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# Anchoring of long-term inflation expectations: Do inflation target formulations matter?\*

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## Abstract

We use a novel anchoring-measure based on the distribution across professional forecasters' point forecasts to test empirically whether target formulations matter for the anchoring of long-term inflation expectations. In a panel of 29 countries, we find that the formulation of a point target increases the degree of anchoring compared with countries with a mere quantitative definition of price stability. A point target is more successful in limiting upside risks to inflation, while a range target allows for higher downside risk to the inflation outlook. Our results suggest that range targets and tolerance bands are interpreted by professional forecasters as zones where policy is less active.

*Keywords:* monetary policy, inflation targeting, inflation risk, expectations anchoring,

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# 1 Introduction

The central bank’s inflation objective is an important nominal anchor for inflation expectations over the medium- to longer-term. This paper investigates empirically the question whether the exact formulation of a quantitative inflation goal matters for the anchoring of inflation expectations. Specifically, we ask how the inflation risk outlook changes under a point target versus a range target.

To answer this question, we combine two datasets. First, we compile an extensive database of quantitative definitions of inflation targets, focussing on the presence of a point target versus a range target. Second, we construct densities over inflation point forecasts in order to evaluate the balance of risks to the inflation outlook. We use Consensus Economics survey data with forecasting horizons of two to ten years. This dataset has the advantage of being readily available for a large set of countries, but comes with the disadvantage of a lack of micro data from panelists or subjective measures of forecast uncertainty. We fit generalized Beta distributions to four moments of the underlying distribution of point forecasts available in the long-term forecasts from April 2005 onwards in order to bridge this data gap. Inflation risk measures are then derived from the continuous distribution functions, which can be interpreted as an inflation risk outlook. The final dataset is an unbalanced panel covering 29 countries between April 2005 and April 2020.

The focus on inflation risk measures is motivated by the observation that monetary policy decisions are less and less well captured by quadratic-symmetric central bank preferences as they are underlying the Taylor rule. Recent work shows that the standard linear-quadratic approach in monetary policy rules leads to a downward drag on inflation expectations in the presence of the effective lower bound on nominal interest rates (ELB) (Mertens and Williams, 2019; Bianchi, Melosi, and Rottner, 2019). In response, the weighting of upside and downside risks to the inflation objective has become an increasingly important ingredient to monetary policy making (Evans, 2020; Lane, 2020).

Based on a framework developed by Kilian and Manganelli (2008), we show that a risk-averse central banker should be actively managing the inflation risk outlook in order to reduce the expected loss from future inflation deviations. Hence, central banks should seek to manage these risks in the inflation outlook as an intermediate target (Svensson, 2020).

We find that the formulation of a point target increases the degree of anchoring of inflation expectations over horizons of two to ten years. We use several tests in order to derive our result. First, the probability to be close to the inflation aim is significantly higher in the presence of a point target. A point target is also more successful in limiting upside risk to inflation, measured as the probability density of professional forecasters point forecasts exceeding a threshold which lies above the inflation objective. In contrast, downside risks to inflation are significantly higher in the presence of a range target or tolerance band. We show that forecast disagreement is significantly lower in the presence of a point target, in particular over forecast horizons over the medium term of two to four years.

A contribution of this paper is to confront the theoretical literature on the formu-

lation of inflation objectives with empirical facts. Some papers have shown that a tolerance band can signal higher flexibility in the mandate. [Orphanides et al. \(2000\)](#) analyse the implications of a non-linear central bank loss function for optimal monetary policy. In their set-up, the policymaker is indifferent about inflation outcomes falling within a target zone, but experiences linear-quadratic losses outside this zone. The resulting optimal policy response with a positive weight on the secondary objective is characterized by an inflation target corridor in which the central bank sets policy primarily to pursue its secondary objective.<sup>1</sup> A related motivation to announce a tolerance band can be obtained also in a framework with linear-symmetric preferences. [Svensson \(1997b\)](#) shows that 'flexible' inflation targeting involves *ex post* deviations from target. While the target is met on average under any specification of the loss function, the *variance* of target misses is affected by how much policymakers weigh secondary objectives, such as output stabilisation. The announcement of an explicit tolerance band can in this context be interpreted as a measure to increase transparency by revealing to the general public the central bank's preferences over the inflation-output trade-off. While we do not test these hypotheses directly, we find evidence which is consistent with these theories, suggesting that target ranges or tolerance bands are interpreted by professional forecasters as zones where policymakers tolerate smaller, persistent deviations from the inflation target.

In contrast to this increased flexibility through a tolerance band, [Demertzis and Viegi \(2009\)](#) interpret bands as a communication tool to enhance central bank credibility. Their framework features heterogeneous expectations due to information imperfections. Agents need to decide how much weight to put on a public signal, the inflation aim, versus a private signal about a shock hitting the economy. A central bank can influence the weight agents put on the inflation aim by building up credibility via a good inflation track record with respect to a tolerance band. Thereby, bands can help to coordinate expectations toward the inflation target. Interpreting a point target as a limiting case for a tolerance band converging to zero, this should imply low credibility by the central bank and less well-anchored expectations. We find that the opposite is true and that the presence of a tolerance band reduces anchoring in some cases.

A second contribution of this paper is to show that the formulation of the inflation target matters for the anchoring of inflation expectations. [Castelnuovo, Nicoletti-Altimari, and Rodriguez-Palenzuela \(2003\)](#) document that the adoption of a quantitative inflation aim improves anchoring. However, focussing on the mean point forecast among panelists, they do not find any difference between countries adopting a range target versus a point target. [Levin, Natalucci, and Piger \(2004\)](#) find that the IT framework has helped industrialized economies to better anchor medium- to longer-run inflation expectations, which respond less to lagged inflation. [Gürkaynak, Levin, and Swanson \(2010\)](#) compare market-based inflation expectations of a number of IT countries and the U.S., noting that far-ahead forward rates respond more to economic news and are more volatile in the U.S., suggesting higher anchoring in IT countries. [Ehrmann \(2015\)](#) documents that IT countries have less well-anchored expectations during episodes of persistently low inflation. His findings are underling the need to

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<sup>1</sup>Interestingly, when risk is introduced in their set-up, policymakers start to respond to inflation risk around the edges of the inflation zone.

better understand the formation of inflation expectations in IT regimes. Our findings provide novel insights by focussing on the differences arising from the formulation of the inflation objective (*point* vs. *range*) and by extending the empirical test toward the distribution of point forecasts, allowing for conclusions about inflation risk management. Our paper is most closely related to [Ehrmann \(2020\)](#), work developed in parallel to this, who finds that pass-through is weaker for inflation targeters that have defined a tolerance band for inflation. We see his findings as complementary, given that he focusses on short-term forecast horizons of up to one calendar year.

Finally, we contribute to the empirical literature explaining disagreement in survey data. Early work by [Johnson \(2002\)](#) based on a sample of 11 advanced economies does not suggest that the IT framework is able to lower disagreement, a result confirmed by [Siklos \(2013\)](#). Confirming the non-result for advanced countries, [Capistran and Ramos-Francia \(2010\)](#) find that the adoption of IT lowers forecast disagreement in emerging market economies. Their work is based on Consensus Economics forecast data for 25 countries, ending in November 2006 and limited to short-term forecast horizons of up to one calendar year. Using data from 2015 to 2020, we find that point targets lower disagreement in advanced and emerging market economies for forecast horizons beyond two years.

The remainder of the paper is organized as follows. [Section 2](#) presents a general risk management model of a central bank to the inflation outlook, which provides the theoretical background of the empirical inflation risk measures. [Section 3](#) presents the data and describes how we derive continuous densities over point forecasts using four moments of the distribution. [Section 4](#) contains the econometric analysis on the inflation risk outlook while [Section 5](#) presents evidence on forecaster disagreement and volatility of expectations. [Section 6](#) concludes.

## 2 Central bank inflation risk management

This section lays out inflation risk measures that can be used by central bankers to evaluate upside and downside risks to the inflation outlook. Further, we extend the inflation risk management model of a central banker as presented in [Kilian and Manganelli \(2008\)](#) to the case of a forward-looking central bank that is concerned about target misses over the medium- to longer-term.

### 2.1 Risk measures

[Kilian and Manganelli \(2008\)](#) have formalized "upside risk" and "downside risk" to price stability as situations in which a central banker is concerned about inflation realizations below a certain threshold,  $\pi < \underline{\pi} < \pi^*$  or above a certain threshold  $\pi > \bar{\pi} > \pi^*$ . This approach can be transferred to inflation expectations over horizon  $h$  under the assumption that inflation expectations are an important intermediate target for policymakers. The reason to be concerned about inflation forecasts below a threshold is that they pose a risk of disanchoring of expectations due to low inflation.<sup>2</sup>

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<sup>2</sup>See also [Vincent-Humphreys, Dimitrova, and Falck \(2019\)](#) for a detailed discussion of the measurement of the balance of risks to the inflation outlook.

Let  $F_{\pi_h^e}$  denote the probability distribution over point forecasts of year-on-year inflation in year  $t + h$ . Our disanchoring measure due to low inflation ( $DAL$ ) is then given by

$$DAL_{\gamma^L}^h = \int_{-\infty}^{\bar{\pi}} (\bar{\pi} - \pi_h^e)^{\gamma^L} dF_{\pi_h^e}(\pi_h^e), \quad \gamma^L \geq 0. \quad (1)$$

In analogy, we define a disanchoring measure due to high inflation ( $DAH$ ) by

$$DAH_{\gamma^H}^h = \int_{\bar{\pi}}^{\infty} (\pi_h^e - \bar{\pi})^{\gamma^H} dF_{\pi_h^e}(\pi_h^e), \quad \gamma^H \geq 0. \quad (2)$$

The parameters  $\gamma^L$  and  $\gamma^H$  capture the risk attitude of a central bank toward upside and downside inflation risk. It is beyond the scope of this paper to estimate the risk attitude of central banks, such that we focus on the risk-neutral case ( $\gamma^H = \gamma^L = 0$ ) in the empirical application.

In complementation of downside and upside risks to inflation, we can define a probability-based measure of being on target, given by the cumulative density of point forecasts within the lower and upper threshold

$$\begin{aligned} ProbT^h &= \int_{\bar{\pi}}^{\bar{\pi}} dF_{\pi_h^e}(\pi_h^e) \\ &= 1 - DAL_{\gamma^L}^h - DAH_{\gamma^H}^h. \end{aligned} \quad (3)$$

Finally, we derive *percentile-gaps*, obtained by taking the distance of percentiles of the distribution  $F_{\pi_h^e}$  to the target

$$G^h(p) = P^h(p) - \pi^*, \quad (4)$$

with  $p \in \{.05, .95, .25, .75\}$ . The percentile gaps capture how distant certain segments of the distribution of point forecasts are from the inflation target.

