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Seedwell Hove, Albert Touna Mama and Fulbert Tchana Tchana

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Seedwell Hove†
School of Economics,
University of Cape Town

Albert Touna Mama‡
School of Economics,
University of Cape Town

Fulbert Tchana Tchana§
Department of Research and Modelling,
Ministère des Finances du Québec

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Abstract

Most emerging market economies (EMEs) which have implemented inflation targeting (IT) have continued to experience large, frequent and sometimes persistent inflation target misses. At the same time these countries had reformed their institutional structures when implementing IT. In this paper we empirically study the importance of central bank independence, fiscal discipline and financial sector development for the achievement of inflation targets in EMEs using the panel ordered logit model. We find that when we control for variables such as output gap, exchange rate gap and openness, the improvement in central bank independence, fiscal discipline and financial systems reduces the probability of inflation target misses. Importantly, some control variables lead to the missing of inflation target bands. These are, in order of importance; exchange rate gap, output gap, inflation target horizon and level of openness. The combined impact of institutional structures is quite large, indicating their significant contribution to the inflation performance and credibility of IT.

Keywords: Inflation targeting, Institutions, Credibility
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†Corresponding author email: seedwell.hove@uct.ac.za
‡Email: albert.tounamama@uct.ac.za
§Email: fulbert.tchanatchana@finances.gouv.qc.ca

1 Introduction

During the 1990s many emerging market economies (EMEs) adopted inflation targeting (IT). However, they have continued to miss their targets frequently and sometimes by wide margins, leading to loss of credibility. This problem persisted despite significant institutional reforms. This pattern has therefore raised questions about the intrinsic role of institutional structures for the achievement of inflation targets in EMEs.

Two views have emerged in literature about the success of inflation targeting EMEs in achieving their inflation targets. On one hand, some authors such as Mishkin (2004) and Fraga et al. (2003) argue that the success of this regime is limited because of institutional shortfalls and output and inflation volatility trade-offs from external shocks. On the other hand, Batini and Laxton (2006) reject the view that the fragility and lack of good initial institutional conditions can impede the successful implementation of inflation targeting in EMEs. In fact, most EMEs adopted IT in the absence of most ideal institutional conditions. They stress that the feasibility and success of IT depends more on the authorities' commitment to price stability and their ability to plan and implement institutional changes after adopting inflation targeting.

Despite the intensity of this debate, few papers have analysed the role of monetary, fiscal and financial institutional structures for the achievement of inflation targets.[1] The paper by Gosselin (2008) however provides some insights. It uses pooled and fixed effects regressions to explain inflation target deviations from the mean on a sample of developed and developing IT countries. It finds that central bank independence and fiscal balances among other variables seem to explain inflation target deviations. However, the results are susceptible to heterogeneity bias because the institutional framework of developed and developing countries differ. In fact, pooling countries with different characteristics together may increase this bias especially if slope parameters of individual regressions differ across sections. Moreover, the study uses inflation deviations from the mean as an indicator of IT performance. By this, it assumes that central banks strictly set point inflation targets. Yet in practice, most central banks especially in EMEs set target bands (Svensson, 1997).[2] This may result in missing an important dimension in the setting of inflation targets and the role of

[1] The deviation of inflation from the target bands can be considered an indicator that the central bank has not been successful especially if it leads to credibility losses. However there are other indicators which can be considered in determining the overall success of an inflation targeting regime.

[2] In some cases central banks set inflation target points, but they include tolerance bands.

institutions for inflation performance of IT in EMEs.

To the best of our knowledge, no work has been done on the role of monetary, fiscal and financial institutional factors in explaining inflation target deviations from the bands in EMEs. This study fill this gap. Specifically, it aims at addressing the fundamental question of whether the ability to achieve inflation target bands is affected by central bank independence (CBI), fiscal discipline and financial sector development in EMEs. This is important because large and frequent inflation target misses can undermine monetary policy credibility. Within the same framework, the study also tests if these institutional structures enhance the effectiveness of monetary policy.

This study contributes to the existing literature in three ways. Firstly, it characterises and analyses inflation target deviations from the bands as opposed to deviations from the mean, pinning down these institutional differences. In fact, inflation target deviations from the bands are intuitively appealing as measures of central bank performance because most central banks consider inflation to be consistent with their long term inflation objectives if it is within the target bands (Agenor, 2000). Also, inflation target bands may act as thresholds for accountability, where some central banks are required to issue explanatory statements when they miss the target bands (see e.g. Svensson, 1997; Bernanke et al., 1999).[3] In addition, Svensson (1997) argues that, in practice, inflation targeting is flexible as central banks set inflation target ranges or tolerance intervals rather than target points only.[4] Finally, target bands suggest a nonlinearity in the policy response function, depending on whether inflation is within the bands or not. This is consistent with an apparent tendency of central banks to react to inflation when it becomes a problem, but concentrate on other objectives when inflation is under control (Orphanides and Wieland, 2000).

Secondly, the study isolates and focuses on EMEs. We are not aware of any study which has analysed this issue for these countries only, yet their characteristics are different from advanced countries. In fact, most EMEs have a long history of institutional shortfalls, high past inflation records and monetary policy mismanagement which could account for their current large inflation target deviations and low credi-

[3]This is the case in Israel, Brazil, Thailand and the Philippines. Other inflation targeting advanced countries which issue public statements when they miss inflation target bands are the UK, Canada, Sweden and New Zealand. However some central banks use " escape" clauses in accountability arrangements.

[4]Svensson, 1997 supports his argument by noting that the achievement of specific numerical inflation targets is impossible due to imperfect control of inflation.

bility (Mishkin, 2004). Thus in our view, since these countries form a key group in the world economy, they provide an appropriate sample to test the role of institutional structures for IT performance.

Thirdly, the study uses a new empirical strategy to estimate the effects of institutional variables as well as other macroeconomic variables on inflation target outcomes. Consistent with the nonlinearities in policy responses to different inflation target outcomes, the study models the achievement of inflation target bands or deviations from the bands by employing the panel ordered logit model. This technique addresses the nonlinearity issue by carefully identifying and distinguishing between various inflation target response thresholds; that is, below the target band, within the target band and above the target band, as they are affected by institutional factors and other control variables. It also uses fixed effects to account for unobserved heterogeneity between countries. More importantly, the paper develops a new computational strategy to obtain the marginal effects of different inflation target outcomes of an ordered logit model in a panel data context.

The empirical evidence shows that some institutional variables have significant predictive power on the probability of inflation missing the target bands. Precisely, countries with more independent central banks tend to achieve the target bands frequently. In fact, we use two proxies of CBI; legal CBI indices and turnover rate of central bank governors. When the legal CBI is the measure of independence of central banks, we find that it increases the probability of achieving inflation target bands by reducing mainly the probability of exceeding the upper target band. A 1% increase in CBI increases the probability of achieving the target band by 0.16%, while reducing the probability of being above the band by 0.11%. When we use the turnover rate of bank governors, we find no significant effect on the probability of achieving or not achieving the target band. This result suggests instead that in EMEs, lower turnover of central bank governors is not necessarily a sign of more independent central banks.

Also using two proxies of fiscal discipline; budget deficit to GDP and the ratio of debt to GDP, we find that countries with weak fiscal institutions have a higher probability of having inflation higher than the upper target band. An increase in the budget deficits to GDP ratio increases the probability of being above the upper target bound while it reduces the probability of being under the lower target bound. When we replace budget deficits to GDP with the domestic debt to GDP ratio, similar effects are observed.

We also investigate the importance of financial sector development in IT using

two indicators; private credit to GDP ratio and liquid liabilities to GDP. The evidence shows that an increase in private credit to GDP ratio increases significantly the probability of inflation staying in the target band. But when we use liquid liabilities to GDP ratio, we find no significant effect.

Although our findings reveal that strong and well-managed fiscal, monetary and financial institutions improve the performance of inflation targeting in EMEs, it appears that some external and domestic factors also matter. These variables are in order of importance: exchange rate gap, output gap, inflation target horizon and degree of openness. However, some institutional variables are more robust to sensitivity tests than others.

The structure of the paper is as follows: Section 2 outlines existing literature on institutional patterns and inflation performance. Section 3 presents the methodology, while section 4 presents the data and stylised facts. Section 5 reports the estimation results. Section 6 provides robustness and sensitivity analysis. Finally, section 7 presents the conclusion and policy recommendations.

2 Review of Literature

2.1 Central Bank Independence

There are at least two definitions of CBI in literature: (i) according to Walsh (2003), CBI relates to the freedom of monetary policymakers from direct political or governmental influence in the conduct of monetary policy; (ii) Cukierman et al. (1992) defined it as the ability of the central bank to stick to the goal of price stability even at the cost of short term objectives.[5]

Two influential theories plausibly explain how CBI can contribute to the achievement of inflation targets. Firstly, the public choice theory proposed by Buchanan and Wagner (1977) argues that central banks are exposed to strong political pressure to behave in accordance with government's preferences to expand the economy by loosening monetary policy at particular times, especially election periods. This may create a political monetary cycle. This theory suggests that CBI can reduce the pre-election manipulation of monetary policy and increase credibility of commitments to price stability by constraining the government's ability to inflate.

[5]The CBI which gives freedom to choose the policy tool by which to achieve its goals without interference from the government is more relevant for IT because the central bank should be accountable, based on the achievement of inflation targets.

Secondly, the dynamic inconsistency theory by Kydland and Prescott (1977) and Barro and Gordon (1983) acknowledges the absence of precommitment in monetary policy as a source of inflationary bias. It argues that the best plan made in the present for some future period may no longer be optimal when that period actually arrives. This makes inflation to be sub-optimal because private sector wages and prices are formed before observing aggregate demand. This gives central banks an ex-post opportunism to temporarily boost output by allowing in unanticipated higher inflation which reduces the real wage of workers. Due to private expectations that inflation will be high, the policy maker's ability to pursue discretionary policy results in inflation without increase in output. This theory predicts that an independent central bank may be necessary to control money creation capacities, both directly by shaping central bank incentives and indirectly, through their credibility effects. Based on these theoretical foundations, the following testable hypothesis can be derived:

Hypothesis 1. *Countries with more independent central banks are likely to achieve their inflation targets most of the time.*

So far some empirical work has been done to test the role of central bank independence on inflation outcomes. However, there are different results on its effects. Cukierman et al. (1992) used both *de jure* and *de facto* measures of CBI for 72 countries for the period 1950-1989 and found that legal CBI negatively affects inflation and its variability in developed countries.[6] They also observed that the turnover rate of central bank governors (a *de facto* measure of CBI) had no correlation with inflation in developed countries but had significant effects on inflation in developing countries.[7] Nevertheless, their study explained the role of CBI on inflation in general and not on achieving inflation targets, which is the focus of our paper. Further, the study focuses on a small set of control variables and leaves some important variables for developing countries.[8]

Using data from 1985-1988 for 16 developed countries, Alesina and Summers (1993) also presented evidence of a strong negative relationship between inflation

[6] They noted that the key channel through which low CBI leads to inflation is through the provision of credit to government. See also Grilli et al, 1991, for further evidence of the effects of CBI on economic outcomes.

[7] Frequent changes of the central bank governor is a strong indication of low level of CBI, because it shows that the political authorities have more opportunity to have central bank governors that will follow their policies than governors that will challenge them.

[8] For example, they did not consider variables which account for exchange rates, inflation inertia and trade openness.

variability and CBI[9]. However, the analytical framework in their study is not rigorous as it only used simple correlations based on cross sectional data which does not provide much information on the long run relationships.

Posen (1998) argued that any conclusion based on the negative correlation of CBI and inflation is not robust enough because correlation does not necessarily imply causation. He proceeded to study 17 OECD countries for the period 1950-1989 and found that CBI does not necessarily reduce the political manipulation of monetary policy or reduce the monetization of budget deficits. Hence it does not lead to low inflation through the enhancement of commitments to price stability. The study focused on developed countries, with different institutional dynamics from developing countries hence its findings maybe quite unconvincing to be generalised for EMEs.

