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Roman Horváth and Jakub Matějů*

Abstract

This paper contributes to a better understanding of how inflation targets are set. First, we gather evidence on how inflation targets are set from official central bank and government publications and from a questionnaire of our own design. Second, we estimate the determinants of the level of the inflation target in 19 inflation-targeting countries using unbalanced panel interval regressions to deal with the issue that targets are typically set as a range rather than as a point. We find that both a higher level and higher variability of inflation are associated with a higher target. The setting of the inflation target is also found to have an important international dimension, because higher world inflation is positively correlated with inflation targets. Rapidly growing countries exhibit higher inflation targets. Our results also show that authorities establish a wider target range for the inflation rate when the macroeconomic environment is less stable. We find that central bank credibility is negatively associated with the level of the inflation target, suggesting that less credible central banks are likely to recognize the risks related to anchoring inflation expectations at low levels. On the other hand, government party orientation does not matter, even in less independent central banks.

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Nontechnical Summary

Inflation targeting became one of the most common monetary policy regimes. The practice of managing the policy interest rate in a way that the conditional inflation forecast hits the inflation target and communicating this properly to the public has performed well during the over last 20 years and contributed to keeping inflation low and stable even in the periods of macroeconomic distress. The main benefits of inflation targeting include the commitment to transparency in the conduct of monetary policy; central banks publish forecasts, inflation reports and minutes to ensure that the public forms the inflation expectations in accordance to the target of monetary policy. Therefore it is somewhat surprising that the choice of the core variable, the inflation target itself, stays in some cases unexplained or is only vaguely commented in official central bank communication. This paper is, to our best knowledge, the first attempt to analyze systematically how inflation targets are set.

First, we conduct a search through inflation targeting central banks' official publications to find a) who sets inflation target in the country and b) what are the main arguments for choosing the particular target. We accompany this search by a questionnaire survey among inflation-targeting central banks. In most cases, the central bank cooperates closely with the government on the setting of inflation targets. The main determinants of inflation targets mentioned by the central banks are past inflation developments, foreign inflation and previous inflation targets. In addition, the policymakers also consider the measurement error of inflation, wage rigidities, zero interest rate bound and deflation risk as the arguments for targeting low but positive inflation.

We complement this survey by an econometric investigation where we, in addition to the macroeconomic variables, include institutional measures such as central bank credibility and independence. We also examine of the interactions with fiscal policy. Our results suggest that higher past inflation and foreign inflation, the lower degree of economic development (developing countries feature higher inflation targets) and greater inflation volatility contribute to the choice of higher target for inflation. Central bank credibility is found to be associated with lower targets, as credible central banks are more confident about maintaining stable low inflation. Finally, when the policymakers set the inflation target for longer horizon, the target tends to be lower as it represents the long-term optimal rate of inflation.

1. Introduction

Monetary policy transparency has increased substantially over the course of the last 10 to 20 years. In addition, central banks' communication policies have changed dramatically (Blinder et al., 2009, Crowe and Meade, 2008, Dincer and Eichengreen, 2010). Whereas, in the 1980s, some central banks did not even announce changes in their monetary policy rate, they now provide detailed information about their monetary policy conduct. Transparency is considered an important factor for building central bank credibility to manage inflation expectations more effectively (van der Cruijsen and Demertzis, 2007).

More than 20 countries adopted an inflation-targeting regime in the 1990s and 2000s. A characteristic feature of this monetary policy regime is an explicit numerical target for inflation as well as a high degree of accountability and transparency and a major role for inflation forecasts in monetary policy conduct due to lags in monetary transmission (see Walsh, 2009, and Svensson, 2011, for recent surveys on inflation targeting). Nevertheless, as we find, the amount of information that central banks provide about how one of their most important policy variables—the inflation target—is set still varies considerably. Whereas some central banks provide very detailed statements, others do not explain the process of inflation target setting and merely state the numerical target. Similarly, the effect of inflation targeting on macroeconomic development and the performance of economic policies has been extensively examined, but the inflation target setting process has not, to our knowledge, been researched.

Inflation targets (both the levels and the inflation target bands) differ from country to country. The Reserve Bank of Australia specifies its inflation target between 2 and 3%, the Bank of England defines its target as 2% with a ± 1 percentage point tolerance band and the Bank of Thailand targets inflation at 0–3.5%. In addition, some countries implement an inflation-targeting regime as a disinflation strategy. For example, the Central Bank of Brazil adopted this regime in 1999 with a target of 8% with a ± 2 percentage point tolerance interval and decreased the target step by step to 4.5% (with a ± 2 percentage point tolerance interval). Similarly, the Czech National Bank started with a 5.5–6.5% target for 1998 and then gradually decreased its inflation targets, ending with a 2% inflation target with ± 1 percentage point tolerance interval.

We aim to bridge the gap in the literature by analyzing which factors matter for the apparent heterogeneity in inflation target setting. First, we analyze official central bank and government documents together with the answers to our own questionnaire on inflation target setting, which was sent to all central banks in our sample, to determine which factors are considered important for the inflation target choice by central bankers themselves. Second, we construct an empirical model to investigate the determinants of inflation targets as well as the width of the inflation target band. While official central bank documents provide useful guidance on which factors are likely to influence inflation target setting, we aim to investigate whether there are additional, predominantly institutional, factors that are likely to matter for the process of setting the target. For example, we examine whether central banks that are viewed as less credible choose a higher inflation target to reduce the risk that they will not be able to meet the target and whether central bank independence matters to the process of inflation target setting.

We find that not only macroeconomic fundamentals (past inflation, inflation volatility and economic growth), but also institutional characteristics matter when inflation targets are set.

Notably, our results stress the importance of central bank credibility in delivering low inflation, as we find credibility to be negatively correlated with the level of the inflation target. On the other hand, government political orientation is not found to matter, even in less independent central banks. This result probably reflects the fact that inflation-targeting central banks often exhibit a high degree of independence before the adoption of an inflation-targeting regime. In addition, a sufficient degree of independence is viewed as one of the preconditions for successful adoption of inflation targeting (Amato and Gerlach, 2002). Finally, our results suggest that authorities set a wider band for inflation targets in an environment of higher and more volatile inflation.

The paper is organized as follows. Section 2 provides a detailed overview of what central banks claim about how inflation targets are set. Section 3 describes the data and the empirical methodology. We present our results in section 4. Concluding remarks are provided in section 5. An Appendix follows, organized in 3 parts: part A presents central banks' statements, part B consists of the plots of variables and part C brings additional regression results and tests.

2. What Do Central Banks Say about Inflation Targets?

This section presents a brief survey of official central bank publications related to the setting of inflation targets. The amount of information that central banks provide in their official publications varies between banks. Some banks explain in detail how the target is set. Other central banks in our sample remain largely silent on how their inflation target is set and merely state the numerical value without further comment. In this section, we also summarize the results of a short questionnaire on inflation target setting that we sent to all central banks in our sample in March 2010.

Table 1 summarizes which authority is responsible for inflation target setting (central bank, government or both jointly) as well as information on the factors that central banks find important for setting the inflation target. The inflation target is predominantly set jointly by the central bank and government. Central banks frequently state that past domestic inflation and economic growth matter in considering how to set the target. Several central banks mention more specific factors, such as price convergence and foreign inflation, the zero interest rate bound and statistical overvaluation in inflation measurement. Detailed information on what central banks state about inflation target setting is provided in the Appendix A. The questionnaire sent to all central banks in our sample confirms the evidence from official central bank and government publications.

In the following sections, we investigate empirically whether these factors indeed contribute to inflation target setting. On top of that, we examine a broader set of indicators, especially those related to the institutional setting of central banks, i.e., indicators such as central bank credibility and central bank independence, given that the government participates in inflation target setting in most countries in our sample.