The here defined four measures based on probability densities of point forecasts contrast with a distance to target perspective which focusses only on the mean point forecast, the so-called consensus forecast. For completeness, let  $\mu^h$  denote the mean of the point forecasts related to the probability density function  $F_{\pi_h^e}$ . The distance to target of the mean point forecast over horizon  $h$  is then given by

$$DT^h = \mu^h - \pi^*. \quad (5)$$

## 2.2 Inflation risk management model

A simple model of inflation risk management underlines the usefulness of the inflation risk measures derived from inflation expectations data for policymakers. We follow [Kilian and Manganelli \(2008\)](#), who state asymmetric central bank preferences based on a loss function that can be closely linked to the central bank language of inflation risk.<sup>3</sup> Accordingly, a central bank inflation risk problem is characterized by a risk

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<sup>3</sup>There exist alternative specifications of asymmetric central bank preferences. The advantage of the approach chosen here is that it is derived from an explicit loss function, thus not *ad hoc* as in

management problem and the pre-condition for the existence of a risk management model.

**Definition.** [Risk management problem] Let  $F_{\pi_h^e}^{(1)}$  and  $F_{\pi_h^e}^{(2)}$  denote two alternative probability distributions for inflation expectations over horizon  $h$ . Then  $F_{\pi_h^e}^{(1)}$  is weakly preferred over  $F_{\pi_h^e}^{(2)}$  if  $|DAL_{\gamma^L}(F_{\pi_h^e}^{(1)})| \leq |DAL_{\gamma^L}(F_{\pi_h^e}^{(2)})|$  and  $DAH_{\gamma^H}(F_{\pi_h^e}^{(1)}) \leq DAH_{\gamma^H}(F_{\pi_h^e}^{(2)})$ . If this condition does not hold, the central banker faces a risk management problem.

**Definition.** [Risk management model] A central banker's preferences satisfy a risk management model if and only if there is a real valued function  $U$  in risks such that for all relevant distributions  $F_{\pi_h^e}^{(1)}$  and  $F_{\pi_h^e}^{(2)}$ ,  $F_{\pi_h^e}^{(1)}$  is preferred over  $F_{\pi_h^e}^{(2)}$  if and only if  $U(DAL_{\gamma^L}(F_{\pi_h^e}^{(1)}), DAH_{\gamma^H}(F_{\pi_h^e}^{(1)})) > U(DAL_{\gamma^L}(F_{\pi_h^e}^{(2)}), DAH_{\gamma^H}(F_{\pi_h^e}^{(2)}))$

The condition of the existence of a risk management model is a description of central bank preferences in the presence of inflation risk. In order to evaluate such preferences, it is useful to define the loss function of the central banker as

$$\begin{aligned} L_t &= L(\pi_t) \\ &= \left[ aI(\pi_t < \underline{\pi})^{\gamma^L} + (1-a)I(\pi_t > \bar{\pi})^{\gamma^H} \right], \\ &\text{with } 0 \leq a \leq 1. \end{aligned}$$

The parameter  $a$  measures the relative importance of downside risks to upside risks to inflation. The central banker only incurs a loss from inflation realisations below or above a certain threshold, where the gap enters with power of  $\gamma^L \geq 0$  and  $\gamma^H \geq 0$ . Note that this loss function can be extended to a second objective of output gap stabilisation and that the specification nests the standard quadratic and symmetric loss function commonly used in the literature (Clarida, Gali, and Gertler, 1999; Svensson, 1999).

In expectation, this loss function can be written as

$$\begin{aligned} E(L_{t+h}) &= a \int_{-\infty}^{\underline{\pi}} (\underline{\pi} - \pi_h^e)^{\gamma^H} dF_{\pi_h^e}(\pi_h^e) + (1-a) \int_{\bar{\pi}}^{\infty} (\pi_h^e - \bar{\pi})^{\gamma^L} dF_{\pi_h^e}(\pi_h^e) \\ &= aDAL_{\gamma^L} + (1-a)DAH_{\gamma^H}, \end{aligned} \tag{6}$$

where the last line follows from substituting the definitions of risk measures (1) and (2).

Inflation targeting central banks have a long tradition in focussing on the medium-term outlook to inflation when deciding about the appropriate stance of monetary policy (Svensson, 1997a). This practice acknowledges the implementation lag of monetary policy. Importantly, the academic literature has focussed predominantly on the loss function in expected utility terms.

Equation (6), in contrast, characterizes the expected central bank loss function of a *risk-averse* central banker at horizon  $t+h$ . Thus, a risk-averse central banker takes into account the entire distribution of possible future inflation outcomes and weights them according to her preferences.<sup>4</sup>

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Ruge-Murcia (2003), among others.

<sup>4</sup>Kilian and Manganelli (2008) give a simple example. Compare the situation (i) of 2.001% inflation



An important implication of policy preferences that follow model (6) is that central bankers should target the balance of risks to the inflation outlook. Under the specific formulation of the loss function, central bankers should weight inflation projections outside a pre-specified corridor around the target midpoint  $\pi^*$  according to their preferences over downside and upside risks.

### 3 Data

This section describes the classification of quantitative targets and the approach of fitting generalized Beta distributions to moments of empirical distributions of mean point forecasts from survey data.

#### 3.1 Classification of quantitative inflation targets

We code the quantitative inflation targets of 33 countries. The sample of countries is composed out of 18 advanced economies (AEs) and 15 emerging market economies (EME). See Table A.3 in the Appendix for a list of countries and the coding of quantitative inflation targets. We follow [Castelnuovo, Nicoletti-Altamari, and Rodriguez-Palenzuela \(2003\)](#) and define dummy variables for four categories: no explicit announcement ( $d1$ ), a quantitative definition of price stability ( $d2$ ), an inflation range target ( $d3$ ), and an inflation point target ( $d4$ ).

Some remarks on the coding of inflation targets are in order. First, given the nuanced definition of inflation objectives in practice, the boundaries of central bank objectives defined as point targets versus range targets are not clear cut. We therefore acknowledge that there might be controversial views about the classification of some countries over time that we have chosen.

Second, the objective is to collapse the variety of target specifications into the essential informational content that the public is able to understand in the context of noisy information and conflicting signals ([Demertzis and Vieg, 2008, 2009](#)). Therefore, we code all countries with an explicit point target or a focal point as dummy  $d4 = 1$ . At the same time, if a country explicitly defines a tolerance band or operates under a range target without a focal point, we code dummy  $d3 = 1$ . Thus,  $d1$ ,  $d3$ , and  $d3 \cup d4$  mutually exclude each other, while a country might well be classified as having a target point and target range at the same time.

Third, we include also three central banks that never officially adopted inflation targeting as a framework for the conduct of monetary policy, namely the United States, the Euro area and Switzerland. However, we consider that these countries have a mature policy framework which can be integrated into the empirical analysis. Table A.3 gives details regarding our classification choices.

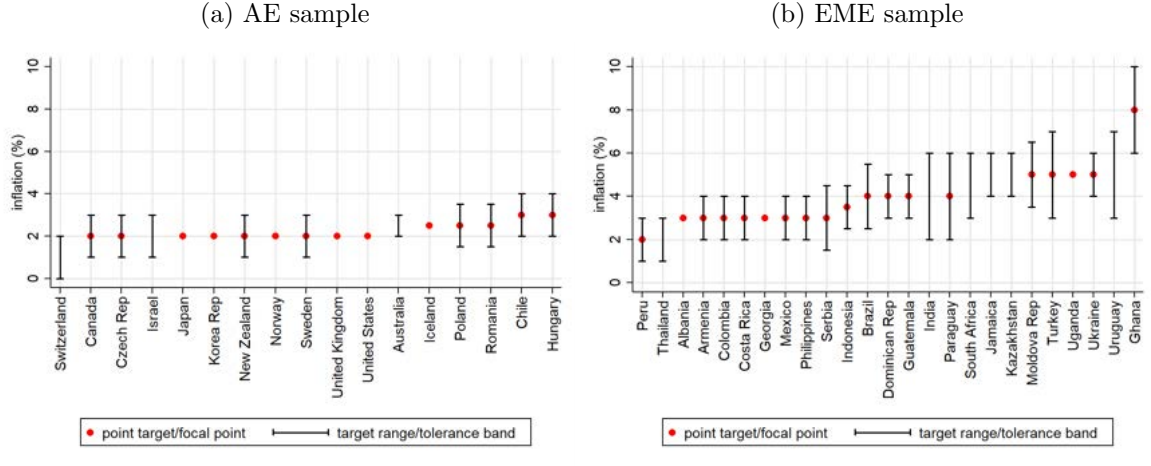
[Fig. 1](#) shows the inflation objectives of 32 central banks as of April 2020. Two observations stand out. First, there is convergence toward an inflation objective of

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with probability 100% versus a situation (ii) of 10% inflation with probability 20% and inflation below 2% with probability 80%. A risk-neutral central banker might be indifferent between the two situations, while most policymakers would prefer (i) over (ii).



Figure 1: Quantitative inflation targets



Notes: Quantitative targets as of April 2020 of 17 AE countries (panel a) and 25 EME countries (panel b). Switzerland and the United States are the only countries not classified as official inflation targeters. Missing from the AE sample is the Euro area with an inflation objective of below, but close to, 2 percent, which cannot be translated into a specific number without controversy.

two to three percent among central banks. Second, there is significant cross-country variation with respect to the adoption of a point target versus a target range and hybrid versions, such as a target band with a focal point or a point target with a tolerance band. Fig. A.1 to Fig. A.1 and Tab. A.3 in the Appendix document that there is also considerable intertemporal variation, as some central banks introduced or abandoned tolerance bands and point targets even when the level of the overall inflation target remained unchanged.

### 3.2 Expectations and macro data

For the computation of inflation risk measures, we build densities over point forecasts using survey data from professional forecasters collected by Consensus Economics. The survey is conducted across a wide range of countries. The longer-term survey is available at biannual frequency from October 1989 onwards with surveys conducted typically in April and October of each year over forecast horizons of  $h = 0, 1, 2, 3, 4, 5, 6-10$  years. The survey switched to a quarterly frequency in April 2014. The forecasts are calendar based, implying a change in the forecast horizon in each survey round. Since we only use forecast horizons of  $h \geq 2$ , our analysis is not significantly affected by the shortening of forecast horizon intervals over time (Dovern, Fritsche, and Slacalek, 2012).