Most related to our study is the paper by Gosselin (2008) who studied 21 IT countries from 1990-2005[10]. He found that CBI was negatively correlated with inflation deviations from the mean among other variables. However, he did not use alternative measures of central bank independence, for example the *de facto* CBI to test for robustness of the de jure measure. Moreover the consideration of inflation target deviations from the target mean does not reflect uncertainity in the inflation process and obscures the clear analysis of central bank performance with regard to inflation targets. Our study uses both *de jure* and *de facto* measures of CBI in a unified framework to explain inflation deviations from the target bands.

2.2 Fiscal Discipline

Fiscal discipline entails managing competing and often excessive claims on limited public resources for macroeconomic stability, without running large and unsustainable budget deficits (Younger et al., 1998). There is a general consensus that fiscal discipline is important for the credibility and viability of price stability.[11]

Theoretical foundations of the relationship between fiscal discipline and inflation outcomes relate to many hypothesis. The fiscal dominance hypotheses proposed by Sargent and Wallace (1981) postulates that fiscally dominant governments running persistent budget deficits may need to finance them with money printing. When a binding financing constraint forces the government to finance its budget deficits

[9] Other recent studies e.g. Crowe and Meade (2008) found similar results.

[10] The sample was composed of 8 industrial countries and 13 emerging market economies.

[11] This is the case especially in EMEs with low tax bases, inefficient tax collection systems and limited access to external borrowing which tend to increase dependence on seigniorage (see e.g. Catao and Terrones, 2005)

through the inflation tax, any attempt to lower inflation today will require higher inflation tomorrow. This may occur because the central bank cannot influence the size of the government's budget deficit, but may be forced to finance the deficit by seigniorage revenue. This theory predicts that consistently high budget deficits are likely to result in persistent inflation target deviations through monetization of public deficits.

The debt dynamics hypothesis by Blanchard (2004) posits that in cases where interest payments on government's domestic debt or expectations of future money growth are high, inflation can rise persistently. Current debt levels may not lead to higher inflation now, but to higher inflation in the future because of high interest payments and expectations. From these reviews we can derive a testable hypothesis:

Hypothesis 2. *Fiscal discipline and sustainable public debt reduces inflation deviations from the target bands.*

Although theory provides coherent and similar predictions about the effects of fiscal balances on inflation, the empirical evidence so far is rather elusive. For example, De Haan and Zelhorst (1990) found a positive long-run relationship between inflation and budget deficits in high inflation countries on a panel of 7 developing countries from 1961-1985. Catao and Terrones (2005) made similar conclusions using a dynamic panel of 103 developing and developed countries from 1960-2001. While these papers give one dimension of the inflationary effects of budget deficits, they do not assess their implications for the success of IT in EMEs.

On the other hand, Fischer et al. (2002) explored the question using a panel of 133 countries for the period 1960-1995. They found a negative relationship between fiscal deficits and inflation which was only strong in high inflation countries and for high inflation episodes but no obvious relationship in low inflation episodes. However, the focus on both developed and developing countries together could introduce heterogeneity bias because of differences in their fiscal institutions.

More recently, Gosselin (2008) found that fiscal deficits account for inflation deviations from the target mean for the sample of both developed and developing countries. The question which remains is whether this applies to EMEs, when inflation deviations from the bands are considered. This has not been explored before.

2.3 Financial Sector Development

Two channels through which financial sector development affect the achievement of inflation targets can be considered; (i) the role of the financial sector in reducing government reliance on seigniorage revenue (see e.g. Neyapti, 2003) and (ii) the credit channel transmission mechanism (see e.g. Bernanke and Blinder, 1988; Bernanke and Gertler, 1995). Neyapti (2003)'s framework postulates that when the financial sector is not developed, fiscal dominance is rife because the government relies on central bank funding for its budget deficits. The model predicts that the degree to which budget deficits are inflationary depends to a greater extent on the level of development of the financial sector. If the financial sector is small relative to the budget deficit, it may fail to absorb newly issued debt, forcing the central bank to monetise the deficits. According to this view, when financial markets are developed, it is easier for the government to finance its budget deficits from the capital markets without relying on seigniorage.

The credit channel monetary transmission mechanism proposed by Bernanke and Blinder (1988) and Bernanke and Gertler (1995) argue that the direct effects of monetary policy on interest rates are amplified by the size of the external finance premium. Since the external finance premium affects the overall price of funds, credit market imperfections affect the consumption and investment decisions, and ultimately prices and output, through economic agent's net worth (balance sheet) and bank lending channels.[12] This model suggests that the transmission of interest rate movements to affect output and price depends on the structure of the financial system. In this case, deep financial systems transmit monetary impulses faster than shallow financial systems. These theoretical rationale lead to the following testable hypothesis:

Hypothesis 3. *Countries with more developed financial systems are likely to keep inflation within the target bands most of the times.*

There are few empirical studies which investigated the role of financial sector development on monetary policy. Cottarelli and Kourelis (1994) tested the effects of financial sector development on the speed of the monetary transmission process using a two step procedure on a panel of 31 developed and developing countries.

[12] The balance sheet channel asserts that the borrower's net worth negatively affects the external finance premium, hence affects economic variables. Bank lending channel relates to the effects of monetary policy on the external finance premium by shifting the cost and supply of intermediated credit.

They concluded that higher financial sector development improves the speed of the transmission process. However, this result could be highly sensitive to influential observations particularly in developed countries which have arguably higher levels of financial sector development than developing countries.

Posen (1995) used the financial opposition to inflation (FOI) on a sample of 32 developed and developing countries from 1960-1989. He found that FOI has a predictive negative effect on inflation outcomes. He argued that the financial sector can support short-run stabilisation policies of the central bank by lobbying for anti-inflation practices.[13] Thus the bigger the financial sector, the more the financial opposition to inflation the economy has. Nevertheless, this study did not account separately, for the effects of FOI between different groups of countries.

Neyapti (2003) used GMM to test the effects of financial sector development and CBI on budget deficits and inflation on 54 developed and developing countries from 1970-1989. She found that when the financial sector is not developed, the positive effect of budget deficits on inflation is strong and CBI affects both the degree of current and future monetary accommodation of budget deficits. Although this analysis provides a framework of understanding the role of financial markets in price stability, it does not analyse its effects on inflation target deviations.

On the other hand, Gosselin (2008) found no significant role of financial sector development in explaining inflation target deviations from the mean. However, his work does not test explicitly the interactions of financial variables and the interest rates to determine if monetary policy effectiveness is enhanced by higher financial sector development.

3 Methodology

This section presents the empirical strategy used in the estimation.

To test the hypotheses highlighted, we specify our empirical model for the likelihood of inflation target deviations from the target bands conditional on institutional factors and other control variables as follows;

$$Infldev_{it} = \mu_i + \delta Inst_{it} + \beta X_{it} + \varepsilon_{it} \tag{1}$$

Where $Infldev_{it}$ is the inflation deviation from the band, $Inst_{it}$ is the vector of

[13] Thus, the central bank can only guarantee price stability as long as the financial sector supports such a policy.

institutional variables, X_{it} is a vector of control variables, μ_i is a vector of country specific unobserved effects that are assumed to be constant over time, δ and β are vectors of slope coefficients that are common to all countries, ε_{it} is a vector of error terms and i and t are country and time indices respectively.

Given the discontinuous and ordinal nature of the dependent variable, it is more appropriate to estimate (1) with a panel ordered logit model.[14] The panel ordered logit model is theoretically appealing because it can account for different inflation target response outcomes and model the nonlinearities in the policy responses to inflation target deviations. In addition, it converges quickly while providing a more flexible analytical framework. In this case, inflation or (*inflation deviation*) can be in three possible states, that is below the target band *(negative deviation)*, within the target band *(no deviation)* and above the target band *(positive deviation)*. The response mechanism is that inflation takes a value of 0 if it is below the target band (*negative deviation*), 1 if it is within the target band (*no deviation*) and 2 if it is above the target band (*positive deviation*).

We estimate the panel ordered logit model with fixed effects to accommodate country-specific unobserved effects. Indeed as argued by Maddala (1987), fixed effects logit models give consistent estimates using the conditional maximum likelihood method, where we condition on the fixed effects. The panel ordered logit econometric procedure is explained in detail in Appendix A.

In discrete choice models, the parameters that are normally provided are the marginal effects because they have reasonable asymptotic properties and can be interpreted easily (Wooldridge, 2002). However, in the case of the panel data, no programme is available in the Stata package which can help us to do this directly. We use the *GLLAMM* module by Rabe-Hesketh et al. (2004) to estimate the fixed effects ordered logit model. This programme allows the specifications of nonlinear models that can accommodate many response categories. Moreover, it can handle unobserved heterogeneity due to individual country features for ordinal endogenous variables in its computational framework. We develop a three-step procedure of estimating marginal effects using *GLLAMM.* This is explained in Appendix B.

[14] We consider that when inflation is within the inflation band, that provides some discontinuity on the target deviation which records zero (no deviation) even if there are different inflation outcomes in that range.

4 Data and stylised facts

The paper uses quarterly panel data of 15 inflation targeting EMEs from 1991-2008. The panel is unbalanced because of different adoption dates for inflation targeting. Table 4 shows the sample of IT emerging market economies and their structural characteristics. The dependent variable is inflation target deviation, an ordinal discrete variable measured as the absolute deviation of inflation from target bands. We consider explicit inflation targets for each country. For many countries, inflation targets are based on the headline consumer price index.[15] We focus specifically on three institutional categories; monetary institutions, fiscal institutions and financial institutions which are captured by CBI indicators, fiscal discipline indicators and financial sector development indicators.

CBI indicators used are legal CBI index (*logcbi1*), which is a *de jure* measure of CBI and the turnover rate of central bank governors (*logtor),* which is a *de facto* measure of CBI. For legal CBI we use the index which was developed by Cukierman et al. (1992) and updated by Polillo and Guillen (2005), Crowe and Meade (2008) and ourselves for more recent years. This measure is an aggregate index computed from sixteen different legal characteristics found in central bank laws.[16] It is conceptually attractive because it is a comprehensive measure which captures the operating institutional framework and various structural aspects of central banks in each country. It has also been widely used in literature.[17] Higher index values indicate higher central bank independence. It is expected to be negatively related to positive inflation target deviations. The turnover rate of central bank governors is alternatively used because central banks may be more independent in practice than what is stated in their legislations (Cukierman et al., 1992)[18]. It is expected to be positively related to positive inflation deviations.

[15] However, some countries e.g. Thailand set inflation targets in terms of core inflation. South Korea and the Czech Republic used to define their targets in terms of core inflation but have now moved to headline inflation.

[16] The legal characteristics: term of office, appointment, dismisal, other government responsibilities of the governor, price stability objective, monetary policy formulation, conflict resolution, role of central bank in government, advance and limits of loans to government, decisions on terms of lending, beneficiaries, types of limits, loan maturity, restrictions on interest and ban on buying or selling government bonds in the market.

[17] (See e.g Campillo and Miron, 1996; Crowe and Meade, 2008; Jacome and Vazquez, 2008)

[18] Turnover rate of central bank governors is calculated as the number of governors in a certain period divided by the reference term of office. The higher the turnover, the higher the risk of influencing the executive branch, hence the lower the independence. Long tenure gives the governor the independent reputation that may solidify his resistance to political pressure.

Fiscal discipline is proxied by budget deficits as a percentage of GDP (*bd*) and domestic debt as a percentage of GDP (*debt*). The primary fiscal balance to GDP is used because it is a relatively good principal component indicator of the level of fiscal discipline which assesses the orientation of fiscal policy over the fiscal year (Fischer et al., 2002). It accounts for the fact that the achievement of inflation targets may depend on the reform of fiscal institutions. Domestic debt to GDP is alternatively used because countries with high debt to GDP ratios are likely to use seigniorage or inflate the debt in future (Reinhart and Rogoff, 2008). We expect fiscal balance or debt to raise the likelihood of inflation deviation from the upper band.