Table 1: Inflation Target Setting and Its Determinants

Country	Who sets the target?	Determinants of inflation targets
Australia	Central bank and government jointly	Business cycle fluctuations
Brazil	Central bank and government jointly	n.a.
Canada	Central bank and government jointly	Costs of inflation, Measurement error, Wage rigidities, Zero interest rate bound
Chile	Central bank	Deflation risk
Colombia	Central bank and government jointly	n.a.
Czech Republic	Central bank	Past inflation, Inflation expectations, Price convergence, Wage rigidities, Zero interest rate bound, Measurement error
Finland	Central bank and government jointly	n.a.
Israel	Government	Measurement error, Wage and price rigidities, Zero interest rate bound
Mexico	Central bank	Foreign inflation
New Zealand	Central bank and government jointly	Past inflation, Foreign inflation, Target expectations
Peru	Central bank and government jointly	n.a.
Poland	Central bank and government jointly	Economic growth, Maastricht inflation criterion for euro adoption
South Africa	Central bank	n.a.
South Korea	Central bank and government jointly	Past inflation, Economic fundamentals, Monetary policy flexibility
Spain	Central bank and government jointly	n.a.
Sweden	Central bank	Past inflation, Costs of inflation, Risks of deflation, Measurement error
Switzerland	Central bank	Measurement error
Thailand	Central bank and government jointly	Foreign inflation, Economic growth
United Kingdom	Government	Sustainable growth

Source: The column "Who sets the target?" is based on our questionnaire sent to central banks in March 2010, Mahadeva and Sterne (2000), Mishkin and Schmidt-Hebbel (2001) and Baltensperger et al. (2007). The column "Determinants of inflation targets" is based on our questionnaire sent to central banks in March 2010 and various central bank official publications and web pages.

3. Data and Empirical Methodology

We collect data from 19 countries targeting inflation, with each series covering the period from the year when the country adopted the inflation-targeting regime until 2008.[1] As a result, our

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[1] More specifically: Australia (1994–2008), Brazil (1999–2008), Canada (1991–2008), Chile (1991–2008), Colombia (1999–2008), Czech Republic (1998–2008), Finland (1993–1998), Israel (1992–2008), Mexico (1999–2008), New Zealand (1990–2008), Peru (1994–2008), Poland (1999–2008), South Africa (2000–2008), South Korea (1998–2008), Spain (1996–1998), Sweden (1995–2008), Switzerland (2000–2008), Thailand (2000–2008), United Kingdom (1992–2008).

panel is unbalanced. The cross-sectional dimension of our data matrix is the same as in Mishkin and Schmidt-Hebbel (2006), but more recent data on the countries are included as well.[2] Our sample consists of both developed and emerging economies. Yearly data are used because inflation targets do not change more frequently. The current inflation targets are presented in Figure 1.

Figure 1: Inflation Targets as of 2008
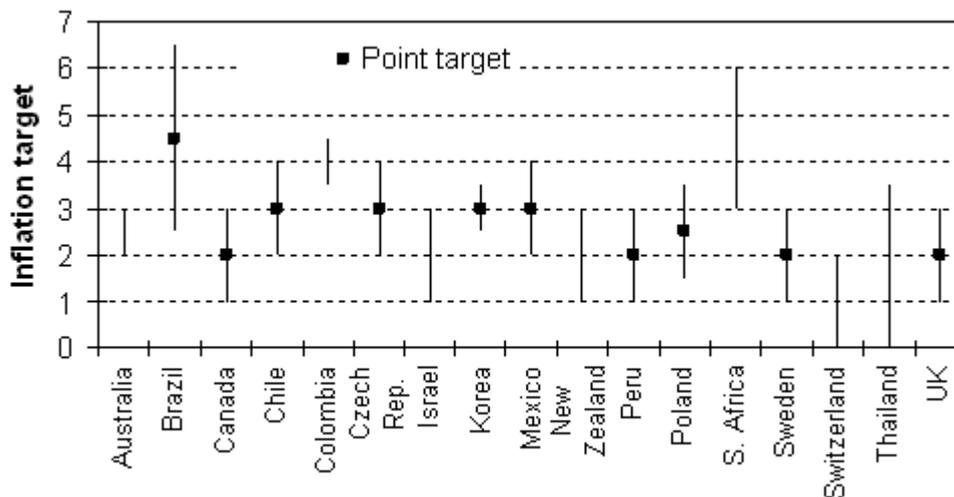
Note: The figure presents the annual inflation targets for our sample countries. Finland and Spain are not reported because they no longer target inflation and are currently members of the euro area.

A vast majority of countries revise their inflation targets from time to time. Central banks evaluate inflation to be consistent with their inflation target if inflation develops within the target band. For this reason, we employ panel interval regression with random effects, where the dependent variable is defined as an interval (Cameron and Trivedi, 2005). Moreover, this technique addresses the issue that the dependent variable is censored. For robustness checks, we use the midpoint[3] of the target as the dependent variable and estimate the standard random effects model. We test the random effects model against the endogeneity-robust fixed effects using the standard Hausman test, not rejecting the baseline random effects specification (Table C7 in the Appendix).

Our baseline empirical model takes the following general form:

$$[\pi_{i,t}^{T(L)}, \pi_{i,t}^{T(U)}] = \beta \mathbf{X}_{i,t-k} + \varepsilon_{i,t} \tag{1}$$

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[2] Several developing countries that adopted inflation targeting only recently are thus not included as the time coverage is too short.

[3] Some central banks specify only a target band and do not provide a central target (see Figure 1). In this case, we calculate the mid-point of the target band. The regression results are largely in line with the baseline estimates and are available upon request.

where $\pi_{i,t}^{T(L)}$ and $\pi_{i,t}^{T(U)}$ are the lower and upper bounds, respectively, of the inflation target in country i at time t. $\mathbf{X}_{i,t-k}$ is a vector of explanatory variables in country i at time $t - k$. Finally, β is a vector of parameters to be estimated, and $\varepsilon_{i,t}$ represents a residual.

In our baseline model, the explanatory variables are lagged by one period (*k=1*) to deal with potential endogeneity. This lag is adequate in our view because there is evidence that inflation targets have an effect on at least some of our explanatory variables.[4] Many central banks, especially those that adopted inflation targeting as a disinflation strategy, set their inflation targets one year ahead.[5] In the UK, the government's inflation target is announced each year by the Chancellor of the Exchequer in the annual budget statement and therefore, in principle, can be considered as being revised every year. However, other central banks announce the target further in advance. For example, the Central Bank of Brazil has on several occasions announced its target two years in advance. To deal with this issue, we re-estimate all regressions with explanatory variables lagged by two as well as three periods.

In addition, we estimate our empirical model based on a restricted sample in which we include only countries for which we know the exact dates for when the decision about the inflation target was made and when it came into effect. The lag of explanatory variables is thus time and country specific in the "Exact lag" model; i.e., the lag conforms exactly to the announcement of the target and makes it robust to the endogeneity concerns. In the "Exact lag" specification, the relationships can be interpreted as causal because the variables available at the time of the decision about inflation targets are exogenous with respect to the resulting inflation target. However, there is a trade-off in the form of fewer observations.

Dynamic panel analysis is in this case constrained by the number of observations and the variance present in the data (relatively low frequency of "switches"), so we opt for a parsimonious static model. Nevertheless, we test the dynamic properties of the model by the inclusion of an AR(1) term, which does not change the results fundamentally.

Some of our explanatory variables, $\mathbf{X}_{i,t-k}$, are motivated by the findings of Section 2. These are typically variables capturing the state of the economy, such as inflation or the degree of economic activity. In addition, we include variables that are deemed to influence central bank policies in general, such as the institutional setup of the central bank, i.e., whether the banks are granted independence or how credible the public perceives their policies to be.

Below, we provide a full list of our explanatory variables, $\mathbf{X}_{i,t-k}$. These include both variables capturing the state of the economy as well as institutional variables such as central bank independence and credibility.

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[4] The empirical literature typically analyzes the impacts on other macroeconomic variables (such as the development of actual and expected inflation and GDP) or their characteristics (such as volatility or persistence of inflation) of introducing inflation targeting. Mishkin and Schmidt-Hebbel (2006), for example, have analyzed the impact of inflation targeting on the level of inflation and the intensity of the inflation response to various shocks. Levin et al. (2004), Vega and Winkelried (2005) and Yigit (2010) have examined whether introducing an inflation target has lowered the persistence and volatility of inflation. Johnson (2002, 2003), de Mello and Moccero (2006) and Cerisola and Gelos (2009) have evaluated the inflation target's impact on the level of expected inflation. Babecky et al. (2009) and Franta et al. (2010) have, inter alia, analyzed the impact on inflation persistence of introducing the inflation target. Demir and Yigit (2008) find that inflation targeting matters for central bank credibility.

[5] These countries include Columbia, Peru, Israel, Korea, Chile and Mexico.

Inflation

Consumer price index (CPI) inflation, measured as year-on-year change, is included to assess whether the central bankers take into account past inflation developments when setting the target. Quite intuitively, higher past inflation is associated with a higher inflation target. Central bankers may believe that inflation expectations are, at least to a certain extent, formed by past inflation.[6] Because the authorities do not want the target to be missed, they take past inflation into account. The source of the data is the IFS database of the International Monetary Fund.