Let  $MPF_{jit}^h(x)$  denote the mean point forecast of panelist  $j$  in country  $i$  at time  $t$  of realizations of variable  $x$  over the forecast horizon  $h$ . Unfortunately, the micro data of all panelists mean point forecasts are not available from Consensus. This makes a risk assessment based on the probability density across panelists' views, denoted by  $F_{xit}^e$ , difficult. In order to bridge this data gap, we fit a generalized Beta distribution

to four moments reported by Consensus in its longer-term forecasts as of April 2005, namely (i) the sample mean, (ii) the sample standard deviation, (iii) the lowest and (iv) the highest mean point forecast of the survey sample. In order to formalize the concept, let us denote these four moments as follows:

$$\mu_{it}^h = E_t[MPF_{it}^h] = \frac{1}{N} \sum_{j=1}^N MPF_{jit}^h \quad (7)$$

$$\sigma_{it}^h = \sqrt{\frac{1}{N-1} \sum_{j=1}^N (MPF_{jit}^h - \mu_{it}^h)^2} \quad (8)$$

$$high_{it}^h = \max [MPF_{1it}^h, \dots, MPF_{Nit}^h] \quad (9)$$

$$low_{it}^h = \min [MPF_{1it}^h, \dots, MPF_{Nit}^h] \quad (10)$$

Fitting generalized Beta distributions is common in the literature to smooth expectations data reported in bins (Engelberg, Manski, and Williams, 2009; Boero, Smith, and Wallis, 2015; Grishchenko, Mouabbi, and Renne, 2019). Note that we fit a distribution to an unobserved distribution of point forecasts, obtaining a continuous probability density function over individual forecasters' point forecasts  $MPF_{jit}^h(x) \sim \mathcal{B}_{it}^h(a, b, c, d)$ . The parameters  $a$  and  $b$  define the shape of the resulting distribution, while the parameters  $c$  and  $d$  determine the lower and upper bound of the support of  $\mathcal{B}(\cdot)$ , respectively.

[Fig. 2 about here]

The generalized Beta distribution falls in the class of asymmetric continuous densities that feature a skewness different from zero. In order to inform the skewness in estimation of  $\mathcal{B}(\cdot)$ , we define an objective function  $\mathcal{Z}$  that includes a quantile-constraint:

$$\begin{aligned} \min_{a>1, b>1, c, d} \mathcal{Z} = & w_1 (\mu_{it}^h - \hat{\mu}_{it}^h)^2 + w_2 (\sigma_{it}^h - \hat{\sigma}_{it}^h)^2 \\ & + w_3 (\max [c - low_{it}^h, 0])^2 + w_3 (\max [low_{it}^h - \hat{Q}_{it}^h(\zeta), 0])^2 \\ & + w_3 (\max [high_{it}^h - d, 0])^2 + w_3 (\max [\hat{Q}_{it}^h(1 - \zeta) - high_{it}^h, 0])^2 \\ & + w_4 (c - low_{it}^h)^2 + w_4 (high_{it}^h - d)^2, \end{aligned} \quad (11)$$

where  $\hat{\mu}_{it}^h$ ,  $\hat{\sigma}_{it}^h$ ,  $\hat{Q}_{it}^h(\zeta)$  and  $\hat{Q}_{it}^h(1 - \zeta)$  are moments from the estimated generalized Beta ( $\hat{\mathcal{B}}(a, b, c, d)$ ), and  $w_1, w_2, w_3$  and  $w_4$  are weights. The first line of (11) contains the squared difference of the first two moments of the distribution. The second and third line imply the quantile constraint and impose that  $low_{it}^h \in [c, \hat{Q}_{it}^h(\zeta)]$  and  $high_{it}^h \in [\hat{Q}_{it}^h(1 - \zeta), d]$ , respectively. This informs the skewness of the estimated distribution  $\hat{\mathcal{B}}$ .<sup>5</sup> The fourth line of (11) minimizes the distance between the parame-

<sup>5</sup>We rejected the approach of setting the highest and lowest survey values directly to the support of the generalized Beta due to a concern over sensitivity toward outliers.

ters governing the support  $(c, d)$  and the highest and lowest reported forecast among panelists  $(low_{it}^h, high_{it}^h)$ . This last element prevents indeterminacy of the optimization problem.

We calibrate weights as  $w_1 = 100$ ,  $w_2 = 10$ ,  $w_3 = 1$ ,  $w_4 = 0.1$  and choose  $\zeta = 0.25$ , such that extreme values fall within the lowest and highest quantiles of the resulting generalized Beta. We minimize the loss function numerically under the constraints of  $a > 1$ ,  $b > 1$  in order to impose unimodality. The procedure is illustrated in Fig. 2.

The result for the Euro area are shown in Fig. 3 for forecast horizons of two and six to ten years, respectively. The procedure successfully constructs a probability density around the mean point forecast that is consistent with the moments provided in the survey data.

[Fig. 3 about here]

## 4 Effect on inflation risk measures

### Baseline specification and results

Our focus is to test empirically if there are differences in the balance of risks to the inflation outlook depending on the exact formulation of the inflation target. Risk measures to the inflation outlook are computed from the generalized Beta distributions for each country-survey observation. We calibrate the thresholds  $\bar{\pi}_t = \pi_t^* + 0.1$  and  $\underline{\pi}_t = \pi_t^* - 0.1$ . Importantly, it is not possible to map the thresholds  $\bar{\pi}_t, \underline{\pi}_t$  into the target ranges as defined in official operational frameworks. The reason is that the estimated generalized Beta distributions  $\hat{\mathcal{B}}_{it}^h(a, b, c, d)$  are fitted to *point* forecasts. These point forecasts exhibit significantly lower uncertainty than individual forecasters' uncertainty around the point forecast. Fig. 3 illustrates this point for the case of the Euro area. If one would define a hypothetical range for the Euro area of 0.9 to 2.9 percent, then downward and upward risk to the inflation outlook would be zero most of the time.<sup>6</sup>

Tab. A.1 in the Appendix shows summary statistics for the probability measure of being on target ( $probT^h$ ), the downside risk to inflation ( $DAL^h$ ) and upside risk to inflation ( $DAH^h$ ) for three country samples, advanced economies (AE), more recently advanced economies (AEext), and emergin markets (EME). Some observations are worth mentioning. The probability to be on target ( $probT$ ) is higher for the advanced economies samples than in the EME sample. Overall, expectations seem to be well anchored in all three country groups, as the probability to be close to target increases over the forecast horizon. Downward risk to inflation ( $DAL$ ) seems to be more elevated in the advanced economies samples, while upward inflation risk ( $DAH$ ) is more present in the EME sample.

The formulation of the inflation target is, however, not systematically related to the samples. We therefore consider an econometric panel model to gauge the quantitative

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<sup>6</sup>The range of 0.9 – 2.9% is consistent with the assumption of a hypothetical point target of 1.9 percent and a tolerance band of  $\pm 1$  percentage point, as it would be common among many central banks' operational frameworks.

effects of the formulation of the inflation target on inflation risk measures:

$$ProbT_{it}^h = c + \beta_1 d3_{it} + \beta_2 d4_{it} + \gamma X_{it} + \nu_i + \nu_Y + \varepsilon_{it} \quad (12)$$

The dummy variable capture the inflation targeting strategies, with  $d3_{it}$  indicating a target range or tolerance band, while  $d4_{it}$  indicates a point target or focal point.  $X_{it}$  is a vector collecting control variables. It includes two variables. First, a measure of inflation volatility, namely the 48 month backward looking rolling window standard deviation of realized inflation. Second, the current inflation gap,  $\pi_{it} - \pi_{it}^*$ .<sup>7</sup> All remaining country differences are captured by country fixed effects  $\nu_i$ , while shocks to global inflation and their implications for forecasts are captured by year fixed effects  $\nu_Y$ .<sup>8</sup>

The sample is chosen to start from 2005m4 onwards due to availability of higher order moments of Consensus forecast data.<sup>9</sup> Further, we exclude country observations if the inflation target has not converged to a stable target, yet. Our timing of a stable IT regime broadly follows [Roger \(2009\)](#), with minor adjustments and several extensions. The starting dates for stable regimes in each country are provided in [Tab. A.3](#) in the Appendix.<sup>10</sup> This leaves us with a final maximum sample of 29 countries.

[[Tab. 1](#) about here]

Results for model (12) are shown in [Tab. 1](#). Standard errors are computed following the procedure proposed by [Driscoll and Kraay \(1998\)](#), which are robust to spatial dependence, heteroscedasticity and serial correlation. Inflation volatility and the inflation gap measure have the expected negative sign. It is harder for a central bank to steer inflation close to target in the presence of higher volatility or adverse starting conditions.

There is a strong result regarding the probability of being on target, which is significantly higher for countries with an explicit point target. It is statistically significant for all forecast horizons and quantitatively important, ranging between an increase from 11.4 to 14.1 percentage points in the probability of inflation falling in the region between the thresholds, i.e. close to the inflation aim.

It is important to note that the reference group in this model are countries that have neither a point target, nor a target range. This group consists of the United States before March 2012, the Euro area over the entire sample period, and Japan before February 2012. These reference regimes are classified as featuring a quantitative definition of price stability.<sup>11</sup> To strip out the differences between a range target and

<sup>7</sup>[Vincent-Humphreys, Dimitrova, and Falck \(2019\)](#) present data from a special survey among professional forecasters, asking what influences their longer-term forecasts. While 80 percent consider the central banks inflation target, 55 percent use trends in actual inflation to form longer-term expectations.

<sup>8</sup>[Galati, Poeleke, and Zhou \(2011\)](#) show evidence that the collapse of Lehman Brothers has lead to changes in survey-based longer-term inflation expectations in the United States and United Kingdom.

<sup>9</sup>This excludes Iceland and Ghana from the econometric analysis due to missing survey data.

<sup>10</sup>The limitation on stable IT regimes excludes Brazil and Indonesia from the sample.

<sup>11</sup>For some specifications using realized inflation data or only the mean of Consensus forecasts that are shown below, the reference group will also consist of Switzerland before December 1999.

a point target more clearly, we additionally perform an F-test with the hypothesis  $H_0 : \beta_1 = \beta_2$  and report the p-values in the last line of the table. The result suggests that the coefficients are statistically different from each other at all forecast horizons.

[Tab. 2 about here]

Next, we focus on other inflation risk measures, while keeping the baseline specification of model (12). Tab. 2 shows the results on downside risks to the inflation outlook (*DAL*). The presence of a target range increases the downside risks to inflation significantly over all forecast horizons and by an economically important margin. Countries with a target range have a 11 percentage point higher density of exhibiting inflation below a threshold at the two year horizon. For a point target, the effect is insignificant over the medium term up to four years. However, over the longer-term the effect is similar under a point target as under a range target.

[Tab. 3 about here]

Tab. 3 shows the results for upside risks to the inflation outlook (*DAH*). The results point into a similar direction. An explicit target range and a point target both lower the upside risks to the inflation outlook. The point target is more successful in doing so, in particular over the longer forecast horizon, which is reflected in a higher point estimate for the effects of a point target. However, the F-test does not reject the hypothesis that the coefficients are equal.