Financial sector development is measured by private credit to GDP ratio (*logpcrdt*) and alternatively by liquid liabilities to GDP ratio (*logll_gdp)*. Private credit to GDP is the value of all credit that financial intermediaries issue to the private sector as a share of GDP. It is the preferred measure of financial sector development in literature because higher levels of private credit indicate larger involvement of the private sector in the economy. Liquid liabilities to GDP ratio is composed of currency plus demand and interest bearing liabilities of banks and non banks. It reflects the size of the financial sector relative to the economy (see e.g Levine et al., 2000; Boyd et al., 2001).

Based on the standard literature on inflation dynamics, we choose the following control variables in our regressions: output gap (*lygp*) to account for business cycle growth, exchange rate gap (*lexrg*) to account for the effects of exchange rates on inflation, terms of trade (*logtot*) to account for external shocks, openness (*logopen*) to control for exposure to external shocks, while lagged inflation(*inflg*) account for the persistence effects of inflation. Policy rates (*rts*) are there to capture central bank policy instruments which reflect monetary policy decisions. This follows from the understanding that in an inflation targeting framework, whenever inflation deviates from the target, central banks use interest rates to bring inflation within the target bands (Svensson, 1997). We also control for the inflation targeting horizon (*loghorzn*). This is the period over which inflation is required to return to the target band following a shock (Roger and Stone, 2005). It is an important variable to consider since it relates to the design of IT with respect to its response to shocks.[19] Since these control variables cover a wide range of characteristics of EMEs, they also help to reduce omitted variable bias, which has plagued most previous studies.

[19] Since inflation target horizon is related to the design of IT, it can be considered as an institutional variable. However, we have controlled for this variable in order to evaluate the explicit role played by central bank independence, fiscal discipline and financial sector development in inflation targeting.

The main sources of data are IMF's International Financial Statistics, World Development Indicators, Datastream, Global Insight and various Central Bank websites. Table 5 in the appendix provides variable descriptions and their sources in detail.

We also present some stylised facts on institutional patterns and inflation target outcomes. According to Roger and Stone (2005), inflation targeting countries have missed their target ranges by about 40% of the time and that EMEs have experienced more target misses of about 52.2% of the time compared with developed countries with 34.8%. In Table 6 we show several stylized facts about the experience of EMEs in the achievement of inflation targets. The average frequencies of target misses are about 15% and 43% below and above the targets respectively. The Philippines, Poland and Peru experienced most frequent target misses below the target band while Israel, the Philippines, South Africa and Turkey experienced more target deviations above the bands. Colombia, Chile, and the Czech Republic achieved their inflation targets most of the times. In terms of magnitudes, deviations above the target are more common, averaging 3.43% compared with deviations below the band which average -1%. Indeed, large deviations above the upper target bands are generally considered to be more harmful than deviations below the target bands in EMEs.[20]

In terms of persistence, Table 6 shows that inflation target deviations above the bands averages 4.9 quarters, which may reflect the average inflation target horizon. A common trend is that countries tend to overshoot than undershoot their target bands in their disinflation stages. Generally, large, more frequent and persistent inflation target deviations were common in Brazil, Israel, South Africa and Thailand.

In Figure 1, we bring institutional dynamics in the picture by presenting their relationship with inflation target outcomes at an aggregate level in EMEs. We observe that on average there has been progressive improvement in monetary and financial institutional structures in emerging countries since the 1990s. This corresponds to a noticeable decrease in the magnitude of inflation target deviations. This pattern suggests that there could be a link between institutional structures and inflation target deviations. Two horizons can be noticed in Figure 1. First, is a disinflationary trend in the 1990s which was associated with large and frequent inflation target deviations. For many countries, higher inflation deviations during the disinflationary periods were attributed to previous hyperinflations, weak institutions and imbalances

[20]Naturally economic agents prefer lower inflation to higher inflation, hence upper target misses may have more costs and lead to credibility loss. Also most central banks associate larger welfare losses to positive than negative inflation deviations. However, there is a threat of a zero lower bound if deviations below the band persist, but the risk has been considered to be minimal for most EMEs.

of previous monetary anchors which had not subsided (Petursson, 2004). Second, is a more stable inflation horizon associated with relatively low inflation and small inflation target deviations in the 2000s. This pattern may reflect the improvement in institutional structures and monetary policy management.[21]

Figure 1: Institutional developments and inflation performance in EMEs

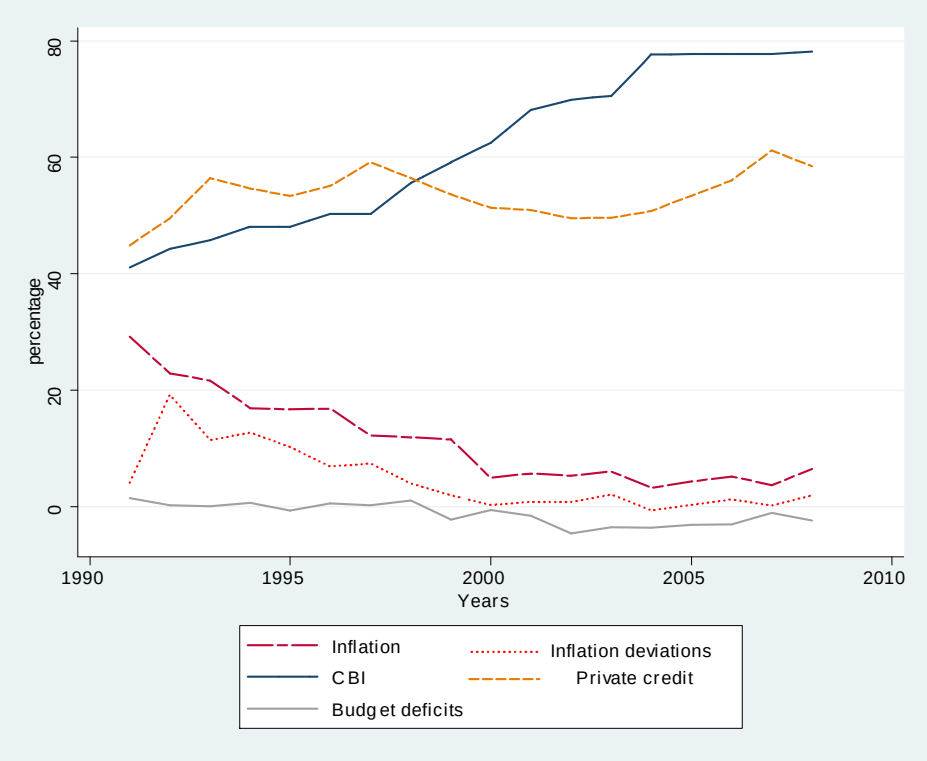

Figure 2 in the Appendix shows institutional patterns and inflation target performance of individual EMEs. The figure shows that Chile and South Africa have strong monetary, fiscal and financial institutions as measured by central bank independence, budget deficit to GDP ratio and private credit to GDP ratio. On the other hand, Brazil, Thailand and South Korea have poor institutional frameworks. But in terms of inflation targeting performance, inflation has stayed within the range most of the times in Chile, Thailand and South Korea, while in South Africa, Brazil, Israel and Poland it has often been outside the range. In some countries, for example Brazil, the government has been considered to have a history of poor support for price stability, where laws supporting CBI have been easily overturned (Albagli and

[21] The Great Moderation could also have contributed to general stability of inflation and low inflation target deviations in the 2000s.

Schmidt-Hebbel, 2003). It is therefore important to analyse the role of institutional patterns for inflation targeting performance in EMEs.

4.1 Panel data estimation issues

Estimation of the panel ordered logit model raises several methodological issues. First, there is the possibility of endogeneity in our institutional variables. For example legal reform of central banks may be a response to high inflation rates. Neyapti (2003) also noted that high budget deficits may force monetary authorities to tighten monetary policy inorder to reduce inflation. In addition, price stabilisation due to inflation targeting may improve financial development (Boyd et al., 2001). Secondly, non-stationarity of variables is an issue since we are dealing with macroeconomic data. Thirdly, we need to check for the presence of multicollinearity of variables and heteroskedasticity of the residuals.

We use the Hausman technique to test for potential endogeneity of our key institutional variables; legal CBI, private credit to GDP and budget deficits to GDP. We use first lags of these variables as instruments in the test for endogeneity. The Hausman test statistic is 1.81 with a p-value of 0.97, hence we accept the null hypothesis of no endogeneity. Therefore the analysis is based on the standard panel ordered logit model.

We also test for stationarity in all the variables using the Fisher-type test as suggested by Maddala and Wu (1999). This test involves combining the p-values of the test statistics for unit root in each cross-sectional unit to generate a test statistic. The null hypothesis is that there are unit roots (not stationary) against the alternative that at least one is stationary. This test is more appropriate because it can be applied in unbalanced panels. Table 8 shows the results. Legal CBI was not stationary in levels and became stationary after first differencing, but the rest of the variables were stationary in levels. We also test for possible cointegration in the non-stationary variable using the Persyn and Westerlund (2008) technique.[22] Using robust p-values, we found no cointegration.

The possibility of multicollinearity on the variables is inferred using correlation coefficients. Table 7 shows the pairwise correlation matrix for all the variables. We do not suspect the presence of serious multicollinearity in our explanatory variables

[22] This technique is composed of four tests which do not impose common factor restrictions on the data.

because of low correlations. This is also the case with our institutional variables.[23] Some variables were transformed into logs in order to stabilise the variances. We also use robust standard errors in our estimations to deal with possible heteroskedasticity.

5 Empirical Results

In this section, we present and discuss the results from the estimations. The discussion of results is based on marginal effects. These tell us the probability of having inflation falling in each inflation target category following a unit change in a particular variable.

5.1 Central Bank Independence

The institutional variables were added to the ordered logit regression one at a time. The results for two CBI measures; legal CBI (*logcbi1*) and turnover rate of central bank governors (*logtor*) are shown in Table 1.

Model 1 shows regression which includes CBI and all control variables. The results in Model 1 show that higher legal CBI reduces the probability of having inflation above the target band. At the same time an increase in the legal CBI increases the probability of having inflation within the target band as well as below the target band. Quantitatively, a 1% increase in legal CBI index results in a decrease in the probability of having inflation above the target by 0.11%, while increasing the probability of achieving the target band by 0.16%. The probability of having inflation below the target also increases by 0.05% as CBI increases. The results suggest that countries with more aggressive central bank reforms have better chances of achieving inflation targets, which may reflect a stronger ability to commit to price stability (Cukierman et al., 1992). This is consistent with the dynamic inconsistency hypothesis which indicates that higher CBI may eliminate policy makers' appetite for surprise inflation. These results are in line with other studies, for example Gosselin (2008), who made similar conclusions on inflation deviations from the mean.