Inflation Volatility

As the measure of inflation volatility (see the debate about optimal inflation in Billi and Kahn, 2008) we use the sample variance of the past detrended inflation record. Inflation is detrended using the Hodrick-Prescott (HP) filter to reflect the fact that some countries adopted the inflation target as a disinflation strategy and experienced a higher inflation rate for some parts of our sample period. For sensitivity analysis, we also calculate inflation volatility based on inflation series that are not detrended.[7] Naturally, we expect that policymakers who decide the inflation target value more recent inflation developments. Therefore, we average sample variances in the past 5 and 10 years (where the inflation measures π_t are already HP detrended and $\bar{\pi}$ stands for the average inflation rate).

$$var(\text{inflation})_t = \frac{1}{2} \sum_{i=t-5}^{t} \frac{(\pi_t - \bar{\pi})^2}{5} + \frac{1}{2} \sum_{i=t-10}^{t} \frac{(\pi_t - \bar{\pi})^2}{10} \qquad (2)$$

The choice of 5 and 10 years is somewhat arbitrary, but alternative specifications such as a simple 10-year sample variance resulted in a largely similar estimated effect of inflation volatility on the inflation target in our econometric exercises. The source of the data is the IFS database of the International Monetary Fund.

World Inflation

We also include world CPI inflation because central banks, especially in small open economies, may understand world inflation as a certain leading indicator for domestic inflation. This supposition is supported by recent empirical evidence from Mojon and Cicarelli (2010), who document that nearly 70% of the variance of inflation in OECD countries is due to common shocks. The source of the data is the Federal Reserve Bank of Cleveland.

Price Level

We include the price level measured in PPP to test the hypothesis of price convergence: Do countries with a lower price level set a higher inflation target to reflect the expected price

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[6] We prefer actual inflation to inflation expectations data, which are typically based on surveys because of data availability and may have accuracy issues; see Caskey (1985), Evans and Gulamani (1984), Jeong and Maddala (1996) and Evans and Honkapohja, (2001), among others. Note that the inflation measure includes the measurement error of inflation, and there are no reliable estimates of the measurement error to model the effect of this error separately from inflation.

[7] Nevertheless, our regression results are largely unchanged irrespective of the measure of inflation volatility we use.

convergence toward more developed countries? The price level may also serve as a useful indicator to assess if inflation targets are set differently in emerging market countries. The source of the data is the Penn World Table.

GDP per capita

Like the price level, GDP per capita is included to investigate whether inflation targets are higher in less developed countries. Less developed countries also tend to have a more volatile macroeconomic environment (see Coricelli and Roland, 2008), and their officials are more likely to set wider tolerance intervals for the inflation target (i.e., to create a wider target band). Alternatively, we use a dummy for emerging market economies instead of GDP per capita. The source of the data is the IFS database of the International Monetary Fund.

GDP Growth

We hypothesize that a higher inflation target is set in fast-growing economies because these countries typically exhibit higher inflation, at least in the short and medium terms (this hypothesis can be rationalized by the New Keynesian Phillips curve, see Gali and Gertler, 1999). The source of the data is the IFS database of the International Monetary Fund.

Credibility

Central bank credibility is likely to affect the formation of inflation expectations. Private sector long-term inflation expectations are found to give greater weight to the inflation target under a credible central bank (Bomfim and Rudebusch, 2000). Typically, credibility is defined as the difference between the inflation target and inflation expectations (Svensson, 1999). Blinder (2000) also argues that the difference between the inflation target and inflation expectations can be taken as an objective measure of central bank credibility.[8] For this reason, we use the cross-sectional index of central bank credibility developed by Cecchetti and Krause (2002). The credibility index has no time-series dimension, so it will only serve to explain cross-country variation. As Holub and Hurnik (2008) note, central bank credibility is unlikely to change abruptly over time, so the time-invariant measure might be a feasible approximation. For a robustness check, we also construct a time-variant measure of central bank credibility as the sum of past deviations of realized inflation from the inflation target. We hypothesize that more credible central banks, especially those in developed countries, can manage inflation expectations more effectively and set inflation targets below the levels typical for emerging market economies. Moreover, credible central banks might be more confident about their ability to avoid deflation under negative price shocks. Therefore, they might be willing to set lower targets compared with less credible central banks.

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[8] The difference between inflation expectations and the inflation target is likely to be a better indicator of credibility than the difference between actual inflation and the inflation target. Short-term developments in inflation are influenced, to a certain extent, by temporary shocks, whereas long-term inflation expectations are likely to be immune to short-term disturbances. For instance, Holub and Hurnik (2008) document that although inflation targets were missed relatively often in the Czech Republic, inflation expectations remained anchored, i.e., close to the inflation target.

Central Bank Independence

Less independent central banks may be more prone to government influence and, knowing that they are likely to deliver higher inflation, may eventually prefer a higher inflation target.[9] There are various measures of central bank independence, and various studies cover different sets of countries.[10] Cukierman (1992) develops a central bank independence (CBI) index, which is a composite measure based on both legal and real indicators. We use several recently developed CBI indexes that build on the original Cukierman (1992) contribution. First, we employ the central bank autonomy index by Arnone et al. (2008), who developed the index for a large group of central banks for the late 1980s and 2003. We use the index only for 2003 because our sample countries adopted the inflation-targeting regime after the 1980s. The Arnone et al. (2008) index distinguishes between political (goal) and economic (instrument) independence. Political independence refers to the extent to which the central bank can set the objective of monetary policy, while economic independence refers to the degree of freedom the central bank has in selecting its instruments. Arnone et al. (2008) show that political and economic independence can differ greatly for certain central banks; therefore, we examine the impacts of political and economic central bank independence jointly as well as separately. Alternatively, we also use the index from Guillén and Polillo (2005), who extend the original Cukierman CBI index up to 2000. Their CBI measure is time varying, and more recent data that are not available are extrapolated.

Government Party Orientation

Finally, we include a measure of government party orientation. The government may directly influence the setting of the inflation target because the targets are often set on the basis of a joint agreement between the central bank and the government. In addition, in some countries, such as the United Kingdom, the government is responsible for setting the inflation target, and the central bank does not have goal independence. We hypothesize that left-leaning governments are more likely to favor greater expenditures and higher inflation (Hibbs, 1977, Alesina, 1988) and, as a consequence, may support higher inflation targets. The data are taken from the World Development Indicators database. The variable is coded is follows: -1 for left wing, 0 for center or other orientation, 1 for right wing.

Because government party orientation may, in addition, be more influential in less independent central banks, we construct an interaction term capturing the joint effect of government party orientation and central bank independence. As we work with two different indexes of central bank independence, we have two corresponding measures of the joint effect of government party orientation and independence. Moreover, for the Arnone et al. (2008) index, we are able to distinguish political and economic central bank independence. In this respect, Alesina, Roubini and Cohen (1997), Boix (2000), Clark (2003), Sakamoto (2008) and Belke and Potrafke (2009) study whether government party orientation matters for interest rate setting in less independent central banks. Their research shows that party orientation is of limited importance, probably because of the high degree of central bank independence. In contrast to these studies, we examine the effect of government party orientation on setting the inflation target and also distinguish

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[9] See Siklos, 2008, for a recent survey of theories and empirical evidence on central bank independence and inflation.

[10] For a survey of central bank independence measures, see Arnone et al. (2006).

between political and economic central bank independence, as political independence may clearly be more relevant in our case.

Finally, the scatter plots of the inflation targets and all the explanatory variables are presented in Figures B1 and B2 in the Appendix.

4. Results

We present our baseline estimates in Table 2 and focus on robustness checks in Table 3 using alternative specifications. The results unambiguously suggest that the actual inflation rate matters for the setting of inflation targets. This finding is not so surprising given that many central banks have noted past inflation as an important determinant of their inflation target setting (see the Appendix A for the official statements of central banks). Similarly, policymakers take the variability of inflation into account and set higher targets in an environment with more volatile inflation. These considerations may reflect their concerns about deflation risk. Alternative measures of inflation variability yield largely similar results (available upon request).

The degree of economic activity is also found to matter. Higher growth is likely to go hand in hand with higher inflation, at least in the medium term. This result corresponds to the reasoning based on the New Keynesian Phillips curve, where large positive output shocks are likely to be followed by inflation increases. This result also suggests that, in practice, flexible inflation targeting is a more appropriate description than strict inflation targeting[11] of how inflation targeting is conducted. This is so because real objectives are taken into account not only for setting the policy rate (Walsh, 2009) but also when setting the inflation target. We suggest that this finding further challenges the claims that inflation targeters would ignore real objectives and deliver greater output volatility (Friedman, 2004).