[Tab. 4 and Tab. 5 about here]

Next, given the inferior performance of the target range compared to a point target so far, we would like to find out what drives the high probability mass outside a corridor between the threshold values  $\underline{\pi}, \bar{\pi}$ . Are fatter tails of the distribution responsible for the higher inflation risk outlook? Tab. 4 and Tab. 5 show the effects of a point target versus a target range on the percentile-gaps. The point target is lowering the 5%-percentile gap compared to the target range. The reverse pattern can be observed for the 95%-percentile-gap, which is lowered by more in the presence of a point target. These mixed results cast some doubt on the efficacy of tolerance bands to serve as a coordination mechanism, as the point target seems to outperform the target range when it comes to limiting outlier expectations.

## 5 Effect on forecast disagreement and uncertainty

### Baseline specification and results

In this section, we focus on the second moment of the point forecasts which are commonly interpreted as disagreement and uncertainty regarding the inflation outlook. Tab. 6 presents the descriptive statistics of the two main variables used in this section, namely disagreement, measured by the cross-sectional standard deviation of  $j$

panelists' point forecasts given in eq. (8) (Zarnowitz and Lambros, 1987). The second series is a rolling window standard deviation of panelists' consensus point forecast (see eq. (7)) over the last 24 months. Note that there are significantly more observations, since the mean point forecast is available for much longer series.

In line with the results presented in Andrade et al. (2016), the term structure of disagreement regarding the inflation outlook is flat. In contrast, volatility in mean point forecasts is downward sloping. Both variables are higher in the emerging market sample compared to the samples of advanced economies and recently advanced economies.

[Tab. 6 about here]

$$Dis_{it}^h = c + \beta_1 d3_{it} + \beta_2 d4_{it} + \gamma X_{it} + \nu_i + \nu_Y + \varepsilon_{it} \quad (13)$$

We estimate a similar model as in the case for inflation risk measures, but extend the vector of control variables  $X_{it}$  by including further macro variables. Specifically, in addition to inflation volatility and the trend inflation gap, we also include the year on year percentage change in the consumer price index. This is in line with previous empirical work which finds that forecast disagreement rises with the level and volatility of the inflation rate (Ball, 1992; Dovern, Fritsche, and Slacalek, 2012).<sup>12</sup>

Tab. 6 presents the estimation results. The presence of a point target is lowering forecasters' disagreement substantially across all forecast horizons. The difference between a point and a range target is significant according to the F-test. The control variables have the expected signs and are mostly statistically significant.

This result is confirmed when we use an alternative measure for disagreement often used in the literature, namely the inter-quartile range (IQR). The IQR is sometimes preferred over the sample standard deviation, since it is more robust toward outliers. We compute the *IQR* for each country in the sample and for all forecast horizons from the estimated densities over forecasters point forecasts. Tab. 7 presents the estimation results.

[Tab. 7 about here]

Tab. 8 presents the results on the volatility of mean inflation point forecasts. Due to better data availability regarding the mean point forecast, the number of observations increases. This allows for highly significant, but economically small effects. Nevertheless, the picture is consistent with the previous finding, namely that a point target lowers overall volatility of inflation forecasts also at the shorter horizons, while the presence of a target range only lowers revisions of inflation forecasts over the longer horizon, from four to ten years.

[Tab. 8 about here]

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<sup>12</sup>There are several explanations consistent with these patterns, such as sticky information models (Mankiw, Reis, and Wolfers, 2004), inattentiveness (Sims, 2003; Andrade and LeBihan, 2013) or heterogeneity in forecasters preferences (Capistran and Timmermann, 2009).



## 6 Conclusion

The adoption of a quantitative target for inflation is common practice among central banks. While there is strong convergence toward a target between two to three percent, there remains remarkable heterogeneity with respect to the exact formulation of a target. There are passionate debates among policymakers and academics on the role of a point target versus a target range, as well as on elements leading to hybrid cases such as a range target with a focal point or a point target with a tolerance band.<sup>13</sup> However, there is very limited empirical evidence that these differences matter for outcomes.

This paper provides evidence that a point target increases the degree of anchoring of inflation expectations over horizons of two to ten years compared to central banks with a mere quantitative definition of price stability. Based on a panel of 29 countries, we show that a point target steers inflation expectations closer to the inflation aim. It is more successful in limiting upside and downside risks to the inflation outlook. Further, our results suggest that range targets and tolerance bands are interpreted by professional forecasters as areas where policy is less responsive.

The results of this paper contribute to the policy debate along two dimensions. First, many central banks review their monetary policy framework regularly. We document that it is common practice for central banks to change elements in the specification of their inflation target. This paper suggests that point targets or focal points should be considered as an important device to improve the balance of risks to the inflation outlook.

Second, the results of this paper are informative for an ongoing debate among academics and policymakers about challenges to monetary policy in the presence of a downward bias to inflation. [Mertens and Williams \(2019\)](#) show that the standard linear-quadratic approach in monetary policy rules lead to a downward drag on inflation expectations. [Bianchi, Melosi, and Rottner \(2019\)](#) propose a asymmetric policy rule in order to correct for this bias. Our results shed insights on the management of the inflation risk outlook by using alternative formulations of the inflation objective.

Some limitations apply to our results. The findings are based on a survey among professional forecasters who are relatively well informed about central bank objectives. While the views of professional forecasters are widely reported in the news and could influence other agents in the economy ([Carroll, 2003](#)), recent research finds that households and firms have a poor understanding of inflation dynamics and are generally inattentive to central bank announcements.<sup>14</sup> If central bankers want to exploit the active management of the inflation outlook as a policy tool, then these deficiencies might call for improved central bank communication ([Coibion et al., 2020](#)). On a positive note, results presented in this paper show that relatively small modifications to the operational framework can lead to significant differences.

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<sup>13</sup>See [Andersson and Jonung \(2017\)](#) and [Apel and Clausen \(2017\)](#) for a discussion of the case of Sweden.

<sup>14</sup>See [Afrouzi et al. \(2015\)](#), [Coibion, Gorodnichenko, and Weber \(2019\)](#), and [Lewis, Makridis, and Mertens \(2020\)](#).



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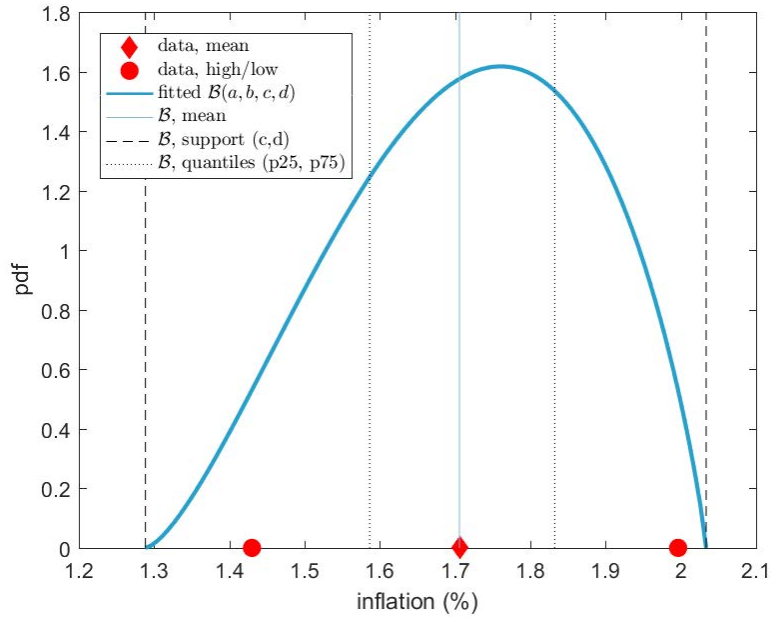
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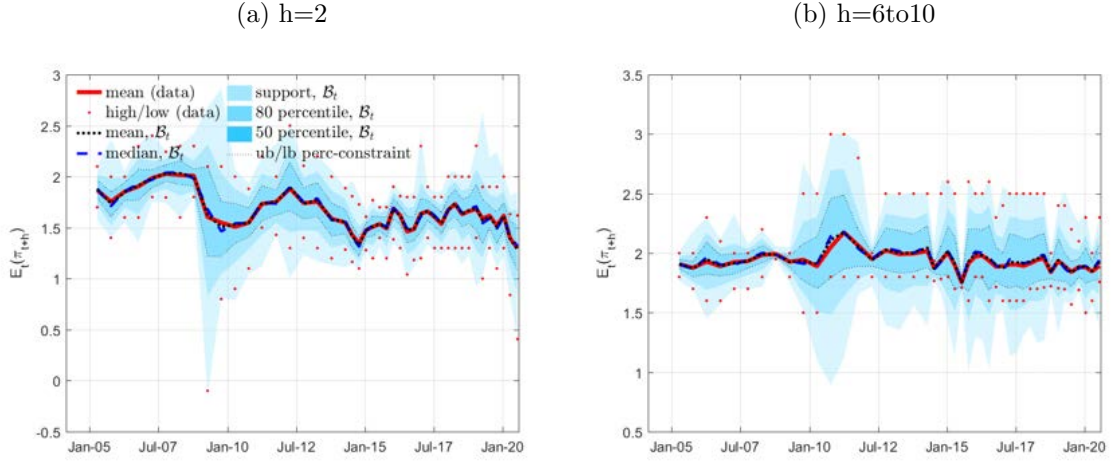
## Tables and Figures

Figure 2: Fitting a generalized beta distribution to point forecast data from Consensus Economics



Notes: A generalized Beta distribution  $\mathcal{B}(a, b, c, d)$  fitted to Consensus Economics data, using long-term survey data on the mean, standard deviation, high and low observations among panelists. The quantile constraint imposes that the high/low values from the data fall within the interval  $low \in (c, p_{25})$  and  $high \in (p_{75}, d)$ , respectively. The shown example uses Euro area forecasts for CPI inflation over the three year horizon ( $h = 3$ ) from April 2014. Resulting parameters are  $a = 2.49$ ,  $b = 1.86$ ,  $c = 1.28$ ,  $d = 2.03$ .

Figure 3: Fitted generalized Beta distributions (Euro area)



Notes: Fitted generalized beta distributions to professional forecasters' cpi inflation projections over horizons of two to ten years. Original data is from Consensus Forecast.