When the turnover rate of central bank governors is used as a measure of CBI, we find no significant effect on the probability of achieving the target band or missing the target bands. The signs of marginal effects are contrary to expectations. This result suggests instead that in EMEs, lower turnover of the central bank governors is not necessarily a sign of a high central bank independence. This may be due to the fact that it is not a very comprehensive measure as it focuses on one central bank

[23] However private credit to GDP is highly correlated to domestic debt to GDP ratio

Table 1: Ordered logit results: the effects of central bank indepedence

	Model 1			Model 1'		
Variables	mfx_0	mfx_1	mfx_2	mfx_0	mfx_1	mfx_2
lygp	-0.181***	-0.0681**	0.249***	-0.181***	-0.0779**	0.259***
	(0.0572)	(0.0478)	(0.0476)	(0.0604)	(0.0537)	(0.0480)
lexrg	-0.419***	-0.223***	0.642***	-0.419***	-0.225***	0.644***
	(0.0727)	(0.0698)	(0.0800)	(0.0756)	(0.0716)	(0.0821)
logtot	-0.0280	-0.0842*	0.112**	-0.0278	-0.0853*	0.113**
	(0.0285)	(0.0423)	(0.0482)	(0.0281)	(0.0427)	(0.0494)
logopen	-0.163***	-0.0320	0.195***	-0.154***	-0.0378	0.192***
	(0.0479)	(0.0437)	(0.0278)	(0.0504)	(0.0509)	(0.0300)
loghorzn	-0.182***	0.0553	0.126**	-0.183***	0.0541	0.129**
	(0.0418)	(0.0484)	(0.0576)	(0.0405)	(0.0446)	(0.0586)
rts	-0.00999**	0.000134	0.00985	-0.00965**	-1.47e-05	0.00966
	(0.00414)	(0.00371)	(0.00584)	(0.00411)	(0.00382)	(0.00583)
inflg	-0.0127***	-0.0141***	0.0268***	-0.0128***	-0.0142**	0.0270***
	(0.00348)	(0.00468)	(0.00785)	(0.00352)	(0.00479)	(0.00801)
logcbi1	0.0502**	0.159**	-0.109**			
	(0.0637)	(0.0681)	(0.0567)			
logtor				0.00848	0.0154	-0.0239*
				(0.0118)	(0.0172)	(0.0153)
Constant	-0.00169**	-0.00235**	0.00404**	-0.00143*	-0.00291**	0.00434**
	(0.000761)	(0.00107)	(0.00168)	(0.000711)	(0.00108)	(0.00168)
Observations	586	586	586	586	586	586
Number of countries	15	15	15	15	15	15
R^2	0.339	0.289	0.527	0.334	0.277	0.525

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Model 1 is the ordered logit model including $logcbi1$

Model 1' is the ordered logit model including $logtor$

mfx_0, mfx_1 and mfx_2 are marginal effects of having inflation below the band, within the band and above the band respectively.

feature. Mas (1995) argued that low turnover rate of central bank governors may rather indicate a low CBI instead of higher CBI because the subservient governor can stay in office longer than a governor who tries to resist political pressure.[24] However the results contradicts the conclusions by Cukierman et al. (1992) and Jacome and Vazquez (2008) who found its significance in explaining inflation outcomes in developing countries.[25]

Table 9 shows results when all institutional variables are included in the regression together. We observe that the marginal effects for legal CBI increases and are significant. This improvement in the results may suggest that these institutional variables are complementary. For example a credible central bank may commit not to finance the fiscal deficit, which may strengthen fiscal authorities' incentive to balance the budget (Grilli et al., 1991). However, the turnover rate of central bank governors remain insignificant.

5.2 Fiscal Discipline

Table 2 presents the results when fiscal institutional variables are used. Model 2 shows regressions with budget deficits to GDP ratio while model 2' shows results when we use domestic debt to GDP ratio instead.

The results show that an increase in budget deficits increases the likelihood of missing the upper inflation target band while reducing the likelihood of missing the lower inflation target band and achieving the inflation target band. In fact, a 1% increase in budget deficit increases the likelihood of inflation being above the target band by about 0.007%, while it reduces the likelihood of being below the target band and of being within the band by 0.005% and 0.001% respectively. The effects are significant at the 1% level. This is intuitive for EMEs considering their poor fiscal institutions (Catao and Terrones, 2005). The results are consistent with Sargent and Wallace (1981)'s fiscal dominance hypothesis and the empirical findings of De Haan and Zelhorst (1990) and Catao and Terrones (2005) which show that high budget deficits may lead to high inflation while fiscal consolidation enhances the achievement of inflation targets. The evidence suggests that countries that seek a low inflation path should ensure that their fiscal positions do not lead to fiscal dominance.

[24] Walsh (2003) argued that in countries where the rule of law is embedded in political culture, there can be a wide gap between legal CBI and actual CBI.

[25] As Cukierman et al. (1992) note, possibly this could be explained by the fact that legal CBI and the turnover rate of central bank governors are measuring orthogonal aspects of CBI.

Table 2: Ordered logit results: The effects of fiscal discipline

	Model 2			Model 2'		
Variables	mfx_0	mfx_1	mfx_2	mfx_0	mfx_1	mfx_2
lygp	-0.131*	-0.164*	0.295***	-0.155**	-0.0633*	0.218***
	(0.0700)	(0.0992)	(0.0568)	(0.0659)	(0.0527)	(0.0473)
lexrg	-0.411***	-0.287***	0.698***	-0.407***	-0.268***	0.675***
	(0.0719)	(0.0675)	(0.0866)	(0.0759)	(0.0869)	(0.0847)
logtot	0.00666	-0.0959*	0.0892	-0.0465	-0.0203	0.0668*
	(0.0243)	(0.0536)	(0.0524)	(0.0416)	(0.0394)	(0.0367)
logopen	-0.136**	-0.0647**	0.200**	-0.158**	-0.0492**	0.207**
	(0.0503)	(0.0513)	(0.0310)	(0.0559)	(0.0551)	(0.0280)
loghorzn	-0.194***	0.119	0.0750*	-0.169***	0.0472	0.122**
	(0.0445)	(0.0780)	(0.0533)	(0.0410)	(0.0599)	(0.0542)
rts	-0.0101**	0.000366	0.00969*	-0.00948*	0.000131	0.00934
	(0.00409)	(0.00446)	(0.00547)	(0.00455)	(0.00413)	(0.00555)
inflg	-0.0126***	-0.0133**	0.0259***	-0.0134***	-0.0139**	0.0273***
	(0.00329)	(0.00458)	(0.00746)	(0.00406)	(0.00471)	(0.00844)
bd	-0.00524***	-0.00136***	0.0066***			
	(0.000600)	(0.00118)	(0.000599)			
debt				-0.00210***	-0.00358***	0.00568***
				(0.000263)	(0.000273)	(0.000419)
Constant	-0.00137**	-0.00308**	0.00445**	-0.00166**	-0.00226*	0.00392**
	(0.000619)	(0.00123)	(0.00156)	(0.000671)	(0.00118)	(0.00166)
Observations	586	586	586	586	586	586
R^2	0.422	0.264	0.578	0.340	0.271	0.540
Number of countries	15	15	15	15	15	15

*** p<0.01, ** p<0.05, * p<0.1

Robust standard errors in parentheses

Model 2 is the ordered logit model including budget deficit to GDP ratio

Model 2' is the ordered logit model including domestic debt to GDP ratio.

mfx_0, mfx_1 and mfx_2 are marginal effects of having inflation below the band, within the band and above the band respectively.

When the ratio of debt to GDP is the variable which captures fiscal discipline, we observe that its increase reduces the probability of being in the target band mainly by increasing significantly the probability of being above the upper bound. A 1% increase in debt to GDP ratio significantly increases the probability of exceeding the upper bound by 0.006%. At the same time, an increase in debt significantly decrease the probability of undershooting the lower bound by 0.002% while the probability of inflation staying within the target bound also decreases by about 0.0036%. Consistent with earlier work (see e.g. Campillo and Miron, 1996), our results support the view that unsustainable public debts makes monetary authorities reluctant to raise interest rates to fight inflation because such increases would raise the cost of debt service.

When institutional variables are included together in the regression (as shown in Table 9), the marginal effects are magnified for both budget deficits to GDP and domestic debt to GDP. For example the likelihood of overshooting the target band significantly increases by 0.0068% and 0.0057% following a 1% increase in budget deficits and debt respectively. This lends further support for fiscal consolidation as a condition of sustained price stability.

5.3 Financial Sector Development

The effects of financial sector development are indicated by the private credit to GDP ratio (*logpcrdt*) and liquid liability to GDP (*logll_gdp*). The results are presented in Table 3. Model 3 reports the results for private credit to GDP ratio while model 3' replaces the private credit to GDP by liquid liabilities to GDP.

The results show that an increase in the private credit to GDP ratio increases significantly the probability of staying in the target band and of having inflation below the target. On the other hand an increase in private credit to GDP reduces the probability of having inflation above the target band. In fact, a 1% increase in private credit to GDP translates into an increase of 0.12% in the probability of staying in the target band as well as 0.06% of having inflation in the lower band. At the same time, an increase in private credit to GDP reduces the probability of inflation overshooting the upper band by 0.055%. The marginal effects are significant. Consistent with Neyapti (2003)'s findings, these results suggest that countries with deep financial markets can easily finance their budget deficits in the capital markets without resorting to inflationary financing. However, when we use liquid liabilities to GDP ratio, we find no significant effects and its sign is also contrary to what is generally expected.

Table 3: Ordered logit results: the effects of financial sector development

	Model 3			Model 3'		
Variables	mfx_0	mfx_1	mfx_2	mfx_0	mfx_1	mfx_2
lygp	-0.184***	-0.191*	0.251***	-0.186***	-0.0722*	0.258***
	(0.0599)	(0.183)	(0.0483)	(0.0591)	(0.0551)	(0.0504)
lexrg	-0.424***	-0.208**	0.627***	-0.417***	-0.211***	0.628***
	(0.0743)	(0.0774)	(0.0844)	(0.0727)	(0.0694)	(0.0805)
logtot	-0.0269	-0.0554	0.112**	-0.0281	-0.0883*	0.116**
	(0.0284)	(0.0385)	(0.0492)	(0.0272)	(0.0417)	(0.0458)
logopen	-0.159**	-0.0861**	0.196**	-0.166**	-0.0366**	0.203**
	(0.0492)	(0.0530)	(0.0297)	(0.0487)	(0.0494)	(0.0300)
loghorzn	-0.188***	0.114	0.128**	-0.185***	0.0555	0.130**
	(0.0396)	(0.0732)	(0.0583)	(0.0390)	(0.0472)	(0.0594)
rts	-0.00955**	0.00294	0.00974	-0.00950**	0.000193	0.00931
	(0.00409)	(0.00485)	(0.00577)	(0.00406)	(0.00382)	(0.00577)
inflg	-0.0129**	-0.0145**	0.0270**	-0.0129**	-0.0141**	0.0270**
	(0.00359)	(0.00514)	(0.00799)	(0.00348)	(0.00469)	(0.00786)
logpcrdt	0.0604**	0.120**	-0.0552**			
	(0.0172)	(0.0363)	(0.0361)			
logll_gdp				-0.0777	-0.0798	0.157
				(0.0640)	(0.138)	(0.119)
Constant	-0.00110	-0.00375**	0.00462**	-0.00103	-0.00252*	0.00355*
	(0.000704)	(0.00134)	(0.00183)	(0.000614)	(0.00139)	(0.00184)
Observations	586	586	586	586	586	586
Number of countries	15	15	15	15	15	15
R^2	0.341	0.253	0.526	0.339	0.276	0.528

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Model 3 is the ordered logit model including private credit to GDP ratio

Model 3' is the ordered logit model including liquid liabilities to GDP ratio

mfx_0, mfx_1 and mfx_2 are marginal effects of having inflation below the band, within the band and above the band respectively.

In Table 9, we report the results when we include all institutional variables together in the regression. We observe that the marginal effects of private credit to GDP and liquid liabilities to GDP are not very different from those reported in Table 3. In fact, an increase in private credit to GDP still displays negative significant effects of having inflation above the target band while increasing significantly the probability of achieving inflation targets. Liquid liabilities are still insignificant, possibly due to the relatively high correlation with domestic debt.[26] The less significant effect of liquid liabilities to GDP may indicate that it is not a robust measure of financial sector development. The other possibility could be that the credit channel transmission mechanism of monetary policy is weak in EMEs.