Higher world inflation delivers higher inflation targets because policymakers recognize that a substantial part of the price index is often driven by world prices. This finding conforms with Cicarelli and Mojon (2010), who document the prominent role of global inflation in domestic inflation developments in the OECD countries.

The results indicate that central bank credibility influences the level of the inflation target. This result probably arises because less credible central banks (i.e., those with a less impressive track record) may be more concerned about their ability to anchor the inflation expectations of the public and thus prefer a higher target. This result corresponds to the findings of Blinder (2000), whose survey indicates that central bankers recognize credibility as a very important factor for maintaining low inflation. Similarly, more credible central banks have the advantage of setting a lower target during disinflation with the same output loss (Nicolae and Nolan, 2006). Further, less credible central banks are more likely to face the zero interest rate bound for monetary policy because their responses to price shocks need to be more aggressive. A higher inflation target

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[11] Strict inflation targeting is associated with the notion that central banks consider inflation as their only goal and ignore real objectives. To the contrary, in flexible inflation targeting, central banks take into account both inflation and real objectives.

therefore gives them more freedom to conduct policy (see Blanchard et al., 2010, for a suggestion to increase inflation targets in response to the recent financial crisis).

On the other hand, although some central banks mention price convergence as a factor in the choice of inflation target (see Table 1), we do not find it to be a general phenomenon. We hypothesize that the reason for the lack of significance of price convergence may lie in the fact that inflation-targeting central banks largely succeeded in delivering low inflation.[12] In addition, price convergence has materialized via appreciation of the nominal exchange rate (catching-up countries often display real exchange rate appreciation) rather than via inflation of domestic consumer prices.

Neither central bank independence nor government party orientation is found to influence the level of inflation targets. As Belke and Potrafke (2009) note, government party orientation may still matter for the interest rate setting process if the degree of central bank independence is low. However, our interaction term of government party orientation and central bank independence is, as in Belke and Potrafke (2009), not significant. In this context, it is interesting to note that government pressure on central banks can be harmful for effective monetary policy because central bankers may want to demonstrate their independence and build their credibility by dismissing any suggestions coming publicly from the government. On the basis of a comprehensive analysis of the U.S. Federal Reserve transcripts, Bailey and Bailey (2005) document that when the Federal Open Market Committee (FOMC) members recognized political pressure from the U.S. government, they decided to "stand tall" and reject the government proposals. More specifically, Bailey and Bailey (2005) mention the political pressure before the 1992 presidential elections, when the then U.S. President publicly expressed a preference for lower policy rates and the Treasury Secretary canceled all meetings with the FOMC Chairman.

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[12] There is a discussion in the literature of the extent to which low inflation during the Great Moderation period has been due to good luck rather than to good policies (see Bernanke, 2004, for a summary of this discussion).

Table 2: Determinants of Inflation Targets

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
CPI inflation	0.50***	0.49***	0.55***	0.49***	0.49***	0.49***	0.50***
	(15.75)	(14.47)	(15.83)	(15.15)	(15.05)	(15.47)	(15.55)
Inflation volatility	0.29**	0.29***	0.23***	0.23***	0.24***	0.22***	0.31***
	(2.61)	(2.46)	(2.67)	(2.64)	(2.68)	(2.51)	(2.71)
GDP growth	0.15***	0.16***	0.16***	0.15***	0.15***	0.15***	0.16***
	(3.96)	(3.76)	(4.11)	(3.77)	(3.77)	(3.75)	(4.03)
World inflation	0.12**	0.11*	0.13**	0.13**	0.13**	0.12**	0.11*
	(2.13)	(1.75)	(2.29)	(2.19)	(2.24)	(2.15)	(1.91)
Credibility	-0.51**	-0.53*	-0.49**	-0.58**	-0.60**	-0.48	-0.65**
	(-2.21)	(-1.76)	(-2.13)	(-2.30)	(-2.39)	(-1.56)	(-2.15)
Price level		-0.01					
		(-0.16)					
Independence			-0.50				
			(-1.01)				
Gov. party orientation				-0.07			
				(-0.66)			
(Independence + Gov. p. orientation)					-0.09		
					(-0.68)		
GDP per capita						-2.50	
						(-0.19)	
Emerging markets dummy							-0.19
							(-0.73)
Constant	0.63*	0.76*	0.88**	0.66**	0.72**	0.65*	0.77**
	(1.95)	(1.86)	(2.16)	(2.03)	(2.13)	(1.86)	(2.04)
No. of observations	134	114	130	130	130	130	130
Pseudo R-squared	0.78	0.80	0.78	0.78	0.79	0.77	0.77

Note: * statistically significant at the 10% level, ** statistically significant at the 5% level, *** statistically significant at the 1% level. Panel interval random effects estimation. Inflation volatility, GDP per capita and price level coefficients premultiplied by 10^6 and 10^3, respectively. T-statistics in parentheses. All explanatory variables are lagged by one period. Independence refers to the central bank independence index developed by Arnone et al. (2008).

Next, we examine whether inflation target setting is different in emerging countries (i.e., those countries that often implemented inflation targeting as a disinflation strategy). We proxy emerging economies by GDP per capita rather than a simple dummy for emerging countries as it gives richer information on the state of economic development.[13] The results suggest that although the inflation targets are typically higher in emerging countries, the inflation target-setting process is largely similar given that the magnitude and significance of other regressors remain unchanged. This finding is also confirmed by the regression in Table 2, column 7, where we use the dummy for emerging market economies as a robustness check.

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[13] The group of emerging market economies is rather heterogeneous; for example, Israel is often considered an emerging economy although its GDP per capita is at the level of industrialized countries. On the other hand, some countries that are typically regarded as emerging economies have a GDP per capita about ten times lower than Israel's and not far from the levels of some developing countries.

A large body of research has focused on the effect of central bank independence on inflation performance (see Klomp and de Haan, 2010, for a quantitative survey). Although empirical results are mixed, the literature shows that central bank independence is negatively associated with inflation. Because, as Siklos (2008) points out, no single definition of central bank independence is right for all countries at all times, we use various measures of central bank independence to provide more robust evidence on the effect of independence on inflation targets. The results are available in the Appendix, Table C1. As noted in the data description, we employ the Arnone et al. (2008) and Guillén and Polillo (2005) measures of independence that have appropriate country and time coverage. Our results suggest that central bank independence does not matter for inflation targets in our sample. This finding may be driven by the fact that sufficient central bank independence is, in general, one of the pre-conditions for the adoption of inflation targeting (Amato and Gerlach, 2002) and that the degree of central bank independence is typically high in inflation-targeting countries. We also examine the interaction between the central bank independence indexes and government party orientation (which could play a role in the case of less dependent central banks), but we fail to find any systematic role of government interference, although most central banks do not have full goal independence and set the inflation target jointly with the government.

As government party orientation recorded in discrete coding may be a noisy indicator of government preferences toward inflation, we employ a direct measure of the government deficit (its ratio to GDP). It is hypothesized that governments that accumulate debt may be willing to use inflation to devalue the domestic currency and lower the debt. However, this effect is not confirmed in our analysis (columns 1 and 2, Table 3), even when the interaction term with central bank independence is used.

Moreover, we construct an alternative, time-variant measure of central bank credibility, as the past difference of realized inflation from the inflation target. The lower the past differences, the higher the credibility. This measure of credibility proves to be positively related to the inflation target (column 3 of Table 3), thereby confirming our previous results that credible central banks are likely to set lower inflation targets.

It may be that the importance of past inflation only reflects the strong autocorrelation of inflation targets. We test for this by including an AR(1) term: the lagged inflation target (column 4 of Table 3). Although being indeed significant, the AR(1) term does not seriously influence the other results, apart from absorbing a part of the variation otherwise ascribed to both domestic and foreign lagged inflation.

Finally, we estimate our empirical model based on a restricted sample, where we include in the data matrix only those countries in those time periods for which we know the exact dates when the decision about the inflation target was made and when it came into effect (the "Exact Lag" specification, column 5 of Table 3). The lag of explanatory variables is thus time and country specific, i.e., the lag exactly conforms to the difference between the announcement of the target and when the target becomes effective. Although this approach tackles the endogeneity problem, the sample size is reduced by about one third. Despite the lower number of observations and related loss of statistical efficiency, these regressions largely confirm our previous findings. Inflation and GDP growth are again robust determinants of inflation targets. The degree of central bank credibility is negatively associated with the level of inflation targets. Although world

inflation and inflation variability keep their expected signs, they are no longer significant at conventional levels (even though world inflation is statistically significant in one specification and its p-values are about 0.15 in the remaining specifications, possibly because of a lower number of observations). All in all, the alternative specifications largely support our baseline estimates.