Table 1: Probability-based measure to be on target

	(1) probT (h=2)	(2) probT (h=3)	(3) probT (h=4)	(4) probT (h=5)	(5) probT (h=6/10)
sd infl. (24m)	-0.00811 (-0.60)	-0.0317* (-1.94)	-0.0561*** (-3.42)	-0.0391** (-2.59)	-0.0290+ (-1.64)
mean infl.gap (48m)	0.0126+ (1.57)	0.00735 (0.63)	0.00869 (0.65)	0.0135+ (1.32)	0.0234** (2.33)
Explicit target range (d3)	0.0272+ (1.25)	0.00160 (0.04)	0.0138 (0.39)	-0.0302 (-0.87)	-0.0568+ (-1.25)
Explicit point target (d4)	0.133*** (6.81)	0.121*** (4.75)	0.144*** (5.76)	0.120*** (5.41)	0.121*** (3.84)
Constant	0.145*** (5.77)	0.150*** (4.06)	0.167*** (4.67)	0.204*** (5.45)	0.230*** (4.71)
country FE	Yes	Yes	Yes	Yes	Yes
year dummies	Yes	Yes	Yes	Yes	Yes
adj. R-squared	0.06	0.06	0.08	0.06	0.06
N.Obs	926	926	926	926	924
N.Countries	29	29	29	29	29
p-val(F-test $\beta_1 = \beta_2$ )	0.00	0.00	0.00	0.00	0.00

<sup>t</sup> statistics in parentheses

+  $p < 0.32$ , \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

Notes: Standard errors based on [Driscoll and Kraay \(1998\)](#).

Table 2: Downside risk to the inflation outlook

	(1) DAL (h=2)	(2) DAL (h=3)	(3) DAL (h=4)	(4) DAL (h=5)	(5) DAL (h=6/10)
sd infl. (24m)	0.0166 (0.79)	0.0466*** (2.80)	0.0549*** (3.52)	0.0442** (2.58)	0.0328 <sup>+</sup> (1.45)
mean infl.gap (48m)	-0.0868*** (-6.79)	-0.0863*** (-5.94)	-0.0859*** (-3.96)	-0.0954*** (-5.39)	-0.0873*** (-5.65)
Explicit target range (d3)	0.0784 <sup>+</sup> (1.32)	0.163*** (3.10)	0.132** (2.32)	0.145** (2.33)	0.133*** (2.82)
Explicit point target (d4)	-0.00902 (-0.14)	0.0418 (0.74)	0.0782 <sup>+</sup> (1.46)	0.107** (2.09)	0.0940* (1.88)
Constant	0.268*** (5.21)	0.183*** (3.51)	0.213*** (4.33)	0.187*** (3.20)	0.205*** (4.45)
country FE	Yes	Yes	Yes	Yes	Yes
year dummies	Yes	Yes	Yes	Yes	Yes
adj. R-squared	0.20	0.22	0.18	0.19	0.19
N.Obs	926	926	926	926	924
N.Countries	29	29	29	29	29
p-val(F-test $\beta_1 = \beta_2$ )	0.38	0.13	0.51	0.63	0.56

<sup>t</sup> statistics in parentheses

<sup>+</sup>  $p < 0.32$ , \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

Notes: Standard errors based on [Driscoll and Kraay \(1998\)](#).

Table 3: Upside risk to the inflation outlook

	(1) DAH (h=2)	(2) DAH (h=3)	(3) DAH (h=4)	(4) DAH (h=5)	(5) DAH (h=6/10)
sd infl. (24m)	-0.00847 (-0.39)	-0.0149 (-0.78)	0.00121 (0.06)	-0.00510 (-0.35)	-0.00376 (-0.17)
mean infl.gap (48m)	0.0741*** (5.04)	0.0790*** (4.81)	0.0772*** (5.10)	0.0820*** (4.73)	0.0639*** (4.63)
Explicit target range (d3)	-0.106* (-1.69)	-0.164** (-2.37)	-0.146** (-2.19)	-0.115 <sup>+</sup> (-1.64)	-0.0765 <sup>+</sup> (-1.23)
Explicit point target (d4)	-0.124* (-1.96)	-0.163*** (-2.75)	-0.222*** (-4.51)	-0.227*** (-4.41)	-0.215*** (-4.21)
Constant	0.587*** (10.94)	0.667*** (10.22)	0.620*** (11.11)	0.609*** (10.59)	0.564*** (10.79)
country FE	Yes	Yes	Yes	Yes	Yes
year dummies	Yes	Yes	Yes	Yes	Yes
adj. R-squared	0.20	0.22	0.23	0.25	0.23
N.Obs	926	926	926	926	924
N.Countries	29	29	29	29	29
p-val(F-test $\beta_1 = \beta_2$ )	0.85	0.99	0.36	0.20	0.09

<sup>t</sup> statistics in parentheses

<sup>+</sup>  $p < 0.32$ , \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

Notes: Standard errors based on [Driscoll and Kraay \(1998\)](#).



Table 4: Percentile-gap,  $p = 0.05$ 

	(1) G05 (h=2)	(2) G05 (h=3)	(3) G05 (h=4)	(4) G05 (h=5)	(5) G05 (h=6/10)
sd infl. (24m)	0.119* (1.71)	0.0296 (0.42)	-0.0125 (-0.27)	-0.00387 (-0.07)	-0.0202 (-0.41)
mean infl.gap (48m)	0.231*** (7.86)	0.207*** (7.08)	0.171*** (5.55)	0.149*** (4.81)	0.112*** (3.61)
Explicit target range (d3)	-0.00755 (-0.10)	-0.0829+ (-1.24)	-0.0828+ (-1.30)	-0.0462 (-0.67)	-0.176*** (-2.83)
Explicit point target (d4)	-0.122+ (-1.29)	-0.163** (-2.34)	-0.239*** (-3.37)	-0.312*** (-4.65)	-0.301*** (-3.96)
Constant	-0.258*** (-3.14)	-0.130* (-1.69)	-0.0888+ (-1.37)	-0.0856+ (-1.06)	-0.0479 (-0.63)
country FE	Yes	Yes	Yes	Yes	Yes
year dummies	Yes	Yes	Yes	Yes	Yes
adj. R-squared	0.28	0.24	0.21	0.18	0.14
N.Obs	926	926	926	926	924
N.Countries	29	29	29	29	29
p-val(F-test $\beta_1 = \beta_2$ )	0.35	0.43	0.12	0.00	0.16

$t$  statistics in parentheses

+  $p < 0.32$ , \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

Notes: Standard errors based on [Driscoll and Kraay \(1998\)](#).

Table 5: Percentile-gap,  $p = 0.95$ 

	(1) G95 (h=2)	(2) G95 (h=3)	(3) G95 (h=4)	(4) G95 (h=5)	(5) G95 (h=6/10)
sd infl. (24m)	0.500*** (2.99)	0.438*** (3.46)	0.388*** (3.21)	0.300*** (3.13)	0.193** (2.50)
mean infl.gap (48m)	0.304*** (4.44)	0.231*** (4.03)	0.211*** (4.05)	0.211*** (4.39)	0.198*** (5.54)
Explicit target range (d3)	-0.0333 (-0.23)	-0.115 (-0.76)	-0.0476 (-0.38)	-0.0712 (-0.62)	-0.00734 (-0.07)
Explicit point target (d4)	-0.498*** (-5.55)	-0.622*** (-5.90)	-0.596*** (-5.84)	-0.429*** (-5.69)	-0.380*** (-4.73)
Constant	0.552*** (3.52)	0.757*** (5.22)	0.586*** (4.47)	0.590*** (4.86)	0.671*** (7.05)
country FE	Yes	Yes	Yes	Yes	Yes
year dummies	Yes	Yes	Yes	Yes	Yes
adj. R-squared	0.38	0.38	0.36	0.33	0.30
N.Obs	926	926	926	926	924
N.Countries	29	29	29	29	29
p-val(F-test $\beta_1 = \beta_2$ )	0.02	0.01	0.00	0.02	0.02

$t$  statistics in parentheses

+  $p < 0.32$ , \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

Notes: Standard errors based on [Driscoll and Kraay \(1998\)](#).

Table 6: Forecaster disagreement

	(1) disag. (h=2)	(2) disag. (h=3)	(3) disag. (h=4)	(4) disag. (h=5)	(5) disag. (h=6/10)
sd infl. (24m)	0.147*** (3.78)	0.148*** (4.56)	0.150*** (4.86)	0.113*** (3.98)	0.0940*** (2.96)
mean infl.gap (48m)	0.0160 (0.97)	0.0125 (0.73)	0.0177+ (1.48)	0.0265* (1.91)	0.0492*** (3.36)
inflMeasure	0.0176+ (1.58)	0.0126+ (1.29)	0.0105+ (1.45)	0.0173*** (3.12)	-0.00310 (-0.54)
Explicit target range (d3)	-0.0260 (-0.77)	-0.0285 (-0.64)	-0.0169 (-0.46)	-0.00413 (-0.11)	0.0689+ (1.50)
Explicit point target (d4)	-0.128*** (-5.02)	-0.162*** (-5.07)	-0.140*** (-4.77)	-0.0466+ (-1.59)	-0.0275 (-0.64)
Constant	0.339*** (5.07)	0.332*** (5.57)	0.305*** (6.15)	0.314*** (7.02)	0.290*** (4.82)
country FE	Yes	Yes	Yes	Yes	Yes
year dummies	Yes	Yes	Yes	Yes	Yes
adj. R-squared	0.26	0.25	0.22	0.18	0.14
N.Obs	823	823	823	823	821
N.Countries	27.00	27.00	27.00	27.00	27.00
p-val(F-test $\beta_1 = \beta_2$ )	0.01	0.01	0.01	0.35	0.06

$t$  statistics in parentheses

+  $p < 0.32$ , \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

Notes: Standard errors based on [Driscoll and Kraay \(1998\)](#).

Table 7: Inter-quartile range

	(1) iqr (h=2)	(2) iqr (h=3)	(3) iqr (h=4)	(4) iqr (h=5)	(5) iqr (h=6/10)
sd infl. (24m)	0.177*** (3.99)	0.190*** (5.29)	0.184*** (5.12)	0.141*** (4.85)	0.106*** (3.43)
mean infl.gap (48m)	0.0233+ (1.11)	0.00593 (0.32)	0.0104 (0.76)	0.0240+ (1.55)	0.0464*** (2.69)
inflMeasure	0.0193+ (1.27)	0.00967 (0.84)	0.0103+ (1.03)	0.0137** (2.06)	-0.00728 (-0.92)
Explicit target range (d3)	-0.0115 (-0.26)	-0.0191 (-0.33)	0.000484 (0.01)	-0.0136 (-0.30)	0.0797+ (1.59)
Explicit point target (d4)	-0.164*** (-4.83)	-0.230*** (-4.82)	-0.184*** (-4.80)	-0.0626* (-1.70)	-0.0283 (-0.60)
Constant	0.427*** (5.78)	0.428*** (6.21)	0.369*** (6.02)	0.390*** (7.65)	0.337*** (4.98)
country FE	Yes	Yes	Yes	Yes	Yes
year dummies	Yes	Yes	Yes	Yes	Yes
adj. R-squared	0.23	0.24	0.21	0.17	0.11
N.Obs	823	823	823	823	821
N.Countries	27	27	27	27	27
p-val(F-test $\beta_1 = \beta_2$ )	0.00	0.00	0.00	0.40	0.07

$t$  statistics in parentheses

+  $p < 0.32$ , \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

Notes: Standard errors based on [Driscoll and Kraay \(1998\)](#).