5.4 Control Variables

Our discussion of control variables is based on Table 9. We only discuss the most important variables which explain inflation target deviations, that is exchange rate gap, output gap, openness and inflation target horizon. The results show that a 1% increase in the exchange rate gap increases the probability of having inflation above the target by 0.7%, while decreasing the probability of achieving the target band by 0.28%. The probability of having inflation below the target also decreases by 0.41%. The marginal effects are significant at the 1%. This outcome suggests that countries which experience sharp exchange rate fluctuations and high exchange rate pass-through effects have problems in meeting their inflation targets. This is probably the case for countries like South Africa in which most target misses were associated with periods of high exchange rate volatility (Roger and Stone, 2005). Indeed, Ho and McCauley (2003) argued that exchange rate volatilities have strong effects on inflation in EMEs.

The output gap also explains inflation deviations from the bands. This means that inflation in EMEs is very sensitive to demand shocks. This highlights the fact that demand led component of inflation is an important determinant of inflation target deviations in EMEs and explains why central banks also include the output gap in their loss functions. The evidence suggests that central banks should move interest rates more to offset demand shocks and bring inflation back in the target band. This contrasts the results of Gosselin (2008), possibly because of differences in the composition of the samples used.

[26] see table 7

The degree of openness seems to increase the chances of overshooting the upper target bound while reducing chances of undershooting the lower bound. This result contrasts with that of Campillo and Miron (1996) which shows a negative effect on inflation outcomes. Our results imply that EMEs being small and open, are greatly exposed to external shocks and global inflationary pressures (Fraga et al., 2003). Another possible explanation could be that openness of EMEs have not reduced the incentives by policy makers to pursue expansionary monetary policies.

We further observe the significant role of the inflation target horizon. In this case, specifying a longer inflation target horizon increases chances of having inflation above the upper target while lowering the chances of having inflation below the lower target. The result suggests that long target horizons increase the time over which inflation can stay out of the target range. This may also imply that central banks allow inflation to return to target slowly in order to reduce volatility in real economic activity. This may also highlight the fact that central banks are flexible in dealing with inflation deviations from the target bands.

6 Robustness and Sensitivity Analysis

In this section, we conduct various robustness and sensitivity tests of the results. Firstly, we test if our results are sensitive to alternative specifications and distributional assumptions of the error terms. We specify the random effects ordered probit model.[27] The results are presented in Table 10. We observe that legal CBI still affects negatively and significantly the probability of having inflation above the target band while affecting positively and significantly the probability of achieving inflation targets. The turnover rate is still insignificant and exhibits signs contrary to expectations. The fiscal variables also do not change the results. In fact, budget deficits affect positively and significantly the probability of inflation target overshoots and negatively the probability of inflation target undershoots. However, the magnitudes of the effects are marginally larger than those in the baseline case, but the conclusions are basically consistent. For financial sector development indicators, the results reveal, as in the baseline case, that an increase in private credit to GDP decreases the probability of overshooting, while increasing significantly the probability of achieving inflation targets. Liquid liabilities to GDP ratio are still insignificant, possibly implying that it may not be a good measure of financial sector development. This evidence

[27] The ordered probit model assumes normal distribution of the error process.

therefore confirms that our results are not very sensitive to model specification and distributional assumptions.[28]

Secondly, we estimate the model for two subperiods; the 1990s and the 2000s to account for different inflation episodes which we observed in Figure 1. The 1990s were associated with disinflations while the 2000s, experienced more stable inflation (Roger and Stone, 2005). This can influence our results in many ways. For example, the strength of the nominal anchor may vary depending on whether inflation targets are stable or not (Mishkin and Schmidt-Hebbel, 2007). Also the global macroeconomic conditions could have changed in the two periods which could affect the achievement of inflation targets.

Table 11 shows the results for the 1991-1999 subsample. We observe that legal CBI has some explanatory power for positive inflation deviations, negative inflation deviations as well as zero deviations. This confirms our earlier finding that legal CBI matters for the achievement of inflation targets. However, the turnover rate of central bank governors has no significant effects on inflation target outcomes. Perhaps this suggests that what was more important during this period was *de jure* CBI than *de facto* CBI. As Fraga et al. (2003) argue, legal independence could have been a pre-requisite to gain credibility so as to effectively stabilise inflation. We also observe that both fiscal deficits and domestic debt have strong and significant effects on inflation deviations in the 1990s. However, both private credit to GDP ratio and liquid liabilities to GDP seems to have less significant effects on inflation target outcomes. This is in line with findings from previous studies which confirm its weak impact on inflation target deviations (see e.g Gosselin, 2008). A possible explanation for this weak effect on inflation target outcomes is that, presumably many EMEs have adopted IT in the presence of weak financial systems. Another possible explanation is that the financial crises in Asia and Latin America in the 1990s, could have made EMEs more vulnerable to high inflation and currency crises (Mishkin, 2004).

The estimations for the 2000-2008 subsample is presented in figure 12. We observe that the statistical significance of legal CBI becomes weaker. However, turnover rate exhibit strong significant effects on inflation target outcomes. The results suggest that what matters during the 2000s was actual CBI rather than legal CBI. The significant effect of legal CBI in the 1990s compared to the 2000s also suggests that the contribution of CBI to IT is largest during disinflations than during stable inflation

[28] We also experimented by including one institutional variable in the ordered probit model, but this did not change our results. We did not present these results, but they are available on request.

periods. Also most central bank reforms were done during the 1990s rather than in the 2000s, which could have improved monetary policy credibility in dealing with inflation. The fiscal variables seem to have strong effects on inflation target outcomes. For example, a 1% increase in budget deficits and domestic debt significantly increases the probability of overshooting the upper target by 0.005% and 0.012% respectively. This robustly confirms our baseline results and provides further support for the need for fiscal discipline in IT. On the financial institutional indicators, we observe that private credit to GDP has strong effects on inflation target outcomes, while liquid liabilities to GDP seems to be less significant. This result could be linked with the general improvements in the level of development of the financial systems in the 2000s than in the 1990s.

Thirdly, there is a possibility that the financial crises from 2007 could have affected our results through their effects on fiscal balances, financial variables and macroeconomic variables. Thus we test if the results remain stable when we exclude the 2007-2008 period from the whole sample. The results are presented in table 13. We observe that legal CBI still explain inflation target outcomes. The turnover rate of central bank governors is now significant. This provides further support to the view that the conduct of monetary policy must remain independent of political pressure in order to achieve sustainable price stability. Consistent with the baseline results, both budget deficits to GDP ratio and domestic debt to GDP ratio exhibit significant effects on inflation target outcomes. However, the marginal contributions to the likelihood of all inflation response categories are relatively lower than those in the baseline specification. On the financial variables, we observe that private credit to GDP significantly affects inflation target outcomes. Also liquid liabilities to GDP exhibit the correct signs and are significant in all response categories. One possible explanation for this result is that these measures are better indicators of financial sector development in EMEs during stable periods than during crises.

Fourthly, it is often argued that institutional structures affect inflation target outcomes by enhancing the effectiveness of monetary policy (Cecchetti and Krause, 2001). We test this hypothesis by interacting institutional variables with interest rates. The results are shown in table 14. The results show that policy interest rates are more effective in reducing inflation target deviations in countries that have more independent central banks when legal CBI indices are used. As emphasised by Bernanke et al. (1999), this implies that CBI contributes to monetary policy strength and credibility by reducing the possibility of inflation surprises. The marginal effects of the

interacted fiscal variables are all significant. This suggests that strong fiscal institutions improve the effectiveness of policy interest rates, thus underscoring the need for fiscal discipline in inflation targeting. Moreover, the results shows that financial sector development enhances the effectiveness of monetary policy when private credit to GDP is interacted with policy rates. In general, these results supports the view that monetary policy is likely to be more effective in countries with mature institutions.

7 Conclusion

This paper analyses the role of central bank independence, fiscal discipline and financial sector development on the achievement of inflation targets. It focuses on inflation deviations from the target bands rather than deviations from the mean. Inorder to test the hypothesis, the panel ordered logit model was applied.

The results show that improvement in central bank independence, fiscal discipline and financial sector development help to reduce the probability of missing the target bands. These results therefore support the view that monetary, fiscal and financial institutional structures matter for inflation targeting in EMEs, once we control for macroeconomic and other factors. We also conclude from the results that improvement in these institutional structures tend to enhance the effectiveness of monetary policy. These institutional factors are not orthogonal, in fact, they reinforce each other since their combined impact is quite large.

Although these institutional structures explain inflation target outcomes in EMEs, other factors also matter. The results show that control variables such as output gap, exchange rate gap, openness and inflation target horizon also seem to explain inflation target outcomes. This suggests that inflation in EMEs is sensitive to macroeconomic developments, which could explain why some countries with good institutional structures have often missed their inflation targets.

The findings suggest that the process of institutional reform of central banks, fiscal institutions and financial institutions should continue for countries to achieve sustainable price stability. What is needed is an institutional framework that can respond, adapt and perform effectively while inducing responsible government behaviour and restraining abuses of macroeconomic policies. In fact, good institutional frameworks should be complemented by sound good macroeconomic policies to bring sustainable price stability. The results also suggest that policy makers should pay attention to both domestic and external factors, since they also account for inflation

target deviations even in countries where these institutions are good. More importantly, the strong effects of the exchange rate gap on inflation target outcomes suggest that EMEs must consider their greater vulnerability to exchange rate shocks in the formulation of monetary policy. These findings have important implications both for countries preparing to adopt inflation targeting and the current inflation targeters.

References

Agenor, P. (2000). *Monetary policy under flexible exchange rates: an introduction to inflation targeting*, World Bank Publications.

Albagli, E. and Schmidt-Hebbel, K. (2003). By how much and why do inflation targeters miss their targets?, *Conference on Monetary Policy and Learning*.

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

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

Batini, N. and Laxton, D. (2006). Under what conditions can inflation targeting be adopted? the experience of emerging markets, *Central Bank of Chile Working Paper* (406).

Bernanke, B. and Blinder, A. (1988). Credit, money, and aggregate demand, *American Economic Review* **78**(2): 435–439.

Bernanke, B. and Gertler, M. (1995). Inside the black box: the credit channel of monetary policy transmission, *Journal of Economic Perspectives* **9**(4): 27–48.

Bernanke, B., Laubach, T., Mishkin, F. and Posen, A. (1999). *Inflation targeting: lessons from the international experience*, Princeton University Press.

Blanchard, O. (2004). Fiscal dominance and inflation targeting: lessons from brazil, *NBER working paper* (10389).

Boyd, J., Levine, R. and Smith, B. (2001). The impact of inflation on financial sector performance, *Journal of Monetary Economics* **47**(2): 221–248.

Buchanan, J. and Wagner, R. (1977). *Democracy in deficit*, New York Academic Press.

Campillo, M. and Miron, J. (1996). Why does inflation differ across countries?, *NBER working paper* (5540): 335–57.

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

Cecchetti, S. and Krause, S. (2001). Financial structure, macroeconomic stability and monetary policy, *NBER Working Paper* (8354).

Cottarelli, C. and Kourelis, A. (1994). Financial structure, bank lending rates, and the transmission mechanism of monetary policy, *Staff Papers-International Monetary Fund* **41**(4): 587–623.

Crowe, C. and Meade, E. (2008). Central bank independence and transparency: Evolution and effectiveness, *European Journal of Political Economy* **24**(4): 763–777.

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

De Haan, J. and Zelhorst, D. (1990). The impact of government deficits on money growth in developing countries, *Journal of International Money and Finance* **9**(4): 455–469.

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

Fraga, A., Goldfajn, I. and Minella, A. (2003). Inflation targeting in emerging market economies, *NBER Macroeconomics Annual* **18**: 365–400.

Gosselin, M. (2008). Central bank performance under inflation targeting, *Bank of Canada Review* (18).

Grilli, V., Masciandaro, D., Tabellini, G., Malinvaud, E. and Pagano, M. (1991). Political and monetary institutions and public financial policies in the industrial countries, *Economic Policy* **6**(13): 342–392.