An interesting question is whether the horizon for which the target is set matters for the level of the inflation target. When setting a target for three years ahead, policymakers may aim at lower inflation compared to when setting the target for the current year. The "Exact lag" framework allows for such a test (column 6 of Table 3): the interaction with the decision horizon is marginally significant. We conclude that policymakers may also take into account the horizon of the inflation target, as longer horizons give them enough time for convergence toward more ambitious inflation levels, for example during disinflation periods.

Table 3: Determinants of Inflation Targets:

Alternative Specifications: Exact Lag, Time-variant Credibility, Government Deficit

	(1)	(2)	(3)	(4)	Exact Lag (5)	Exact Lag (6)
CPI inflation	0.40***	0.40***	0.33***	0.24***	0.40***	0.48***
	(12.00)	(12.00)	(8.93)	(5.16)	(13.24)	(10.40)
Inflation volatility	0.30***	0.30***	0.27***	0.19**	1.16	-0.05
	(3.53)	(3.53)	(3.06)	(2.55)	(0.08)	(-0.39)
GDP growth	0.13***	0.13***	0.08**	0.13***	0.11**	0.12**
	(4.17)	(4.19)	(2.29)	(5.25)	(2.15)	(2.29)
World inflation	0.18***	0.17***	0.21***	0.02	0.03	0.03
	(2.70)	(2.61)	(3.26)	(0.37)	(1.48)	(1.38)
Credibility	-0.72***	-0.70***	-0.34*	-0.41**	-1.30***	-1.44***
	(-3.87)	(-3.73)	(-1.67)	(-2.27)	(-3.11)	(-3.50)
Government deficit	0.18					
	(1.40)					
Independence + Government deficit		0.22				
		(1.40)				
Time-variant credibility *(past deviations from inflation targets)*			0.04***			
			(3.41)			
Lagged inflation target				0. 30***		
				(5.14)		
Decision horizon + Inflation						0.06*
						(2.08)
Constant	0.96***	0.79***	0.50	0.91***	2.04***	2.12***
	(2.44)	(2.45)	(1.53)	(2.96)	(6.05)	(6.39)
No. of observations	108	102	92	112	85	85
Pseudo R-squared	0.81	0.80	0.76	0.88	0.41	0.42

Note: * statistically significant at the 10% level, ** statistically significant at the 5% level, *** statistically significant at the 1% level. Panel interval random effects estimation. Inflation volatility coefficients premultiplied by 10^6. T-statistics in parentheses. All explanatory variables are lagged by one period.

We also conduct further robustness checks. First, our inflation volatility measure is based on inflation rather than de-trended inflation as in our baseline model. Second, we lag all explanatory

variables by two periods to reflect the fact that the inflation targets in some countries are set two years ahead. The results, which are available in Tables C2 and C3 in the Appendix, largely support our baseline estimates. Table C4 in the Appendix shows more results and robustness checks for the "Exact lag" specification. In addition, we estimate the model with explanatory variables lagged by three periods. The results remain largely unchanged and are available upon request.

It should be kept in mind that the results presented in Tables 2 and 3 are based on reduced-form models and are primarily meant to serve as a positive description of factors influencing the actual setting of inflation targets. We believe that for the normative analysis of questions such as the optimal level of the inflation target, one has to proceed with a general equilibrium model where all important interactions between the inflation target and its determinants are fully articulated. Put differently, it would be naïve to interpret the result from reduced-form regressions, which show the positive correlation between past inflation and the inflation target, as an argument to increase the level of the inflation target when past inflation performance was unfavorable. As we note, such policy analysis and recommendations should be based on a structural model that can evaluate the welfare consequences of taking such measures.

In this context, Blanchard et al. (2010) propose that policymakers should aim for a higher inflation target in good times (say, from the current practice of 2% to a 4% target) to reduce the chances that monetary policy would be restricted by a zero interest rate bound during the recessions. The primary policy questions here are 1) to what extent adoption of a higher target would damage central banks' credibility and hamper management of inflation expectations and 2) how likely are recessions that are so deep that a zero lower bound will become a constraint to policy.[14] In this context, Coibion et al. (2010) demonstrate that previous models examining the effect of trend inflation on welfare can be quite misleading as they evaluated the welfare around zero trend inflation. These models typically concluded that the welfare costs of inflation of up to 5% are rather small. Properly accounting for the fact that trend inflation is typically positive, Coibion et al. (2010) show that welfare decreases sharply for trend inflation greater than 2%, in contrast with the proposal that inflation targets should be raised.

Finally, we examine the determinants of the width of the inflation target band. Typically, policymakers set the point inflation target with a tolerance band of ± 1 percentage point. Nevertheless, some central banks, such as the Czech National Bank, have chosen narrower tolerance bands, whereas others, such as the Central Bank of Brazil and the Bank of Thailand, have set the tolerance bands at a wider range.

As we have seen in Section 2, central banks note the stability of the macroeconomic environment as a key for their decisions about the inflation target band's width. Indeed, our results, as presented in Table 4, indicate that, controlling for other factors, the volatility of the macroeconomic environment together with the level of inflation is important for determining the width of the inflation target band that policymakers adopt. We find that inflation volatility is positively associated with the inflation target band's width. Additional evidence for the supposition that the volatility of the macroeconomic environment matters is that the inflation target band's width is greater in emerging market economies. Interestingly, as of 2010, the Bank

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[14] Walsh (2010) summarizes this debate, including the empirical studies that discuss points 1 and 2 above.

of Korea decided to expand its inflation target range from 2.5–3.5% to 2–4% in order to conduct monetary policy in a more flexible manner. The Bank of Korea officials noted that *"We decided to expand the target range after taking into consideration various factors, including the recent movement of consumer prices and cases from other major countries"* and *"In the years to come, chances are that price volatility will further widen in line with rising prices of oil and raw materials. In addition, economic uncertainties are likely to linger for a while"* (Korea Times, 2009). This statement complies with our empirical analysis suggesting that, in a less stable macroeconomic environment, the officials will prefer a wider range for the inflation target to gain more flexibility for conducting monetary policy.

Table 4: Determinants of Inflation Target Band Width

	(1)	(2)	(3)	(4)	(5)	(6)
CPI inflation	0.03***	0.03***	0.04***	0.03***	0.03***	0.03***
	(3.13)	(3.00)	(3.32)	(3.13)	(2.84)	(3.04)
Inflation volatility	0.01*	0.01*	0.01	0.01*	0.01*	0.01*
	(1.77)	(1.76)	(1.60)	(1.70)	(1.95)	(1.78)
Credibility	0.35	0.35	0.64	0.35	0.86	1.05**
	(0.69)	(0.70)	(1.34)	(0.66)	(1.57)	(1.99)
World inflation		-0.01				
		(-0.11)				
Price level			-0.01			
			(-1.35)			
GDP growth				0.02		
				(0.15)		
GDP per capita					-35.2**	
					(-2.03)	
Emerging markets dummy						0.91**
						(2.13)
Constant	1.70***	1.70***	1.93***	1.69***	1.93***	1.00***
	(5.13)	(5.16)	(5.31)	(4.86)	(5.72)	(2.32)
Observations	139	139	124	139	139	139
R-squared	0.08	0.08	0.15	0.08	0.19	0.20

Note: * statistically significant at the 10% level, ** statistically significant at the 5% level, *** statistically significant at the 1% level. Inflation volatility and GDP per capita coefficient premultiplied by 10^6. T-statistics in parentheses. All explanatory variables are lagged by one period. Random effects estimation.