Table 8: Volatility of inflation forecasts

	(1) sd(inflExp) (h=2)	(2) sd(inflExp) (h=3)	(3) sd(inflExp) (h=4)	(4) sd(inflExp) (h=5)	(5) sd(inflExp) (h=6/10)
sd infl. (24m)	0.0804*** (3.24)	0.0640*** (3.26)	0.0542*** (3.24)	0.0375*** (2.64)	0.0208* (1.94)
mean infl.gap (48m)	0.0162+ (1.40)	0.0197** (1.97)	0.0220*** (3.04)	0.0232*** (3.83)	0.0164*** (3.25)
inflMeasure	0.0146*** (2.60)	0.00647+ (1.45)	0.00195 (0.55)	0.00405+ (1.40)	-0.00108 (-0.46)
Explicit target range (d3)	0.00798 (0.49)	0.0107 (0.79)	-0.00764 (-0.62)	-0.0210+ (-1.62)	-0.0249* (-1.74)
Explicit point target (d4)	-0.0357* (-1.94)	-0.0473*** (-3.14)	-0.0255* (-1.73)	-0.0158+ (-1.39)	-0.0115+ (-1.22)
Constant	0.110*** (3.24)	0.111*** (4.07)	0.109*** (4.63)	0.122*** (6.42)	0.122*** (7.70)
countryFE	Yes	Yes	Yes	Yes	Yes
year dummies	Yes	Yes	Yes	Yes	Yes
adj. R-squared	0.22	0.21	0.19	0.17	0.15
N.Obs	4284	4284	4278	4278	4278
N.Countries	29	29	29	29	29
p-val(F-test $\beta_1 = \beta_2$ )	0.05	0.00	0.32	0.77	0.45

$t$  statistics in parentheses

+  $p < 0.32$ , \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

Notes: Standard errors based on [Driscoll and Kraay \(1998\)](#).

# A Appendix

Table A.1: Summary statistics, risk measures

variable	obs	mean	sd	min	max	sample
$probT^{h=2}$	426	0.21	0.17	0.00	0.98	AE
$probT^{h=3}$	426	0.24	0.20	0.00	1.00	AE
$probT^{h=4}$	426	0.29	0.23	0.00	1.00	AE
$probT^{h=5}$	426	0.33	0.26	0.00	1.00	AE
$probT^{h=6to10}$	424	0.36	0.28	0.00	1.00	AE
$probT^{h=2}$	288	0.24	0.22	0.00	1.00	AEext
$probT^{h=3}$	288	0.25	0.23	0.00	1.00	AEext
$probT^{h=4}$	288	0.27	0.26	0.00	1.00	AEext
$probT^{h=5}$	288	0.29	0.26	0.00	1.00	AEext
$probT^{h=6to10}$	288	0.30	0.27	0.00	1.00	AEext
$probT^{h=2}$	207	0.10	0.14	0.00	1.00	EME
$probT^{h=3}$	207	0.12	0.16	0.00	1.00	EME
$probT^{h=4}$	207	0.15	0.20	0.00	1.00	EME
$probT^{h=5}$	207	0.14	0.20	0.00	1.00	EME
$probT^{h=6to10}$	207	0.17	0.25	0.00	1.00	EME
$DAH^{h=2}$	426	0.33	0.29	0.00	1.00	AE
$DAH^{h=3}$	426	0.36	0.28	0.00	1.00	AE
$DAH^{h=4}$	426	0.35	0.27	0.00	0.99	AE
$DAH^{h=5}$	426	0.34	0.28	0.00	1.00	AE
$DAH^{h=6to10}$	424	0.32	0.27	0.00	1.00	AE
$DAH^{h=2}$	288	0.42	0.33	0.00	1.00	AEext
$DAH^{h=3}$	288	0.39	0.32	0.00	1.00	AEext
$DAH^{h=4}$	288	0.36	0.32	0.00	1.00	AEext
$DAH^{h=5}$	288	0.34	0.31	0.00	1.00	AEext
$DAH^{h=6to10}$	288	0.30	0.30	0.00	1.00	AEext
$DAH^{h=2}$	207	0.72	0.33	0.00	1.00	EME
$DAH^{h=3}$	207	0.70	0.33	0.00	1.00	EME
$DAH^{h=4}$	207	0.68	0.33	0.00	1.00	EME
$DAH^{h=5}$	207	0.68	0.33	0.00	1.00	EME
$DAH^{h=6to10}$	207	0.64	0.35	0.00	1.00	EME
$DAL^{h=2}$	426	0.46	0.34	0.00	1.00	AE
$DAL^{h=3}$	426	0.40	0.31	0.00	1.00	AE
$DAL^{h=4}$	426	0.37	0.30	0.00	1.00	AE
$DAL^{h=5}$	426	0.34	0.30	0.00	1.00	AE
$DAL^{h=6to10}$	424	0.33	0.30	0.00	1.00	AE
$DAL^{h=2}$	288	0.34	0.29	0.00	1.00	AEext
$DAL^{h=3}$	288	0.36	0.29	0.00	1.00	AEext
$DAL^{h=4}$	288	0.36	0.31	0.00	1.00	AEext
$DAL^{h=5}$	288	0.38	0.32	0.00	1.00	AEext
$DAL^{h=6to10}$	288	0.40	0.33	0.00	1.00	AEext
$DAL^{h=2}$	207	0.18	0.30	0.00	1.00	EME
$DAL^{h=3}$	207	0.18	0.28	0.00	1.00	EME
$DAL^{h=4}$	207	0.17	0.27	0.00	1.00	EME
$DAL^{h=5}$	207	0.18	0.26	0.00	1.00	EME
$DAL^{h=6to10}$	207	0.19	0.28	0.00	1.00	EME

Notes: Summary statistics are reported for periods of stable inflation targets. For the definition of country samples and starting dates of stable inflation targets, see [Tab. A.3](#) in the Appendix.

Table A.2: Summary statistics, disagreement and forecast volatility

variable	obs	mean	sd	min	max	sample
$sd(\pi_{jit}^e)$ , h=2	426	0.34	0.18	0.05	1.08	AE
$sd(\pi_{jit}^e)$ , h=3	426	0.36	0.22	0.00	1.30	AE
$sd(\pi_{jit}^e)$ , h=4	426	0.34	0.23	0.00	1.52	AE
$sd(\pi_{jit}^e)$ , h=5	426	0.33	0.24	0.00	1.80	AE
$sd(\pi_{jit}^e)$ , h=6 to 10	424	0.29	0.22	0.00	1.43	AE
$sd(\pi_{jit}^e)$ , h=2	288	0.34	0.18	0.00	1.27	AEext
$sd(\pi_{jit}^e)$ , h=3	288	0.34	0.20	0.00	1.38	AEext
$sd(\pi_{jit}^e)$ , h=4	288	0.32	0.23	0.00	2.71	AEext
$sd(\pi_{jit}^e)$ , h=5	288	0.31	0.21	0.00	2.28	AEext
$sd(\pi_{jit}^e)$ , h=6 to 10	288	0.31	0.22	0.00	2.11	AEext
$sd(\pi_{jit}^e)$ , h=2	212	0.53	0.40	0.00	2.70	EME
$sd(\pi_{jit}^e)$ , h=3	212	0.55	0.37	0.00	2.41	EME
$sd(\pi_{jit}^e)$ , h=4	212	0.56	0.38	0.00	2.44	EME
$sd(\pi_{jit}^e)$ , h=5	212	0.55	0.39	0.00	2.46	EME
$sd(\pi_{jit}^e)$ , h=6 to 10	212	0.57	0.43	0.00	2.42	EME
$roll.window\,sd(\mu_{it})$ , h=2	1820	0.15	0.12	0.01	0.69	AE
$roll.window\,sd(\mu_{it})$ , h=	1820	0.11	0.08	0.01	0.79	AE
$roll.window\,sd(\mu_{it})$ , h=4	1820	0.09	0.07	0.01	0.41	AE
$roll.window\,sd(\mu_{it})$ , h=5	1820	0.10	0.09	0.01	0.55	AE
$roll.window\,sd(\mu_{it})$ , h=6 to 10	1820	0.09	0.07	0.00	0.53	AE
					0.00	
$roll.window\,sd(\mu_{it})$ , h=2	1162	0.15	0.08	0.01	0.37	AEext
$roll.window\,sd(\mu_{it})$ , h=	1162	0.13	0.08	0.01	0.43	AEext
$roll.window\,sd(\mu_{it})$ , h=4	1162	0.11	0.07	0.00	0.37	AEext
$roll.window\,sd(\mu_{it})$ , h=5	1162	0.11	0.07	0.00	0.38	AEext
$roll.window\,sd(\mu_{it})$ , h=6 to 10	1162	0.12	0.08	0.00	0.35	AEext
$roll.window\,sd(\mu_{it})$ , h=2	743	0.24	0.30	0.01	2.10	EME
$roll.window\,sd(\mu_{it})$ , h=	743	0.21	0.23	0.00	1.74	EME
$roll.window\,sd(\mu_{it})$ , h=4	743	0.21	0.18	0.00	1.39	EME
$roll.window\,sd(\mu_{it})$ , h=5	743	0.22	0.16	0.02	1.20	EME
$roll.window\,sd(\mu_{it})$ , h=6 to 10	743	0.20	0.13	0.01	0.85	EME