Ho, C. and McCauley, R. (2003). *Living with flexible exchange rates: issues and recent experience in inflation targeting emerging market economies*, Bank for International Settlements, Monetary and Economic Department.

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

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

Levine, R., Loayza, N. and Beck, T. (2000). Financial intermediation and growth: Causality and causes, *Journal of monetary Economics* **46**(1): 31–78.

Maddala, G. (1987). Limited dependent variable models using panel data, *Journal of Human Resources* **22**(3): 307–338.

Maddala, G. and Wu, S. (1999). A comparative study of unit root tests with panel data and a new simple test, *Oxford Bulletin of Economics and statistics* **61**: 631–652.

Mas, I. (1995). Central bank independence: a critical view from a developing country perspective, *World Development* **23**(10): 1639–1652.

Mishkin, F. (2004). Can inflation targeting work in emerging market countries?, *NBER Working Paper* (10646).

Mishkin, F. and Schmidt-Hebbel, K. (2007). Does inflation targetting make a difference?, *NBER working paper* (12876).

Neyapti, B. (2003). Budget deficits and inflation: The roles of central bank independence and financial market development, *Contemporary Economic Policy* **21**(4): 458–475.

Orphanides, A. and Wieland, V. (2000). Inflation zone targeting, *European Economic Review* **44**(7): 1351–1387.

Persyn, D. and Westerlund, J. (2008). Error-correction–based cointegration tests for panel data, *Stata Journal* **8**(2): 232–241.

Petursson, T. (2004). The effects of inflation targeting on macroeconomic performance, *Central Bank of Iceland Working Paper* (23).

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

Posen, A. (1995). Declarations are not enough: financial sector sources of central bank independence, *NBER Macroeconomics Annual* **10**: 253–274.

Posen, A. (1998). Central bank independence and disinflationary credibility: a missing link?, *Oxford Economic Papers* **50**(3): 335.

Rabe-Hesketh, S., Skrondal, A. and Pickles, A. (2004). Gllamm manual, *UC Berkeley division of biostatistics working paper Series* **160**: 1–138.

Reinhart, C. and Rogoff, K. (2008). The forgotten history of domestic debt, *NBER Working Paper* (13946).

Roger, S. and Stone, M. (2005). On target?: the international experience with achieving inflation targets, *IMF Working Paper* (WP/05/163).

Sargent, T. and Wallace, N. (1981). Some unpleasant monetarist arithmetic, *Federal Reserve Bank of Minneapolis Quarterly Review* **5**(3): 1–17.

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

Walsh, C. (2003). Accountability, transparency, and inflation targeting, *Journal of Money, Credit and Banking* **35**(5): 829–850.

Wooldridge, J. (2002). *Econometric analysis of cross section and panel data*, The MIT press.

Younger, S., Sahn, D., Haggblade, S. and Dorosh, P. (1998). Public expenditure management handbook, *World Bank, Washington, DC* .

8 Appendix

A: Econometric model: Ordered Logit

Inorder to explain the process underlying inflation deviations from the bands, we assume that the latent variable Y_{it}^* is explained by a set of institutional and other control variables. We follow Wooldridge (2002) and model the process as :

$$Y_{it}^* = Inst_{it}\delta + X_{it}\beta + \varepsilon_{it},\ t = 1, ..., T;\ \text{and}\ i = 1, ..., N \tag{2}$$

$$\varepsilon_{it}/X_i \sim D(0, 1). \tag{3}$$

Where Y_{it}^* is the latent variable depicting inflation deviations, $Inst_{it}$ captures institutional variables, X_{it} captures control variables, ε_{it} are independent and identically distributed random variables, and δ and β are vectors of slope coefficients for institutional and control variables respectively. The observed indicator variable Y_{it} which is the realised inflation in relation to target bands which is determined from the latent variable Y_{it}^* through the following response mechanism:

$$Y_{it} = \begin{cases} 0 & if \quad Y_{it}^* < \alpha_{1i} \\ 1 & if \quad \alpha_{1i} < Y_{it}^* \leq \alpha_{2i} \\ 2 & if \quad Y_{it}^* > \alpha_{2i} \end{cases} \tag{4}$$

α_{1i} and α_{2i} are threshold parameters reflecting lower and upper inflation target bands respectively. The observed variable Y_{it} depends on whether or not a particular threshold point has been crossed. Inflation takes a value of 0 if it is below the band (*negative deviation*), 1 if it is within the band (*no deviation*) and 2 if it is above the band (*positive deviation*).

The response probabilities of the occurrence of each inflation target outcome are :

$$P(Y_{it} = 0) = P(Y_{it}^* \leq \alpha_{_{1i}}) = \Lambda(\alpha_{_{1i}} - X_{it}B) \tag{5}$$

$$P(Y_{it} = 1) = P(\alpha_{_{1i}} < Y_{it}^* \leq \alpha_{_{2i}}) = \Lambda(\alpha_{_{2i}} - X_{it}B) - \Lambda(\alpha_{_{1i}} - X_{it}B) \tag{6}$$

$$P(Y_{it} = 2) = P(Y_{it}^* > \alpha_{_{2i}}) = 1 - \Lambda(\alpha_{_{2i}} - X_{it}B) \tag{7}$$

The parameters are estimated by maximum likelihood and the log likelihood func-

tion of the logistic function is;

$$LogL = \sum_{i=1}^{N}\sum_{t=1}^{T}\left\{ \begin{array}{c} 1[Y_{it}=0]\ln[F(\alpha_{1i}-X_{it}\beta)] + 1[Y_{it}=1]\ln[F(\alpha_{2i}-X_{it}\beta)-F(\alpha_{1i}-X_{it}\beta)] \\ +1[Y_{it}=2]\ln[1-F(\alpha_{2i}-X_{it}\beta)] \end{array} \right\} \tag{8}$$

where $F(X_t)$ is the cumulative probability distribution function of ε_{it} taken at X_{it}

B: Marginal effects of the ordered logit model

When we use discrete choice model, the parameters that are normally provided are the marginal effects. But in the case of the panel data, no programme is available in the stata package which can help us to do this directly. We use the *GLLAMM* module by Rabe-Hesketh et al. (2004) to estimate the fixed effects ordered logit model. We follow a strategy of computing marginal effects which is done in 3 steps.

Step1: We run the *gllamm* command in stata, making sure that *f(binom)* and *adapt* are set as options.

Step2: We compute the predicted probabilities for each outcome; the *gllapred* command can help to achieve this.

Step 3: We compute the marginal effects of each outcome, using *xtreg* to regress the first difference of the predicted probability of each outcome on the first difference of all the previous explanatory variables.

Figure 2: Institutional developments and inflation target outcomes in EMEs

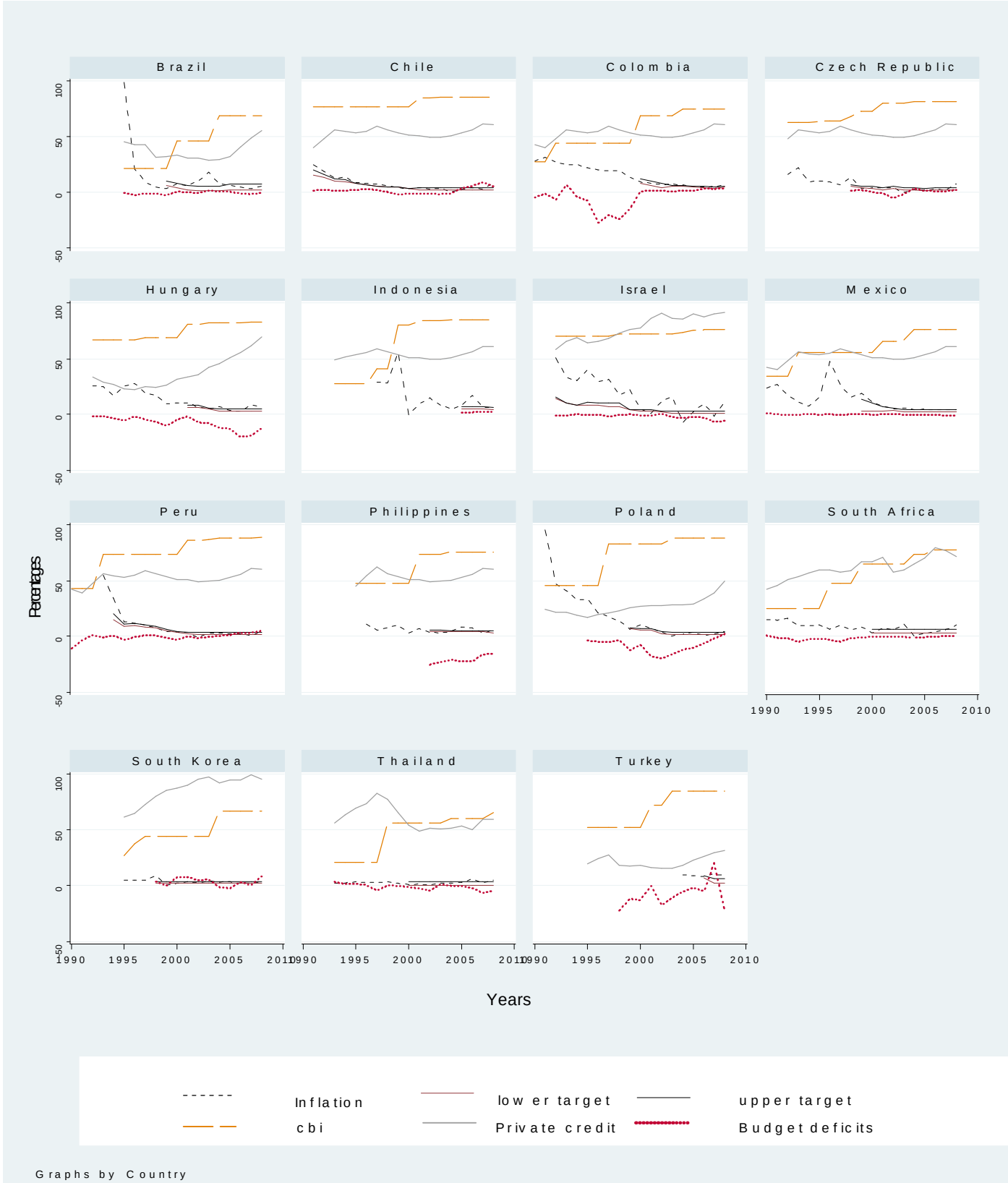

Table 4: Inflation targeting emerging market economies

Country	Adoption date	Target range*	Previous anchor	Target measure	Target horizon	Policy rate
Brazil	1999Q1	2-7	ER	CPIA	Ann/Multi Year	Celic rate
Chile	1991Q1	2-4	ER	CPI	Ann/Multi Year	Policy rate
Colombia	2000Q1	4.5-5.5	ER	CPI	Ann/Long term	Intervention rate
Czech Republic	1998Q1	2-4	ER & MS	CPI	Ann/Multi Year	Repo rate
Hungary	2001Q1	2.5-4.5	ER	CPI	Ann/Long term	Base rate
Indonesia	2005Q1	5-7	MS	CPI	Ann	Bank rate
Israel	1992Q1	1-3	ER	CPI	Ann/Indef	Bank rate
Mexico	1999Q1	2-4	ER	CPI	Ann/Long term	Overnight rate
Peru	1994Q1	1.5-3.5	MS	CPI	Indef	Reference rate
Philippines	2002Q1	5-6	ER & MS	CPI	Annual	Repo rate
Poland	1999Q1	1.5-3.5	ER	CPI	Ann/Med/Indef	Policy rate
South Africa	2000Q1	3-6	MS	CPIX	Ann/Med term	Repo rate
South Korea	1998Q1	2.5-3.5	MS	CPI	Ann/Med term	Base rate
Thailand	2000Q2	0-3.5	MS	Core CPI	Ann/Indef	Repo rate
Turkey	2006Q1	2-6	ER	CPI	Annual	Overnight rate