5. Concluding Remarks

In this paper, we have analyzed the process of how inflation targets are set. In the last twenty years, inflation targeting has become increasingly popular, and today about thirty countries explicitly target inflation. However, a large number of issues remain concerning the proper understanding of this process. It has been discussed widely to what extent inflation targeting represents a successful monetary policy regime (e.g. Mishkin and Schmidt-Hebbel, 2007; Ball and Sheridan, 2006). More specifically, the discussion has concentrated on whether the remarkable decrease in inflation rates in many countries over the last two decades has been caused by the

adoption of inflation targeting or whether it has been a matter of good luck (Walsh, 2009). In addition, the discussion regarding the merits of inflation targeting has focused on whether inflation-targeting central banks would deliver greater output volatility (Friedman, 2004). In a similar vein, the recent financial crisis has raised questions whether inflation targeting should be modified to account for financial instability (Svensson, 2011). Notably, Blanchard et al. (2010) put forward that policymakers should aim for a higher inflation target in booms to reduce the chances of monetary policy being restricted by a zero interest rate bound during recessions. Apart from the effect of inflation-targeting adoption on various economic characteristics, such as the level of inflation and output volatility, the question of how inflation targets are set, to our knowledge, has not been researched yet. This is despite the fact that this crucial parameter of monetary policy is often revised and differs among central banks that target inflation.

In this paper we first gather evidence on how inflation targets are set. We not only use official central bank and government publications, but also devise a questionnaire and send it to the central banks in our sample. We find evidence suggesting that inflation targets are often set jointly by the government and the central bank, but in some countries it is solely the central bank that sets the inflation target, while in other countries the target is set by the government alone. For example, Bank of England and Bank of Israel target setting is the responsibility of the government, while in the Czech Republic and Sweden inflation targets are set according to the preferences of their central banks. Our findings also suggest that when the authorities set the target they typically base their decision on past domestic inflation, inflation volatility and economic growth. In some cases, more specific factors such as foreign inflation or price convergence are stated as factors influencing their decision.

We have also carried out a regression analysis of inflation target setting using a panel of nearly twenty countries over the past two decades. To tackle the problem that inflation targets are often set as a range rather than as a point we employ panel interval regressions. This regression technique allows us also to deal with censoring in the dependent variable. In addition to many economic variables that central banks deem important for setting the target, we include several variables capturing institutional factors such as central bank independence and central bank credibility.

Our results suggest that domestic past inflation, inflation volatility and economic growth are indeed among the domestic macroeconomic characteristics that determine the level of inflation targets. The significance of inflation volatility points to concerns about deflation risk, and policymakers may therefore set higher inflation targets in an environment of more volatile inflation. Our finding that economic growth matters for inflation target setting suggests that inflation-targeting central banks take real objectives into account and that flexible rather than strict inflation targeting is a more reasonable characterization of the monetary policy carried out in practice. In addition, higher world inflation is positively associated with higher inflation targets, which supports those who see domestic inflation as a global phenomenon.

Further, our results support the notion that central bank credibility is key for price stability. We find that more credible central banks set lower targets as they are more confident about their ability to manage inflation expectations. Our results also indicate that central bank independence and government party orientation do not seem to play an important role in inflation target setting. This result probably reflects the fact that inflation-targeting central banks typically exhibit a high

degree of independence even before the adoption of an inflation-targeting regime. The horizon for which the inflation targets are set is found to play a role: for longer horizons, policymakers set more ambitious targets, as longer horizons give them more time for convergence to their first-best inflation levels.

Finally, our results show that policymakers establish a wider target range for the inflation rate when the macroeconomic environment gets less stable, as the broadening of the South Korean inflation target in 2010 nicely illustrates.

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Appendix A: Central banks' statements on how inflation targets are set

Bank of Canada

The bank notes that inflation is typically not targeted close to zero for three main reasons: "(i) the measurement error embedded in existing price indexes; (ii) the labour market consequences of the presence of downward nominal wage rigidities; and (iii) the problems posed by the constraint that nominal interest rates cannot go below zero."
(see http://www.bankofcanada.ca/en/press/background_nov06.pdf).

Bank of England

The bank states that the inflation target is chosen to be consistent with economic stability and growth: "the role of price stability in achieving economic stability more generally, and in providing the right conditions for sustainable growth in output and employment."
(see http://www.bankofengland.co.uk/monetarypolicy/framework.htm).

Bank of Israel

The bank gives several arguments for how the target is chosen: "the aberration in measuring inflation that stems from not taking into account the improvement in quality of goods; a positive inflation reduces the risk of being constrained by the zero bound on nominal interest rates; a small inflation rate is the oil in the wheels of the relative price system—when there is a general upward trend in prices it is easier to change relative prices of goods by raising prices by more or less than the general rate of inflation." Next, it is also noted that: "When both prices and wages are sticky downwards, lowering a relative price could be delayed and thus cause distortion in the allocation of resources. We have no basis to think that in Israel one of these factors is any different from that in other developed countries." (see Bank of Israel, 2007, page 19).

Bank of Korea

The Bank of Korea states that "In setting the inflation target itself at the range of $3.0 \pm 0.5\%$, the Bank aims to reflect the appropriate rate of inflation consistent with Korean economic fundamentals and to allow itself flexibility in conducting monetary policy to deal with short-term economic fluctuations." (http://www.bok.or.kr/broadcast.action?menuNaviId=631). This statement suggests that inflation as well as the degree of economic activity are considered when setting the inflation target.

Bank of Poland

The bank states in the document on its monetary policy strategy that the target is chosen to be consistent with economic growth as well as with the Maastricht inflation criterion for euro adoption: "the above-defined continuous inflation target is consistent with strong economic growth. At the same time, the predefined inflation target comes close to the expected reference value for the inflation criterion." (Bank of Poland, 2003).

Bank of Thailand

The Bank of Thailand states that "*The Monetary Policy Committee considers the 0–3.5 per cent target range for core inflation to be appropriate for the Thai economy, while at the same time providing sufficient flexibility for economic growth*." The Bank of Thailand explicitly describes the width of the target: "The target band width of 3.5 per cent will help cushion temporary economic shocks and minimize the need for the MPC to adjust monetary policy frequently, thereby reducing short-term interest rate volatility and promoting financial stability."

(see http://www.bot.or.th/ENGLISH/MONETARYPOLICY/TARGET/Pages/Target.aspx). This statement suggests that the degree of economic activity may act as a determinant of the inflation target. The volatility of the macroeconomic environment is likely to be positively associated with the target band width.

Central Bank of Chile

The bank notes that the inflation target is set to avoid the risk of deflation: "The Central Bank of Chile does not aim for an inflation level below the specified range because of the risk of deflation, which could be very costly in terms of employment and production."
(see http://www.bcentral.cl/eng/about/functions/05.htm).

Czech National Bank

The Czech National Bank extensively explains how the target is set. The bank has revised the target several times since its introduction in 1998 to support the disinflation process (Holub and Hurnik, 2008). Initially, the CNB stated: "The long-term inflation target must be consistent with the strategy for our integration into European institutions, and above all with the demands of EU and EMU accession" and "the rate of progress towards price and monetary stability and the anticipated time horizon for achieving this must take into account necessary structural adaptations, particularly the adjustment of relative prices." (CNB, 1999). Current and expected inflation as well as the general macroeconomic environment are mentioned as determinants: "The inflation target for 2001 reflects the low inflation level achieved so far and expresses the monetary policy intention to maintain this low level in the next period. The target level is in line with the predictions for inflation factors in 2001 and conforms with the inflation expectations of economic

agents. The forecasts also indicate that this inflation target is consistent with the expected favourable characteristics of the Czech macroeconomic environment." (CNB, 2000). Next, price convergence toward the euro area is noted as a reason for the higher inflation target as compared with the definition of price stability of the European Central Bank: "The suggested headline inflation target is in line with the CNB Monetary Strategy. ... The proposed trajectory for the inflation target can meanwhile be expected to leave sufficient room for price adjustment in connection with EU convergence." (CNB, 2001). Similarly, "This small inflation differential reflects the long-term real convergence of the Czech economy towards the euro area average." (CNB, 2004). More recently, statistical overvaluation in measuring inflation, wage rigidity, and the zero nominal interest rate bound are explicitly mentioned as factors that are taken into account: "The inflation target ... also conforms to the limitations stemming from statistical overvaluation in measuring inflation. The target takes into account also the zero nominal interest rate bound and the potential downward inflexibility of wages." Finally, the target for 2010 onwards is set to 2%, with a 1% tolerance band. The determinants mentioned are the same as in previous cases: "the need to keep open a positive inflation differential as one of the channels for raising the Czech price level to the level of the advanced countries will gradually subside." (CNB, 2007).

Reserve Bank of Australia

In a series of statements on the conduct of monetary policy, the bank's formulation of the inflation target is noted: "allows for the natural short-run variation in inflation over the cycle while preserving a clearly identifiable performance benchmark over time."
(http://www.rba.gov.au/MonetaryPolicy/statement_conduct_mp_4_06122007.html)

Reserve Bank of New Zealand

The Reserve Bank of New Zealand provides the following statement about how the inflation target is chosen: "The agreement [about the inflation target] is broadly as the markets have been anticipating and is consistent with the publicly stated advice of expert commentators. I expect it to be well-received by the financial markets and by other stakeholders in the economy."