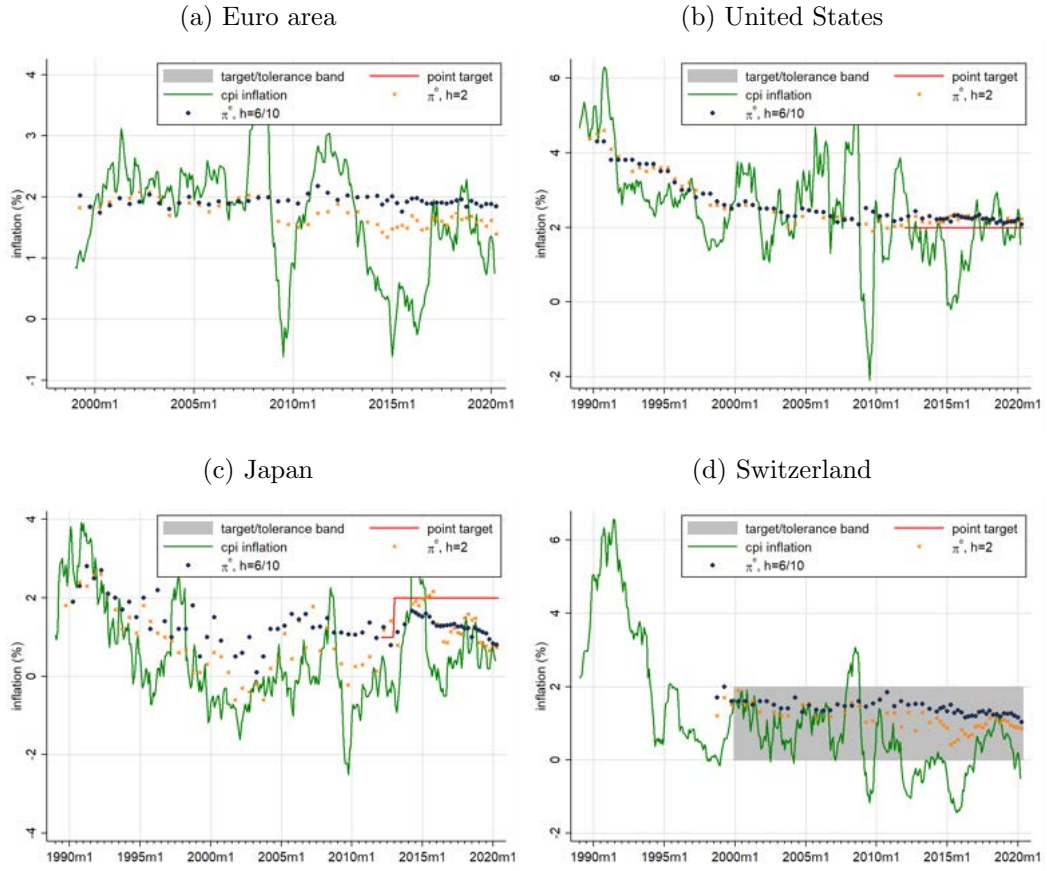
Notes: Summary statistics are reported for periods of stable inflation targets. For the definition of country samples and starting dates of stable inflation targets, see [Tab. A.3](#) in the Appendix.

Table A.3: Target classification

	sample	d1_NoExplAn	d2_QuantDef	d3_RangeTar	d4_PointTar	IT introdate	stable IT
Australia	AE			1993m4		1993m4	1993m4
Canada	AE			1991m3 -	1991m3 -	1991m3	1995m1
Euro area	AE		1999m1 -			no-IT	
Japan	AE	1990m1-2006m2	2006m3-2012m1		2012m2 -	2012m2	
New Zealand	AE			1990m1 -	2012m1 -	1990m3	1993m1
Norway	AE				2001m3 -	2001m3	2001m3
Sweden	AE			1995m1-2009m12; 2017m10-	1993m1	1993m1	1993m1
Switzerland	AE		1990m1-1999m11	1999m12 -		no-IT	
United Kingdom	AE	1990m1-1992m9			1992m10 -	1992m10	1992m10
United States	AE	1990m1-2012m2			2012m3 -	no-IT	
Chile	AEext			1991m1-1994m12; 2001m1-	1995m1-	1991m1	2001m1
Czech Republic	AEext			1998m1-	2006m1-	1998m1	2005m1
Hungary	AEext			2015m3-	2001m6-	2001m6	2007m1
Israel	AEext			1992m1-1992m12; 1994m1-1998m12; 2000m1-	1993m1-1993m12; 1999m1-1999m12	1997m6	2003m1
Mexico	AEext			2003m1-	1999m1-	1999m1	2003m1
Poland	AEext			1999m1-	2002m1	1998m10	2004m1
Romania	AEext			2005m8	2005m8	2005m8	2013m1
South Korea	AEext			1998m4-2015m12	1998m4-2003m12; 2007m1-2013m12; 2016m1-	1998m3	2001m1
Albania	EME			2009m1-		2009m1	2009m1
Armenia	EME			2006m1-	2006m1-	2006m1	2011m1
Colombia	EME			1999m9-2002m12; 2001m1-	2003m1-	1999m9	2010m1
Guatemala	EME			2005m1-	2005m1-	2005m1	2012m1
India	EME			2016m8-		2016m8	2016m8
Peru	EME			1994m1-	2002m1-	1994m1	2002m1
Philippines	EME			2002m1-	2002m1-	2002m1	2015m1
Serbia	EME			2009m1-	2009m1-	2009m1	2017m1
South Africa	EME			2000m2-		2000m2	2000m2
Thailand	EME			2000m5-	2015m1-2019m12	2000m5	2000m5
Turkey	EME			2006m1-	2006m1-	2006m1	2012m1-
Brazil	excluded			1999m6	1999m6	1999m6	–
Ghana	excluded			2007m5	2005m5	2007m5	–
Iceland	excluded				2001m3	2001m3	2004m1
Indonesia	excluded			2005m7	2005m7	2005m7	–

Notes: Countries from the AEext/EME sample are classified only after the adoption of an inflation targeting regime. Four countries are excluded from the estimations for two reasons. First, Consensus data is not available for Ghana and Iceland. Second, the inflation targets of Indonesia and Brazil have been changed in the last two years, such that we conclude that they have not yet converged to a stable quantitative objective for inflation. Source: Related literature ([Castelnuovo, Nicoletti-Altimari, and Rodriguez-Palenzuela, 2003](#); [Mishkin and Schmidt-Hebbel, 2002](#); [Roger, 2009](#); [Hammond, 2012](#)), , the IMF's Annual Report on Exchange Arrangements and Exchange Restrictions (AREAER) and central bank websites.

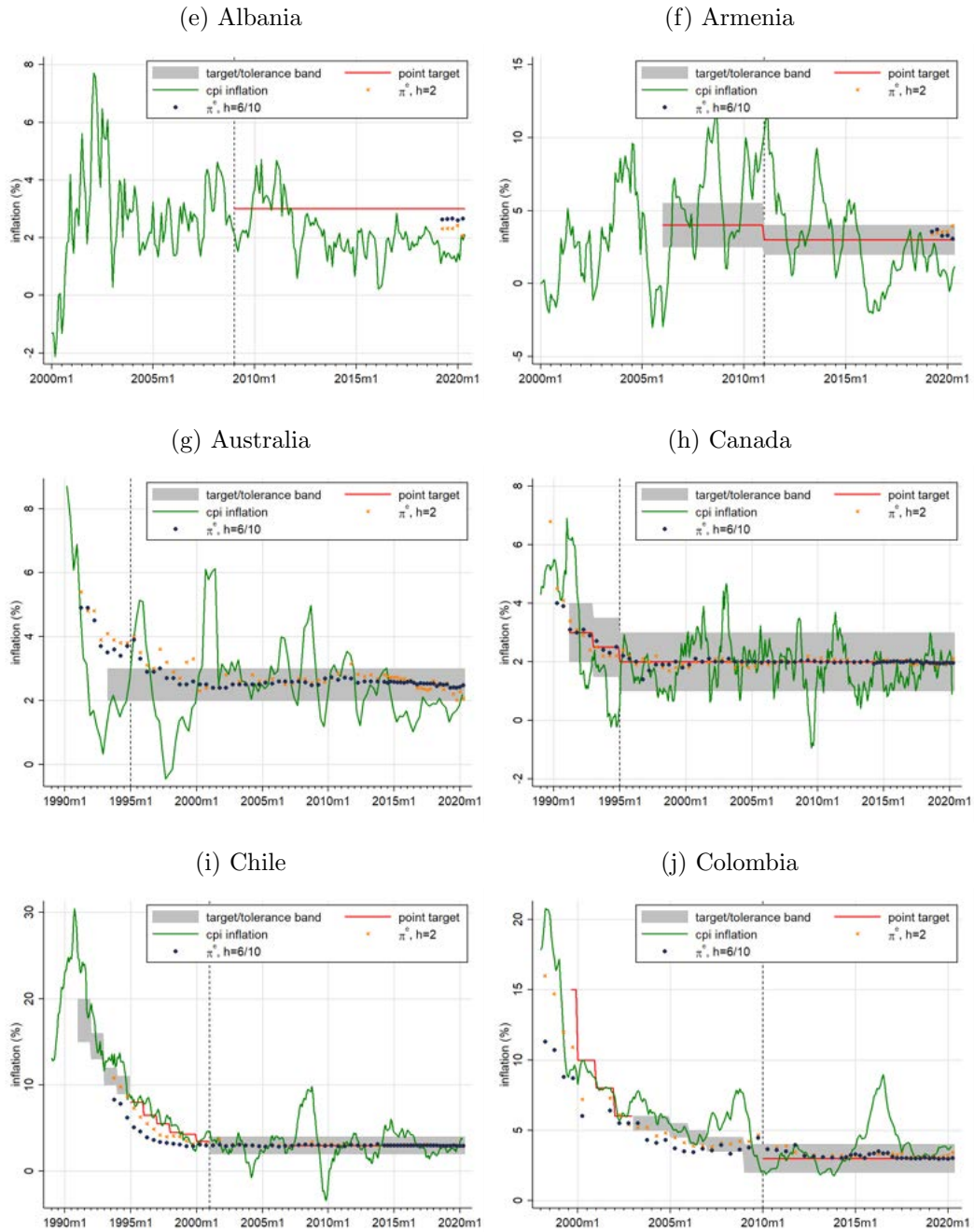
Figure A.1: Targets for monetary policy, non-IT countries



Notes: Green line=YoY CPI inflation. Vertical, dotted line=start date of a stable inflation target, following [Roger \(2009\)](#), with adjustments and extensions. No Consensus Forecast data available.