Key : ER= Exchange Rate, MS= Money supply , CPI= Consumer Price Index

Ann = Annual. Indef =Indefinate, Med term= medium term

*Inflation target ranges are for the end of 2008

Sources: Mishkin and Schmidt Hebbel (2007) and Various Central Bank Websites

Table 5: Variables descriptions and sources

Variables	Description	Sources
infldc	Inflation deviations from the bands. It is the ordinal discrete dependent variable.	IFS, Datastream and Central bank websites
logcbi1	Log of central bank independence is measured by legal cbi index developed by Cukierman et al 1992 It is computed from sixteen different legal characteristics found in central bank laws. Higher indices indicates higher central bank independence	Cukierman et al (1992), updated by Crowe and Meade (2008), Polillo and Guillen (2005) and Authors' updates
logpcrdt	Private credit to GDP ratio measures the financial sector development. Credit that financial intermediaries issue to the private sector as a share of GDP. Higher values indicates higher financial sector development	World Development Indicators and IFS
bd	Primary fiscal balance to GDP ratio measuring fiscal discipline. It reflects budget deficit or surplus.	IFS and Datastream
lygp	Output gap is the difference between the log of actual and trend GDP. Hodrick Prescott filter with a smoothing parameter of $\lambda = 1600$ is used in the estimation	Data obtained from IFS Output gap computed from HP filter
lexrg	Log of the nominal exchange rate gap. It controls for exchange rate-inflation pass-through effects often observed in EMEs	Data obtained from IFS, but Exchange rate gap computed from HP filter.
tot	Terms of trade indices. Calculated as the ratio of the index of export prices to the index of import prices.	IFS and Datastream
logopen	Openness is measured by exports plus imports to GDP ratio. It measures the intensity of the economy's interaction into the world trade	IFS
rts	Policy rates capture central bank interest rate policy decisions.	Central bank websites
inflg	Lagged value of inflation is measured as inflation from the past period.	IFS and Datastream
loghorzn	Log of inflation target horizon is the number of periods it takes for inflation to return to target bands after a shock. It controls for structural features of inflation targeting	Roger and Stone (2005)
logll_gdp	Log liquid liabilities to GDP ratio as an alternative proxy for financial sector development. Are composed of currency plus demand and interest bearing liabilities of banks and non banks	IFS and World Development Indicators
debt	Government domestic debt as a percentage of GDP.	Global Insight and World Development Indicators
logtor	Log of turnover rate of central bank governors. De facto measure of CBI. Higher values shows low CBI	Crowe and Meade (2008) and Central Bank Websites

Table 6: Inflation Outcomes Relative to Target Ranges

Country	Frequency			Magnitude		Duration	
	Below Target	Within Target	Above Target	Below Target	Above Target	Below Target	Above Target
Brazil	7.50	57.50	35.0	-2.14	5.33	3.00	7.00
Chile	15.28	45.83	38.5	-0.89	1.43	2.6.0	3.70
Colombia	0.00	61.11	38.89	0.00	1.06	0.00	3.60
Czech Republic	28.57	40.48	30.95	-1.70	2.33	2.70	3.30
Hungary	21.43	39.29	39.87	-0.77	3.30	2.00	5.00
Indonesia	0.00	37.50	62.50	0.00	5.40	0.00	5.00
Israel	12.50	13.89	73.61	-4.30	14.0	2.75	8.50
Mexico	0.00	47.50	52.50	0.00	1.30	0.00	3.50
Peru	30.00	45.00	25.00	-1.10	2.21	3.00	2.14
Philippines	42.86	10.71	46.43	-1.21	2.95	6.00	6.50
Poland	35.00	32.50	32.50	-0.64	1.70	2.80	4.30
South Africa	16.67	36.11	47.22	-1.50	3.20	2.00	3.50
South Korea	29.55	40.91	29.55	-0.79	1.87	3.25	2.60
Thailand	0.00	77.78	22.22	0.00	2.37	0.00	4.50
Turkey	0.00	41.67	66.67	0.00	2.95	0.00	11.00
Average	15.96	41.85	42.75	-1.00	3.43	2.01	4.94

Notes : Frequency in %, Absolute magnitude in %, Duration in Quarters.

Sources: Authors' computations based on IFS, Datastream and Central bank websites

Table 7: Correlation matrix of variables

	infdc	bd	lexrg	logtot	rts	logcbi1	lygp	logopen	loghorzn	logpcrdt	logtor	debt	logll_gdp	inflag
infdc	1.00													
bd	0.04	1.00												
lexrg	-0.16	0.01	1.00											
logtot	-0.02	-0.04	-0.17	1.00										
rts	-0.27	-0.3	0.01	-0.56	1.00									
logcbi1	-0.04	-0.24	0.07	-0.19	0.15	1.00								
lygp	0.01	-0.05	-0.11	0.02	0.04	-0.01	1.00							
logopen	-0.01	0.12	-0.06	0.1	-0.5	0.08	-0.16	1						
loghorzn	0.04	-0.15	0.14	-0.04	0.31	-0.00	-0.02	-0.4	1					
logpcrdt	-0.08	0.32	0.01	0.33	-0.43	-0.05	0.04	0.42	-0.47	1.00				
logtor	0.15	-0.51	0.10	0.25	-0.03	-0.11	-0.02	-0.33	-0.08	0.03	1.00			
debt	0.08	0.45	0.13	0.08	0.35	0.36	-0.009	-0.38	0.42	-0.67	-0.06	1.00		
logll_gdp	-0.03	0.02	-0.02	0.24	-0.30	-0.26	0.01	0.21	-0.23	0.78	0.03	-0.6	1.00	
inflag	0.46	0.04	0.05	-0.03	0.47	-0.09	-0.04	-0.16	-0.36	0.14	-0.03	0.14	0.330	1.00

Table 8: Panel unit root tests based on the Fisher type test

Variable	logcbi1	bd	logpcrdt	tot	lexrg	rts	logopen	lygp	logtor	debt	logll_gdp	inflg	loghorzn
χ^2	477.39	265.8	77.12	456.2	70.05	85.01	41.8	413.6	62.22	56.8	100.66	55.23	64.36
P Value	0.000	0.000	0.000	0.000	0.000	0.000	0.007	0.000	0.003	0.00	0.000	0.003	0.009

Table 9: Ordered logit results: The effects of all instititutional variables

	Model 4			Model 4'		
Variables	mfx_0	mfx_1	mfx_2	mfx_0	mfx_1	mfx_2
lygp	-0.126*	-0.174*	0.301***	-0.152**	-0.0803	0.232***
	(0.0678)	(0.0933)	(0.0538)	(0.0668)	(0.0540)	(0.0488)
lexrg	-0.413***	-0.285***	0.697***	-0.408***	-0.281***	0.689***
	(0.0722)	(0.0777)	(0.0908)	(0.0788)	(0.0889)	(0.0851)
logtot	0.00639	-0.0945	0.0881	-0.0509	-0.0192	0.0700*
	(0.0230)	(0.0545)	(0.0519)	(0.0406)	(0.0401)	(0.0349)
logopen	-0.145***	-0.0671	0.212***	-0.156**	-0.0541	0.210***
	(0.0476)	(0.0455)	(0.0309)	(0.0570)	(0.0552)	(0.0287)
loghorzn	-0.191***	0.120	0.0713*	-0.165***	0.0449	0.120**
	(0.0486)	(0.0821)	(0.0546)	(0.0430)	(0.0599)	(0.0554)
rts	-0.0103**	0.000130	0.0102*	-0.00936*	0.000193	0.00916
	(0.00408)	(0.00438)	(0.00564)	(0.00446)	(0.00422)	(0.00568)
inflg	-0.0124***	-0.0131**	0.0255***	-0.0134***	-0.0140**	0.0273***
	(0.00319)	(0.00447)	(0.00719)	(0.00395)	(0.00477)	(0.00838)
logcbi1	0.0508**	0.161**	-0.111**			
	(0.0630)	(0.0744)	(0.0570)			
bd	-0.00525***	-0.00157*	0.00682***			
	(0.000642)	(0.00122)	(0.000598)			
logpcrdt	0.0552**	0.113**	-0.0579**			
	(0.0164)	(0.0353)	(0.0346)			
logtor				0.0133	0.0165	-0.0299*
				(0.0127)	(0.0148)	(0.0151)
logll_gdp				-0.0751	-0.0516	0.127
				(0.0743)	(0.158)	(0.117)
debt				-0.00201***	-0.00370***	0.00572***
				(0.000263)	(0.000278)	(0.000422)
Constant	-0.00136*	-0.00296**	0.00433**	-0.00131*	-0.00198	0.00329*
	(0.000671)	(0.00134)	(0.00172)	(0.000641)	(0.00148)	(0.00177)
Observations	586	586	586	586	586	586
Number of countries	15	15	15	15	15	15
R^2	0.422	0.277	0.582	0.333	0.273	0.541

Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Model 4 is the ordered logit model including baseline institutional variables $logcbi1$, bd and $logpcrdt$

Model 4' is the ordered logit model including alternative institutional variables $logtor$, $debt$ and $logll\_gdp$

mfx_0, mfx_1 and mfx_2 are marginal effects of having inflation below the band, within the band and above the band respectively.

Table 10: Ordered probit results

	Model 5			Model 5'		
Variables	mfx_0	mfx_1	mfx_2	mfx_0	mfx_1	mfx_2
lygp	-0.348***	-0.0617**	0.348***	-0.228***	-0.0797	0.307***
	(0.0589)	(0.0288)	(0.0589)	(0.0629)	(0.0656)	(0.0606)
lexrg	-0.707***	-0.0582***	0.707***	-0.449***	-0.300***	0.750***
	(0.0639)	(0.0165)	(0.0639)	(0.0584)	(0.0718)	(0.0638)
logtot	-0.0916*	0.0293	0.0916*	-0.0486	-0.000989	0.0495
	(0.0470)	(0.0198)	(0.0470)	(0.0387)	(0.0477)	(0.0464)
logopen	-0.197***	-0.0178	0.197***	-0.159***	-0.0544	0.214***
	(0.0572)	(0.0146)	(0.0572)	(0.0511)	(0.0571)	(0.0581)
loghorzn	-0.120***	0.0572	0.120***	-0.143***	0.0367	0.106***
	(0.0411)	(0.0429)	(0.0411)	(0.0300)	(0.0444)	(0.0354)
rts	-0.0120**	0.0014**	0.0120**	-0.00955**	-0.00115	0.0107*
	(0.00576)	(0.000840)	(0.00576)	(0.00447)	(0.00352)	(0.00612)
inflg	-0.0258***	0.00119***	0.0258***	-0.0125***	-0.0142***	0.0267***
	(0.00611)	(0.000453)	(0.00611)	(0.00385)	(0.00327)	(0.00655)
logcbi1	0.110***	0.00145*	-0.110***			
	(0.0338)	(0.00895)	(0.0338)			
bd	-0.000271**	-0.00778***	0.000271***			
	(0.000408)	(0.000445)	(0.000408)			
logpcrdt	0.0613*	0.00178*	-0.0613*			
	(0.0522)	(0.00874)	(0.0522)			
logtor				0.00811	0.0170	-0.0251*
				(0.0103)	(0.0132)	(0.0142)
logll_gdp				-0.100	-0.00403	0.104
				(0.0928)	(0.111)	(0.107)
debt				-0.00262***	-0.00355***	0.00618***
				(0.000357)	(0.000398)	(0.000340)
Constant	-0.00403	-6.09e-05	0.00403	-0.000974	-0.00212	0.00310
	(0.00309)	(0.000777)	(0.00309)	(0.00278)	(0.00289)	(0.00321)
Observations	586	586	586	586	586	586
R^2	0.487	0.334	0.487	0.384	0.330	0.601
Number of countries	15	15	15	15	15	15

Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Model 5 is the ordered probit model including initial institutional variables *logcbi1*, *bd* and *logpcrdt*

Model 5' is the ordered probit model including alternative institutional variables *logtor*, *debt* and *logll_gdp*

mfx_0, mfx_1 and mfx_2 are marginal effects of having inflation below the band, within the band and above the band respectively.