(see http://www.rbnz.govt.nz/news/2002/0124629.html). "The raising of the bottom of the band brings the overall target more in line with New Zealand's inflation outcomes in recent years and those in other countries." (RBNZ, 2002). As we read these lines, the first statement suggests the role of financial market expectations, whereas the second points to the importance of both domestic and foreign inflation developments.

Sveriges Riksbank

The Sveriges Riksbank states, in a 1993 press release on the introduction of its inflation target, that "This objective corresponds to the current underlying rate of inflation." (Sveriges Riksbank, 1993). Therefore, the only determinant referred to is current inflation. Recently, a more elaborate description of the target appeared on the Riksbank website. Similarly to the main arguments of optimal inflation theory (see Billi and Kahn, 2008), the Riksbank describes the target as the result of a trade-off between high volatile inflation ("Too high inflation is harmful to the economy, as inflation usually varies substantially when it is high.") and deflationary risks ("But too low inflation is not good either. A too low inflation target increases the risk of deflation, that is, the general price level falls. Deflation has historically been proved to create problems."), also pointing out the consumer price index (CPI) bias: "There is a tendency for the CPI to overestimate the actual rate of increase in the general price level. This is because it is difficult to entirely exclude the effects of quality changes in the CPI. To avoid deflation there is thus reason to set the target at a positive figure." (see http://www.riksbank.com/templates/Page.aspx?id=10596). The Riksbank sees a 2% inflation target as being consistent with the above arguments.

Swiss National Bank

The bank states that it takes measurement error of inflation into consideration when choosing the target: "Measurement problems arise, for example, when the quality of goods and services improves. Such changes are not properly accounted for in the CPI; as a result, measured inflation tends to be slightly overstated." (see http://www.snb.ch/en/iabout/monpol/id/monpol_strat/6).

We were unable to find the potential determinants of the inflation target for other central banks. Note that the Bank of Finland and Bank of Spain no longer target inflation as they are now part of the euro area. Some other central banks, such as the Central Bank of Colombia and the South African Reserve Bank, do not clarify how the inflation target is set but explain the benefits of a low-inflation environment.

Appendix B: Plots of Variables

Figure B1: Mid-point Inflation Targets and Explanatory Variables

Mid-point inflation target and inflation	Mid-point inflation target and inflation volatility
Mid-point inflation target and GDP growth	Mid-point inflation target and world inflation
Mid-point inflation target and CB credibility	Mid-point inflation target and price level
Mid-point inflation target and GDP per capita	Mid-point inflation target and government party

Figure B2: Mid-point Inflation Targets and Central Bank Independence

Mid-point inflation target and CBI, Guillén and Polillo

Mid-point inflation target and CBI, Arnone et al.

Mid-point inflation target and CBI, Arnone et al. – economic part

Mid-point inflation target and CBI, Arnone et al. – political part
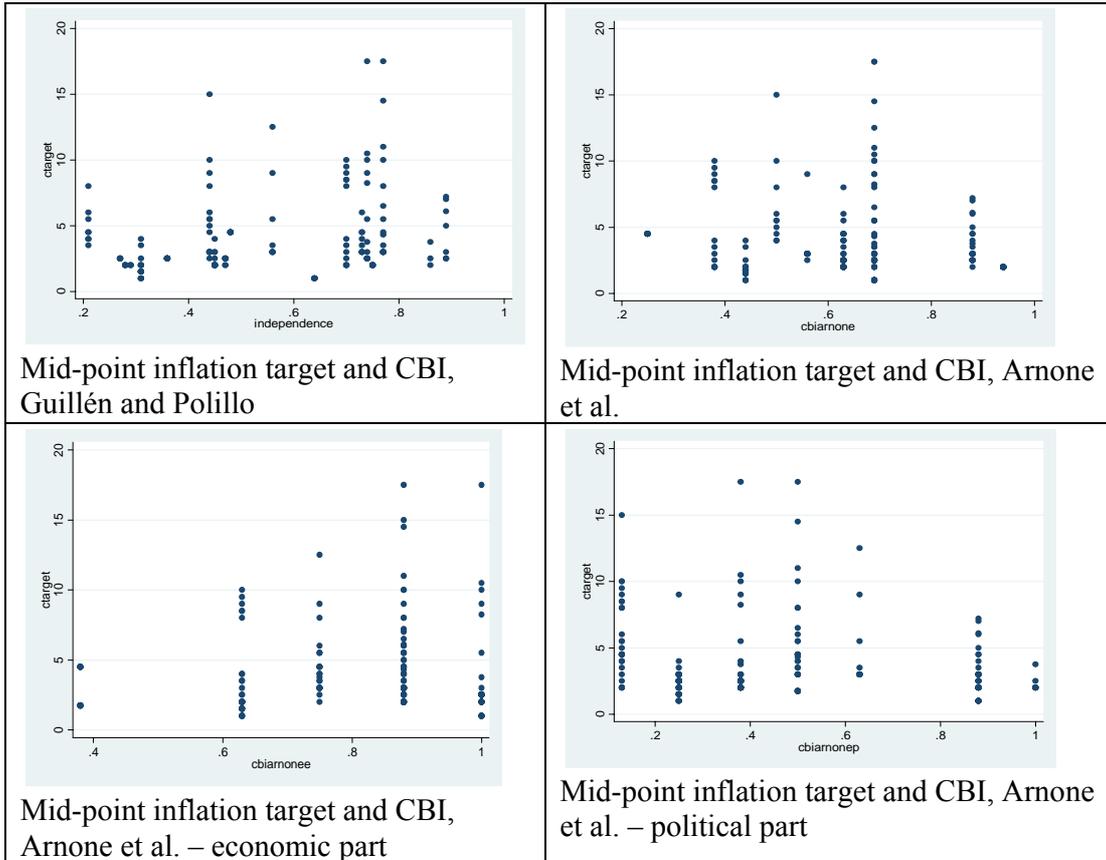
Appendix C: Additional Regression Results and Tests

Table C1: Determinants of Inflation Targets

Different Measures of Central Bank Independence

	(1)	(2)	(3)	(4)	(5)	(6)
CPI inflation	0.50***	0.50***	0.49***	0.49***	0.50***	0.50***
	(15.97)	(15.66)	(15.01)	(15.10)	(15.71)	(15.07)
Inflation volatility	0.29***	0.30***	0.31***	0.31***	0.23***	0.23***
	(2.56)	(2.51)	(2.75)	(2.68)	(2.57)	(2.65)
GDP growth	0.16***	0.15***	0.14***	0.15***	0.16***	0.15***
	(4.17)	(3.96)	(3.73)	(3.79)	(4.02)	(3.85)
World inflation	0.13**	0.12**	0.13**	0.13**	0.11**	0.12**
	(2.30)	(2.12)	(2.28)	(2.218)	(1.96)	(2.00)
Credibility	-0.49**	-0.51**	-0.63**	-0.56**	-0.44	-0.54**
	(-2.14)	(-2.12)	(-2.50)	(-2.29)	(-1.57)	(-1.97)
Independence 1	-0.45					
(Arnone et al. index –	(-1.51)					
political part)						
Independence 2		0.01				
(Arnone et al. index –		(0.02)				
economic part)						
(Independence 1 + Gov. p.			-0.13			
or.)						
			(-1.21)			
(Independence 2 + Gov. p.				-0.06		
or.)						
				(-0.64)		
Independence 3					0.11	
(Guillén and Polillo index)					(0.21)	
(Independence 3 + Gov. p.						-0.05
or.)						
						(-0.50)
Constant	0.77**	0.62	0.74**	0.71**	0.55	0.70**
	(2.34)	(1.23)	(2.23)	(2.205)	(1.09)	(2.01)
No. of observations	130	130	130	130	123	123
Pseudo R-squared	0.78	0.77	0.78	0.77	0.78	0.78

Note: * statistically significant at the 10% level,

** statistically significant at the 5% level,

*** statistically significant at the 1% level.

Panel interval random effects estimation. Inflation volatility, GDP per capita and price level coefficients premultiplied by 10^6 and 10^3, respectively. T-statistics in parentheses. All explanatory variables are lagged by one period.

