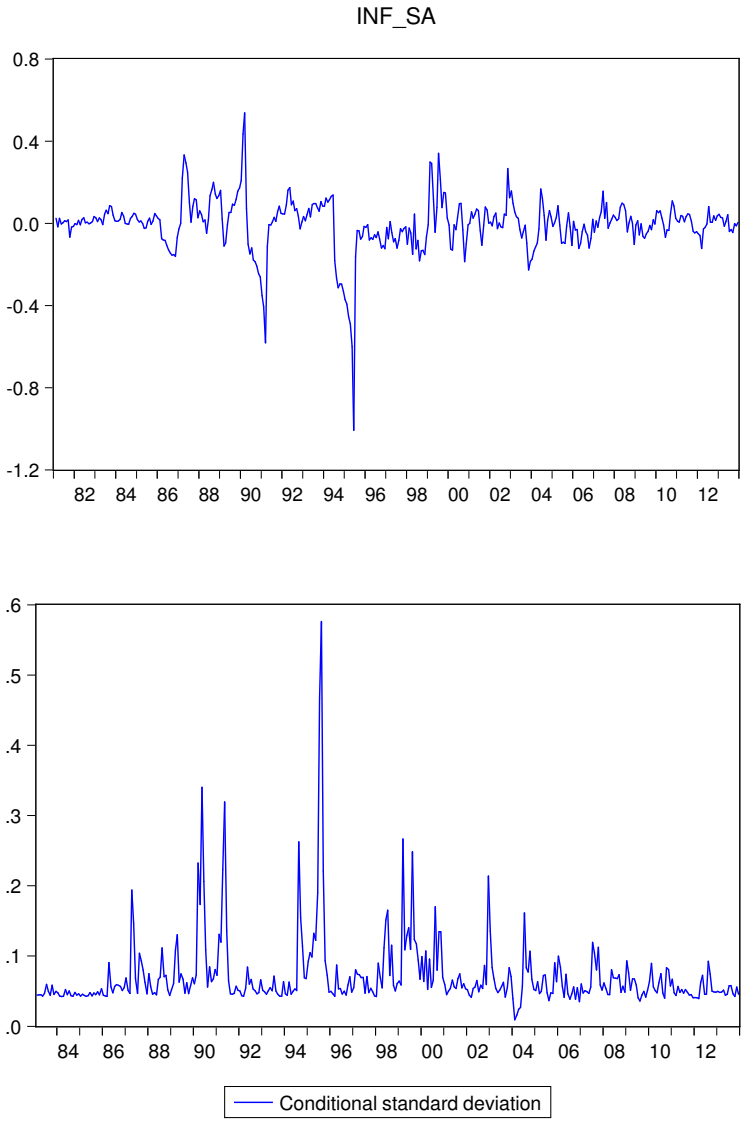
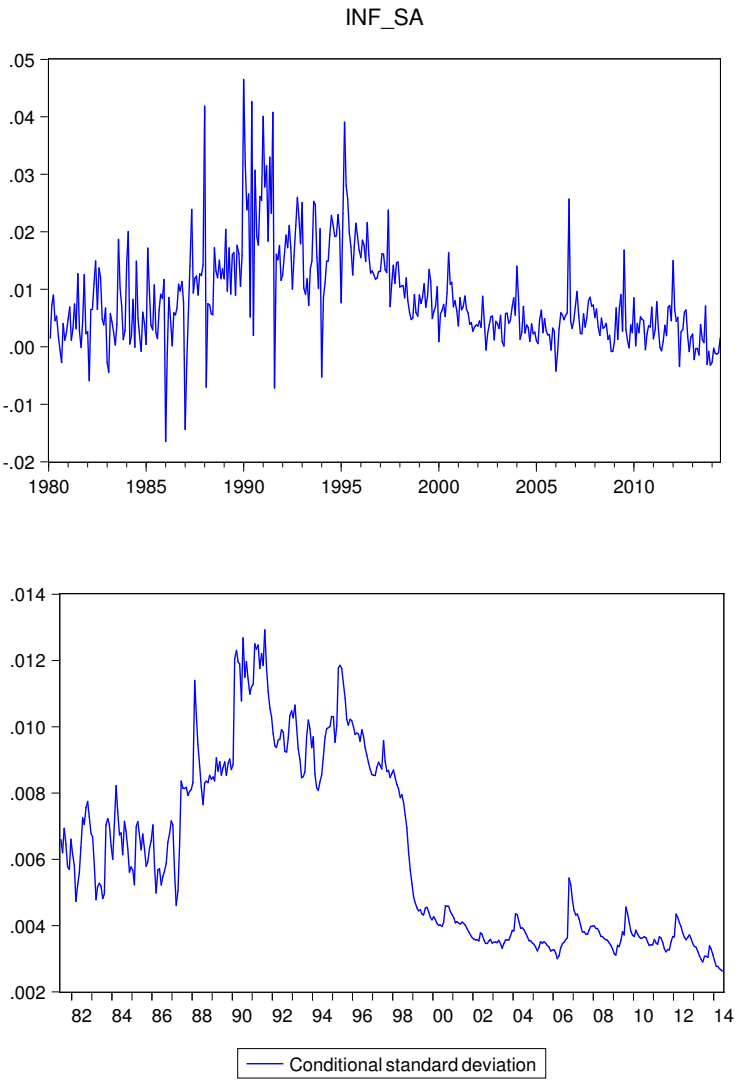


Figure 35: Poland: Average Inflation and Conditional Standard Deviation)



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