Table 11: Ordered logit results for the sample period 1991-1999

	Model 6			Model 6		
Variables	mfx_0	mfx_1	mfx_2	mfx_0	mfx_1	mfx_2
lygp	-0.141**	-0.154*	0.295***	-0.121**	-0.192*	0.313***
	(0.433)	(0.286)	(0.266)	(0.447)	(0.335)	(0.216)
lexrg	-0.332*	-0.0200*	1.352*	-1.407**	-0.0942**	1.501**
	(0.577)	(0.398)	(0.594)	(0.528)	(0.353)	(0.555)
logtot	0.167**	0.187*	-0.354***	0.322***	0.164	-0.486***
	(0.0688)	(0.0872)	(0.0707)	(0.0764)	(0.0923)	(0.0557)
logopen	-0.0392	-0.204	0.243	-0.125	-0.180	0.305*
	(0.249)	(0.268)	(0.184)	(0.223)	(0.255)	(0.159)
loghorzn	-0.0354	0.0177	0.0177	0.0289	0.0493	-0.0782
	(0.0328)	(0.0460)	(0.0188)	(0.0483)	(0.0270)	(0.0705)
rts	-0.0171	-0.00734	0.0244	-0.00441	-0.00676	0.0112
	(0.0153)	(0.0121)	(0.0210)	(0.0107)	(0.0114)	(0.0184)
inflg	-0.00749*	-0.00812**	0.0156*	-0.0107***	-0.00791**	0.0186***
	(0.00418)	(0.00275)	(0.00683)	(0.00251)	(0.00306)	(0.00521)
logcbi1	0.796*	0.491*	-0.305*			
	(0.042)	(0.024)	(0.340)			
bd	-0.00394**	-0.000154**	0.00379**			
	(0.00453)	(0.00459)	(0.00424)			
logpcrdt	0.205	0.277	-0.482			
	(0.170)	(0.351)	(0.462)			
logtor				-0.0706	-0.0319	0.102
				(0.0589)	(0.0420)	(0.0982)
logll_gdp				0.0998	0.342	-0.442
				(0.668)	(0.457)	(0.964)
debt				-0.0201**	-0.00764**	0.0124**
				(0.00381)	(0.00233)	(0.00177)
Constant	0.00893*	-0.000728	-0.00821	0.0147**	-0.00959*	-0.00511
	(0.00385)	(0.00548)	(0.00621)	(0.00590)	(0.00470)	(0.0101)
Observations	111	111	111	111	111	111
R-squared	0.461	0.297	0.547	0.579	0.289	0.635
Number of countries	8	8	8	8	8	8

Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Model 6 is the ordered logit model for the period 1991- 1999 when baseline institutional variables (*logcbi1,bd and logpcrdt*) are included. Model 6' is the ordered logit model for the period 1991-1999 when alternative institutional variables (*logtor, debt,and logll_gdp*) are included.

mfx_0, mfx_1 and mfx_2 are marginal effects of having inflation below the band, within the band and above the band respectively.

Table 12: Ordered logit results for the period 2000-2008

	Model 7			Model 7		
Variables	mfx0	mfx1	mfx2	mfx0	mfx1	mfx2
lygp	-0.0176**	-0.230**	0.248**	-0.0303**	-0.0909**	0.121**
	(0.113)	(0.139)	(0.0638)	(0.0818)	(0.0656)	(0.0606)
lexrg	-0.280***	-0.333**	0.612***	-0.279***	-0.255*	0.534***
	(0.0645)	(0.120)	(0.0953)	(0.0728)	(0.143)	(0.103)
logtot	0.0516	-0.131*	0.0794	-0.00689	-0.129	0.136**
	(0.0581)	(0.0639)	(0.0521)	(0.0617)	(0.0761)	(0.0482)
logopen	-0.0914*	-0.141*	0.233**	-0.125*	-0.0388*	0.164**
	(0.0578)	(0.0698)	(0.0578)	(0.0644)	(0.0547)	(0.0570)
loghorzn	-0.187*	0.0864	0.101	-0.201*	0.0380	0.163**
	(0.0770)	(0.171)	(0.0977)	(0.0857)	(0.131)	(0.0571)
rts	-0.00137	-0.00123	0.00260	-0.00122	0.000649	0.000571
	(0.00636)	(0.00795)	(0.00487)	(0.00607)	(0.00570)	(0.00574)
inflg	-0.0428***	-0.0324***	0.0753***	-0.0441***	-0.0327***	0.0768***
	(0.00622)	(0.00856)	(0.00885)	(0.00677)	(0.00843)	(0.00947)
logcbi1	0.130	0.436	-0.306*			
	(0.262)	(0.316)	(0.0940)			
bd	-0.00439***	-0.00113***	0.00552***			
	(0.000899)	(0.00141)	(0.000588)			
logpcrdt	0.170***	0.0301***	-0.140***			
	(0.0273)	(0.0526)	(0.0364)			
logtor				-0.0113*	-0.0320*	0.0433*
				(0.0146)	(0.0173)	(0.0132)
logll_gdp				-0.0414	-0.252	0.293*
				(0.193)	(0.199)	(0.0972)
debt				-0.000107**	-0.00150**	0.00161**
				(0.000269)	(0.000238)	(0.000160)
Constant	0.00147	-0.000386	-0.00109	0.00226*	-0.000524	-0.00174
	(0.00112)	(0.00191)	(0.00131)	(0.00110)	(0.00174)	(0.00114)
Observations	466	466	466	466	466	466
R-squared	0.502	0.225	0.732	0.475	0.225	0.718
Number of countries	15	15	15	15	15	15

Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Model 7 is the ordered logit model for the period 2000-2008 when baseline institutional variables (*logcbi1,bd and logpcrdt*) are included. Model 7' is the ordered logit model for the period 2000-2008 when alternative institutional variables (*logtor, debt and ll_ gdp*) are included.

mfx_0, mfx_1 and mfx_2 are marginal effects of having inflation below the band, within the band and above the band respectively.

Table 13: Ordered logit results for the sample which excludes 2007-2008 period

	Model 8			Model 8'		
Variables	mfx_0	mfx_1	mfx_2	mfx_0	mfx_1	mfx_2
lygp	-0.139***	-0.374***	0.513***	-0.180***	-0.112***	0.292***
	(0.0495)	(0.0857)	(0.0639)	(0.0564)	(0.0495)	(0.0374)
lexrg	-0.781***	-0.403***	1.184***	-0.859***	-0.311**	1.169***
	(0.0997)	(0.126)	(0.107)	(0.116)	(0.117)	(0.102)
logtot	0.0467	-0.118	0.0718	-0.0106	-0.00572	0.0164
	(0.0394)	(0.0840)	(0.0522)	(0.0291)	(0.0410)	(0.0306)
logopen	0.00773**	-0.128**	0.121**	-0.00541**	-0.0837**	0.0891**
	(0.0626)	(0.0712)	(0.0509)	(0.0677)	(0.0669)	(0.0383)
loghorzn	-0.120***	0.135*	-0.0152	-0.0941***	0.0650	0.0291
	(0.0386)	(0.0721)	(0.0524)	(0.0276)	(0.0527)	(0.0579)
rts	-0.00703*	-0.00122	0.00825	-0.00700*	-0.00110	0.00811
	(0.00337)	(0.00341)	(0.00502)	(0.00391)	(0.00326)	(0.00554)
inflg	-0.0100***	-0.0118***	0.0218***	-0.0108***	-0.0126***	0.0233***
	(0.00282)	(0.00326)	(0.00527)	(0.00344)	(0.00387)	(0.00673)
logcbi1	0.000813*	0.0776*	-0.0784*			
	(0.0675)	(0.0644)	(0.0108)			
bd	-0.00662***	-0.000512***	0.00714***			
	(0.000734)	(0.00158)	(0.000975)			
logpcrdt	0.0350*	0.297*	-0.261*			
	(0.0727)	(0.152)	(0.130)			
logtor				0.00562*	0.0466*	-0.0522*
				(0.0126)	(0.0229)	(0.0188)
logll_gdp				0.214**	0.444***	-0.230**
				(0.148)	(0.141)	(0.124)
debt				-0.000854**	-0.00326***	0.00411***
				(0.000349)	(0.000369)	(0.000480)
Constant	-0.000753	0.00112	-0.000366	-0.000378	0.00120	-0.000826
	(0.00116)	(0.00175)	(0.00172)	(0.000364)	(0.000946)	(0.00106)
Observations	466	466	466	466	466	466
R-squared	0.467	0.262	0.647	0.375	0.252	0.606
Number of countries	15	15	15	15	15	15

Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Model 8 is the ordered logit model including all institutional variables the for period excluding 2007-8

Model 8' is the ordered logit model including all alternative institutional variables for period excluding 2007-8

mfx_0, mfx_1 and mfx_2 are marginal effects of having inflation below the band, within the band and above the band respectively.

Table 14: Ordered logit results: Interaction effects

	Model 9			Model 9'		
Variables	mfx_0	mfx_1	mfx_2	mfx_0	mfx_1	mfx_2
lygp	-0.164**	-0.105**	0.268**	-0.207**	-0.0593**	0.266**
	(0.0628)	(0.0677)	(0.0512)	(0.0916)	(0.0862)	(0.0565)
lexrg	-0.443***	-0.276***	0.720***	-0.385***	-0.278***	0.663***
	(0.0688)	(0.0791)	(0.0805)	(0.0942)	(0.0912)	(0.0979)
logtot	-0.0108	-0.0924*	0.103**	-0.0521	-0.0212	0.0733*
	(0.0236)	(0.0455)	(0.0470)	(0.0447)	(0.0360)	(0.0361)
logopen	-0.141**	-0.0410	0.182***	-0.120	-0.0330	0.153***
	(0.0543)	(0.0445)	(0.0362)	(0.0700)	(0.0559)	(0.0444)
loghorzn	-0.195***	0.0724	0.122**	-0.232***	0.0520	0.180***
	(0.0450)	(0.0574)	(0.0473)	(0.0456)	(0.0566)	(0.0359)
inflg	-0.0122***	-0.0134***	0.0256***	-0.0156**	-0.0108**	0.0264**
	(0.00338)	(0.00461)	(0.00755)	(0.00625)	(0.00439)	(0.00982)
logcbi1_r	0.00548**	0.194**	-0.189**			
	(0.0444)	(0.0620)	(0.0659)			
logpcrdt_r	0.120*	0.108*	-0.0118*			
	(0.0265)	(0.0411)	(0.0380)			
bd_r	-0.000231***	-0.000153***	0.000383***			
	(3.85e-05)	(5.09e-05)	(1.62e-05)			
logtor_r				0.00589**	0.00724**	-0.0131**
				(0.00165)	(0.00182)	(0.00258)
debt_r				0.000267***	0.000356***	-0.000623***
				(8.23e-05)	(7.37e-05)	(6.52e-05)
logll_gdp_r				-0.00104	-0.0146	0.0156*
				(0.00617)	(0.00861)	(0.00530)
Constant	-0.000715	-0.00305***	0.00376**	-0.00157	-0.00208*	0.00365**
	(0.000552)	(0.000991)	(0.00129)	(0.00119)	(0.00101)	(0.00149)
Observations	586	586	586	586	586	586
R^2	0.358	0.297	0.562	0.364	0.213	0.512
Number of countries	15	15	15	15	15	15

Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Model 9 is the ordered logit model when interest rates are interacted with $logcbi1, bd$ and $logpcrdt$

Model 9' is the ordered logit model when interest rates are interacted with $logtor, debt$ and $logll\_gdp$

mfx_0, mfx_1 and mfx_2 are marginal effects of having inflation below the band, within the band and above the band respectively.