Table C2: Determinants of Inflation Targets

Simple Measure of Inflation Volatility

(sample variance of past inflation)

	(1)	(2)	(3)	(4)	(5)	(6)
CPI inflation	0.50***	0.49***	0.50***	0.49***	0.49***	0.49***
	(15.75)	(14.47)	(15.64)	(15.12)	(14.92)	(15.35)
Inflation volatility	0.44**	0.44***	0.45**	0.46***	0.46***	0.46***
	(2.51)	(2.43)	(2.54)	(2.60)	(2.61)	(2.47)
GDP growth	0.15***	0.16***	0.16***	0.14***	0.15***	0.15***
	(3.93)	(3.76)	(4.00)	(3.73)	(3.82)	(3.75)
World inflation	0.12**	0.11*	0.12**	0.13**	0.12**	0.12**
	(2.15)	(1.77)	(1.96)	(2.22)	(2.02)	(2.16)
Credibility	-0.52**	-0.53*	-0.44	-0.58**	-0.55**	-0.49
	(-2.22)	(-1.77)	(-1.56)	(-2.26)	(-1.96)	(-1.54)
Price level		-0.72				
		(-0.17)				
Independence			-0.50			
			(-0.98)			
Gov. party orientation				-0.07		
				(-0.67)		
(Independence + Gov. p. or.)					-0.10	
					(-0.92)	
GDP per capita						-2.29
						(-0.17)
Constant	0.62*	0.75*	0.56	0.65**	0.71**	0.64*
	(1.92)	(1.85)	(1.09)	(2.00)	(2.01)	(1.83)
No. of observations	134	114	123	130	134	130
Pseudo R-squared	0.77	0.79	0.78	0.78	0.77	0.77

Note: * statistically significant at the 10% level,

    ** statistically significant at the 5% level,

    *** statistically significant at the 1% level.

  Panel interval random effects estimation. Inflation volatility, GDP per capita and price level coefficients premultiplied by 10^6 and 10^3, respectively. T-statistics in parentheses. All explanatory variables are lagged by one period. Independence refers to the central bank independence index developed by Arnone et al. (2008). Inflation is not detrended for the calculation of inflation volatility.

Table C3: Determinants of Inflation Targets

Explanatory Variables Lagged by Two Periods

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
CPI inflation	0.37***	0.36***	0.37***	0.37***	0.37***	0.36***	0.37***
	(7.92)	(7.27)	(7.99)	(7.90)	(7.90)	(7.50)	(7.76)
Inflation volatility	1.53	1.33	1.70	1.60	1.66	1.32	1.50
	(1.41)	(1.22)	(1.57)	(1.47)	(1.51)	(1.20)	(1.38)
GDP growth	0.18***	0.18***	0.19***	0.18***	0.18***	0.17***	0.18***
	(6.08)	(6.01)	(6.37)	(5.75)	(5.43)	(6.36)	(6.14)
World inflation	0.14*	0.16**	0.14*	0.14*	0.13*	0.14*	0.14*
	(1.84)	(1.99)	(1.95)	(1.87)	(1.83)	(1.86)	(1.86)
Credibility	-0.33**	-0.18	-0.29*	-0.36**	-0.34*	-0.11	-0.30
	(-2.22)	(-0.97)	(-1.79)	(-2.02)	(-1.65)	(-0.48)	(-1.59)
Price level		-0.01**					
		(-1.98)					
Independence			-0.77**				
			(-2.04)				
Gov. party orientation				-0.04			
				(-0.50)			
(Independence + Gov. p. or.)					-0.04		
					(-0.54)		
GDP per capita						-1.45	
						(-1.33)	
Emerging markets dummy							0.04
							(0.24)
Constant	0.57	0.87**	0.98***	0.65**	0.64	0.71*	0.53*
	(1.36)	(2.08)	(2.63)	(2.00)	(1.36)	(1.90)	(1.25)
No. of observations	134	118	134	130	134	134	130
Pseudo R-squared	0.77	0.80	0.78	0.78	0.78	0.77	0.77

Note: * statistically significant at the 10% level,

** statistically significant at the 5% level,

*** statistically significant at the 1% level.

Panel interval random effects estimation. Inflation volatility, GDP per capita and price level coefficients premultiplied by 10^6 and 10^3, respectively. T-statistics in parentheses. Independence refers to the central bank independence index developed by Arnone et al. (2008). Explanatory variables lagged by two periods.

Table C4: Determinants of Inflation Targets

"Exact Lag" Specification, Significance Tests

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
CPI inflation	0.40***	0.40***	0.40***	0.40***	0.40***	0.40***	0.40***
	(13.24)	(12.91)	(13.24)	(12.93)	(12.94)	(13.28)	(13.99)
Inflation volatility	1.16	0.02	0.04	0.01	0.01	0.08	0.08
	(0.08)	(0.02)	(0.03)	(0.01)	(0.09)	(0.06)	(0.06)
GDP growth	0.11**	0.13**	0.14**	0.11**	0.12**	0.12**	0.09*
	(2.15)	(2.34)	(2.42)	(2.12)	(2.15)	(2.20)	(1.80)
World inflation	0.03	0.02	0.03	0.03	0.03	0.03	0.04*
	(1.48)	(0.99)	(1.42)	(1.50)	(1.43)	(1.41)	(1.80)
Credibility	-	-	-	-1.33***	-	-	-1.31**
	1.30***	1.56***	1.71***		1.28***	1.50***	
	(-3.11)	(-3.23)	(-3.14)	(-3.03)	(-2.88)	(-2.83)	(-2.54)
Price level		-0.01					
		(-0.91)					
Independence			-1.42				
			(-1.20)				
Gov. party orientation				-0.05			
				(-0.25)			
(Independence + Gov. p. or.)					0.02		
					(0.06)		
GDP per capita						1.58	
						(0.61)	
Emerging markets dummy							0.31
							(0.71)
Constant	2.04***	1.69***	3.03***	2.06***	2.04***	1.93***	2.16***
	(6.05)	(2.82)	(3.42)	(6.01)	(5.93)	(4.96)	(6.67)
No. of observations	85	81	84	85	85	85	85
Pseudo R-squared	0.41	0.41	0.41	0.41	0.41	0.41	0.46

Note: The lag of explanatory variables is country- and time specific and is set exactly to reflect the time lag between the announcement of the inflation target and the date when the inflation target becomes effective.
* statistically significant at the 10% level,
** statistically significant at the 5% level,
*** statistically significant at the 1% level.
Panel interval random effects estimation. Inflation volatility, GDP per capita and price level coefficients premultiplied by 10^6 and 10^3, respectively. T-statistics in parentheses. Independence refers to the central bank independence index developed by Arnone et al. (2008).

Table C5: Correlations between Variables

	Inflation target	CPI inflation	Inflation volatility	GDP growth	World inflation	Credibility	Independence	Government party orientation	Government deficit
Inflation target	1,00								
CPI inflation	0,85	1,00							
Inflation volatility	0,38	0,25	1,00						
GDP growth	-0,12	-0,15	-0,13	1,00					
World inflation	0,33	0,19	0,24	0,09	1,00				
Credibility	-0,50	-0,41	-0,21	0,09	0,05	1,00			
Independence	0,27	0,13	0,16	0,00	-0,05	-0,53	1,00		
Government party orientation	0,12	0,08	0,20	-0,23	0,14	-0,42	0,10	1,00	
Government deficit	0,03	0,05	0,01	-0,06	-0,18	-0,06	-0,22	-0,15	1,00

Table C6: Panel Stationarity Tests

Fisher-type unit-root test
Based on Phillips-Perron tests

Ho: All panels contain unit roots   Number of panels   =   19
Ha: At least one panel is stationary

	Test statistic (Inverse chi-squared, 38 d.o.f.)	P-value
Inflation target	374.3471	0.00
CPI inflation	298.1720	0.00
Inflation volatility	107.8546	0.00
GDP growth	142.6868	0.00
World inflation	176.8890	0.00
Credibility	0.00	1.00
Independence	2.250	1.00
Government party orientation	13.2061	0.99
Government deficit	66.6222	0.01

(Credibility, Independence and Government party orientation are nonstationary for obvious reasons: they are constant, or infrequently jump at discrete changes)

Table C7: Hausman Test

Hausman test
Fixed Effects (consistent) vs. Random Effects (efficient under H0)
Basic specification (Model 1, Table 2)

Test: Ho: difference in coefficients not systematic
Test statistic, chi-squared, 3 d.o.f = 1.25
Prob>chi2 = 0.7408

Random Effects not rejected.

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