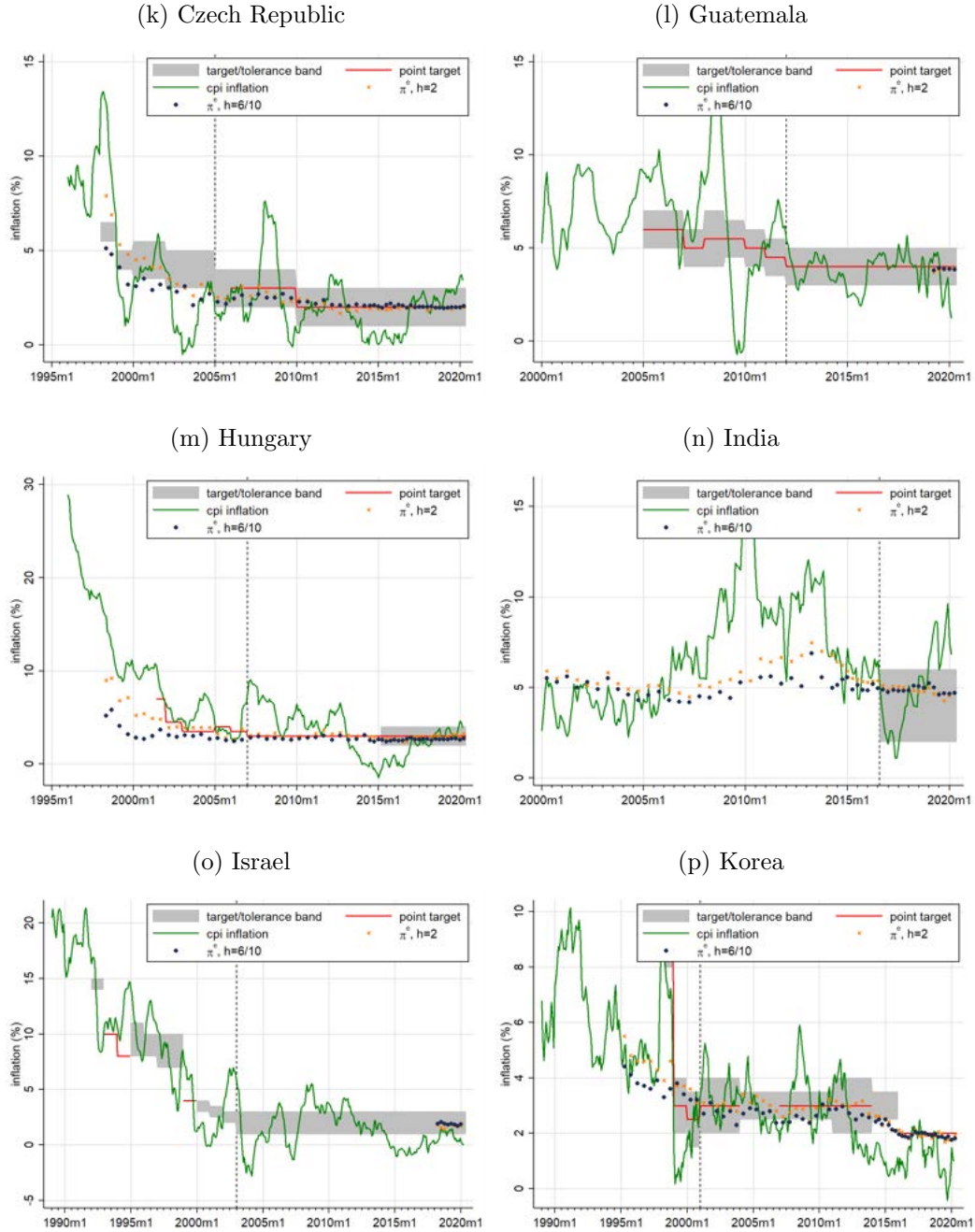


Figure A.1: Targets for monetary policy, IT countries (1)



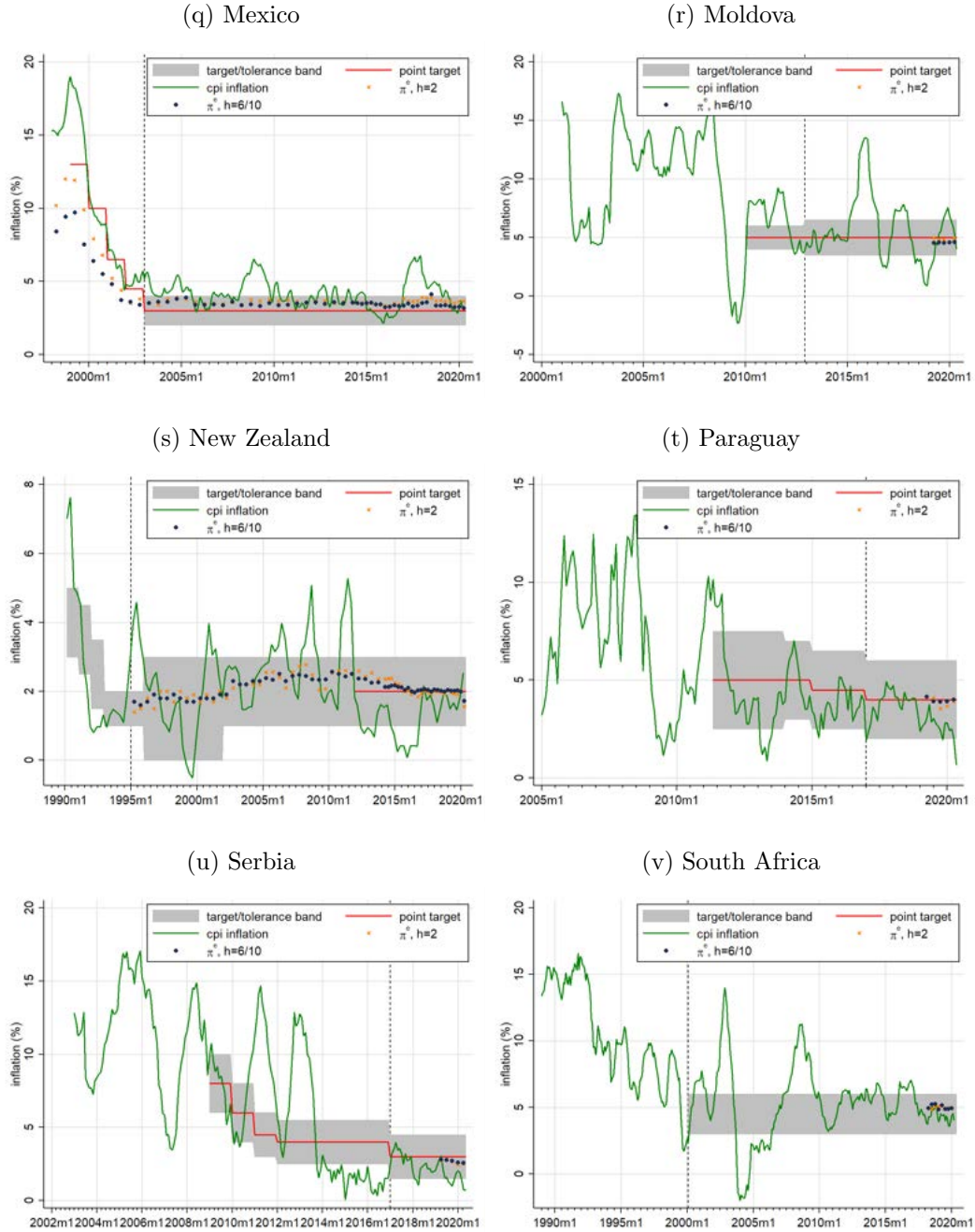
Notes: Green line=YoY CPI inflation. Vertical, dotted line=start date of a stable inflation target, following [Roger \(2009\)](#), with adjustments and extensions. Blue dots=mean point forecast,  $h = 6$  to 10 years. Yellow x=mean point forecast,  $h = 2$  years.

Figure A.1: Targets for monetary policy, IT countries (2)



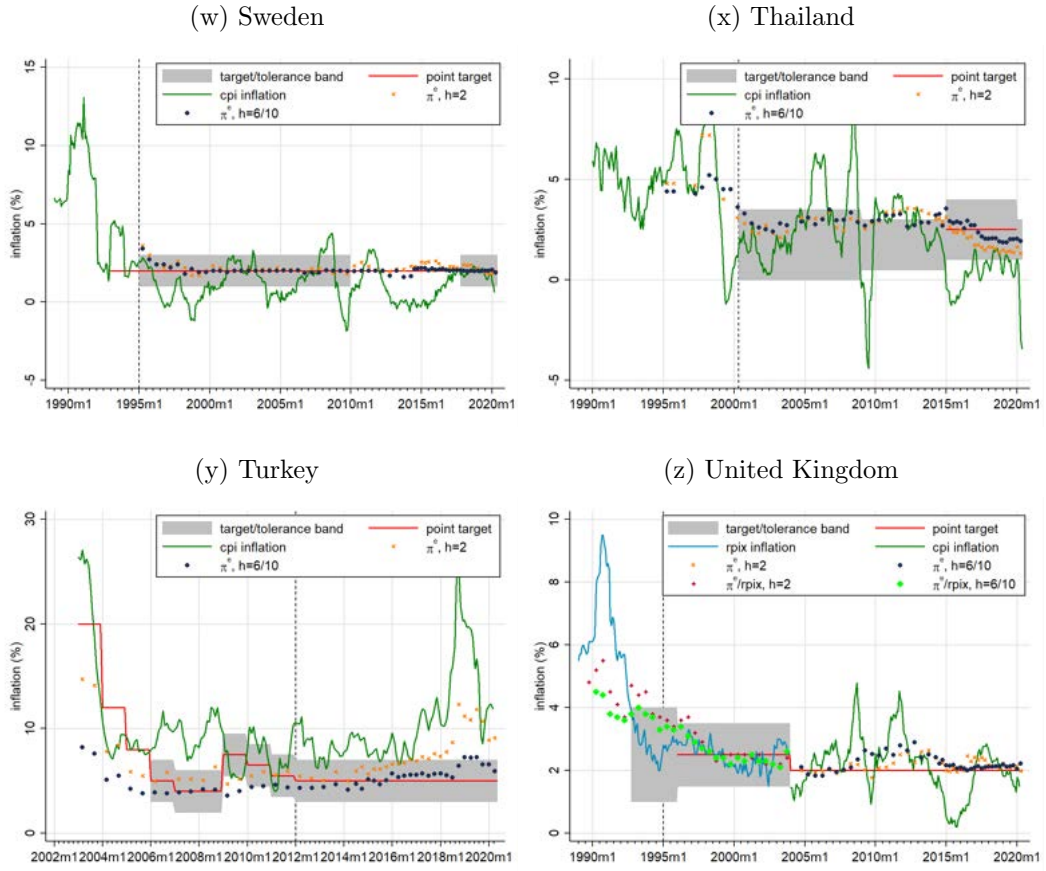
Notes: Green line=YoY CPI inflation. Vertical, dotted line=start date of a stable inflation target, following [Roger \(2009\)](#), with adjustments and extensions. Blue dots=mean point forecast,  $h = 6$  to 10 years. Yellow x=mean point forecast,  $h = 2$  years.

Figure A.1: Targets for monetary policy, IT countries (3)



Notes: Green line=YoY CPI inflation. Vertical, dotted line=start date of a stable inflation target, following [Roger \(2009\)](#), with adjustments and extensions. Blue dots=mean point forecast,  $h = 6$  to 10 years. Yellow x=mean point forecast,  $h = 2$  years.

Figure A.1: Targets for monetary policy, IT countries (4)



Notes: Green line=YoY CPI inflation. Vertical, dotted line=start date of a stable inflation target, following [Roger \(2009\)](#), with adjustments and extensions. Consensus Forecast data is missing for this country sample.