Are inflation targets good inflation forecasts?

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Introduction and summary

The growing use of inflation targeting and other forms of quantified inflation objectives has marked the history of monetary policy since 1990. Indeed, a majority of industrialized countries have either adopted some form of inflation targeting or, most notably for the 15 countries that have adopted the euro, defined a quantified inflation objective. In the United States, the Federal Reserve System aims to conduct the nation's monetary policy by influencing the monetary and credit conditions in the economy in pursuit of "maximum employment, stable prices, and moderate long-term interest rates."[1] The Fed does not have an inflation target.

An inflation target is a numerical point or range for the inflation of a given price index that the central bank declares to be its objective for inflation. For instance, the Bank of Canada aims to keep inflation at the 2 percent target. And the European Central Bank (ECB) aims to keep inflation below but close to 2 percent. Central banks that have a quantified inflation objective do structure the communication of their monetary policy around this objective.[2] Table 1 shows how various central banks currently define their inflation objectives, as reported on the central banks' websites. Table 2 shows when these targets were adopted and how they have changed. Inflation point targets and the midpoints of inflation target ranges are usually between 2 percent and 2.5 percent. These targets were first introduced between the early 1990s and the early 2000s. There is a broad consensus among economists that, as shown in figure 1, countries that have adopted an inflation target have stabilized inflation close to the inflation target.

In theory, a major virtue of quantified inflation objectives is to anchor inflation expectations—a key ingredient for the success of monetary policy. Stabilizing inflation expectations is important[3] because prices and wages adjust relatively infrequently (for the most up-to-date evidence, see Dhyne et al., 2005; Fabiani et al., 2005; Vermeulen et al., 2007; and the references therein). The people and institutions in the economy (we call these economic agents) usually set prices and wages over some horizon, and the level of these prices and wages would reflect their expectation of the evolution of inflation. If these economic agents know what the official inflation target is and the target is credible, they will expect the general price level to grow at the rate of the preannounced objective of the central bank. This expectation in itself then helps to deliver realized inflation close to the target.

While many economists find this argument to be convincing, there has been little research so far on whether the central banks' targets actually do a better job at forecasting inflation than other inflation benchmarks. In this article, we evaluate the potential benefits of inflation targets by comparing the performance of benchmark forecasts of inflation (model-based and published forecasts) and forecasts that are set equal to the inflation target. We conduct this comparison of forecast performance for the euro area, Australia, Canada, New Zealand, Norway, Sweden, Switzerland, and the United Kingdom, all of which have established inflation targets as shown in table 1.

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TABLE 1

Inflation objectives in selected Organization for Economic Cooperation and Development countries and in the euro area

Euro area	The primary objective of the European Central Bank's (ECB) monetary policy is to maintain price stability. The ECB aims at (harmonized index of consumer prices, or HICP) inflation rates of below, but close to, 2 percent over the medium term.
Australia	In pursuing the goal of medium-term price stability, both the bank and the government agree on the objective of keeping consumer price inflation between 2 percent and 3 percent, on average, over the cycle. This formulation allows for the natural short-run variation in inflation over the business cycle while preserving a clearly identifiable performance benchmark over time.
Canada	The Bank of Canada aims to keep inflation at the 2 percent target, the midpoint of the 1 percent to 3 percent inflation-control target range. This target is expressed in terms of total Consumer Price Index (CPI) inflation, but the bank uses a measure of core inflation as an operational guide. Core inflation provides a better measure of the underlying trend of inflation and tends to be a better predictor of future changes in the total CPI.
New Zealand	The Reserve Bank uses monetary policy to maintain price stability as defined in the policy targets agreement (PTA). The current PTA requires the bank to keep inflation between 1 percent and 3 percent on average over the medium term. The bank implements monetary policy by setting the official cash rate (OCR), which is reviewed eight times a year.
Norway	The government has defined an inflation target for monetary policy in Norway. The operational target is an inflation rate of 2.5 percent over time (with annual consumer price inflation of approximately 2.5 percent over time).
Sweden	According to the Sveriges Riksbank Act, the objective of monetary policy is to "maintain price stability." The Riksbank [or the central bank of Sweden] has interpreted this objective to mean a low, stable rate of inflation. More precisely, the Riksbank's objective is to keep inflation around 2 percent per year, as measured by the annual change in the Consumer Price Index (CPI). There is a tolerance range of plus/minus 1 percentage point around this target. At the same time, the range is an expression of the Riksbank's ambition to limit such deviations. In order to keep inflation around 2 percent, the Riksbank adjusts its key interest rate, the repo rate.
Switzerland	The Swiss National Bank equates price stability with a rise in the national Consumer Price Index (CPI) of less than 2 percent per annum. In so doing, it takes account of the fact that not every price movement is necessarily inflationary in nature. Furthermore, it believes that inflation cannot be measured accurately. 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, the measured level of inflation will tend to be slightly overstated.
United Kingdom	A principal objective of any central bank is to safeguard the value of the currency in terms of what it will purchase. Rising prices—inflation—reduces the value of money. ... In May 1997, the government gave the bank independence to set monetary policy by deciding the level of interest rates to meet the government's inflation target—currently 2 percent. [The inflation target of 2 percent is expressed in terms of an annual rate of inflation based on the Consumer Prices Index (CPI).]

Sources: European Central Bank, www.ecb.int/mopo/html/index.en.html; Reserve Bank of Australia, www.rba.gov.au/MonetaryPolicy/; Bank of Canada, www.bank-banque-canada.ca/en/monetary/monetary_main.html; Reserve Bank of New Zealand, www.rbnz.govt.nz/monpol/index.html; Norges Bank, www.norges-bank.no/Pages/Section____11330.aspx; Sveriges Riksbank, www.riksbank.com/templates/SectionStart.aspx?id=10602; Swiss National Bank, www.snb.ch/en/iabout/monpol; and Bank of England, www.bankofengland.co.uk/monetarypolicy/index.htm.

TABLE 2

Characteristics of the inflation quantified objectives

	First introduction	Range (%)	Point target (%)	Horizon	Most recent modifications	Range (%)	Point target (%)	Horizon	Target forecast (%)	Forecast evaluation period
Euro area	November 1998	0–2	none	medium run	2003		close to 2 from below		1.9	2001:Q1–2007:Q4
Australia	April 1993	2–3	none	business cycle					2.5	1995:Q1–2007:Q4
Canada	February 1991	1–3	2	multiyear	1995			indefinite	2	1995:Q1–2007:Q4
New Zealand	March 1990	3–5	none		2003	1–3		business cycle	2	1995:Q1–2007:Q4
Norway	March 2001	none	2.5						2.5	2003:Q1–2007:Q4
Sweden	January 1993	1–3	2						2	1995:Q1–2007:Q4
Switzerland	1999	0–2	none						1	2001:Q1–2007:Q4
UK	October 1992	1–4 for RPIX	none		2004 switch to CPI	1–3 for CPI	2		2.5 RPIX 2.0 CPI	1995:Q1–2003:Q4 2004:Q1–2007:Q4

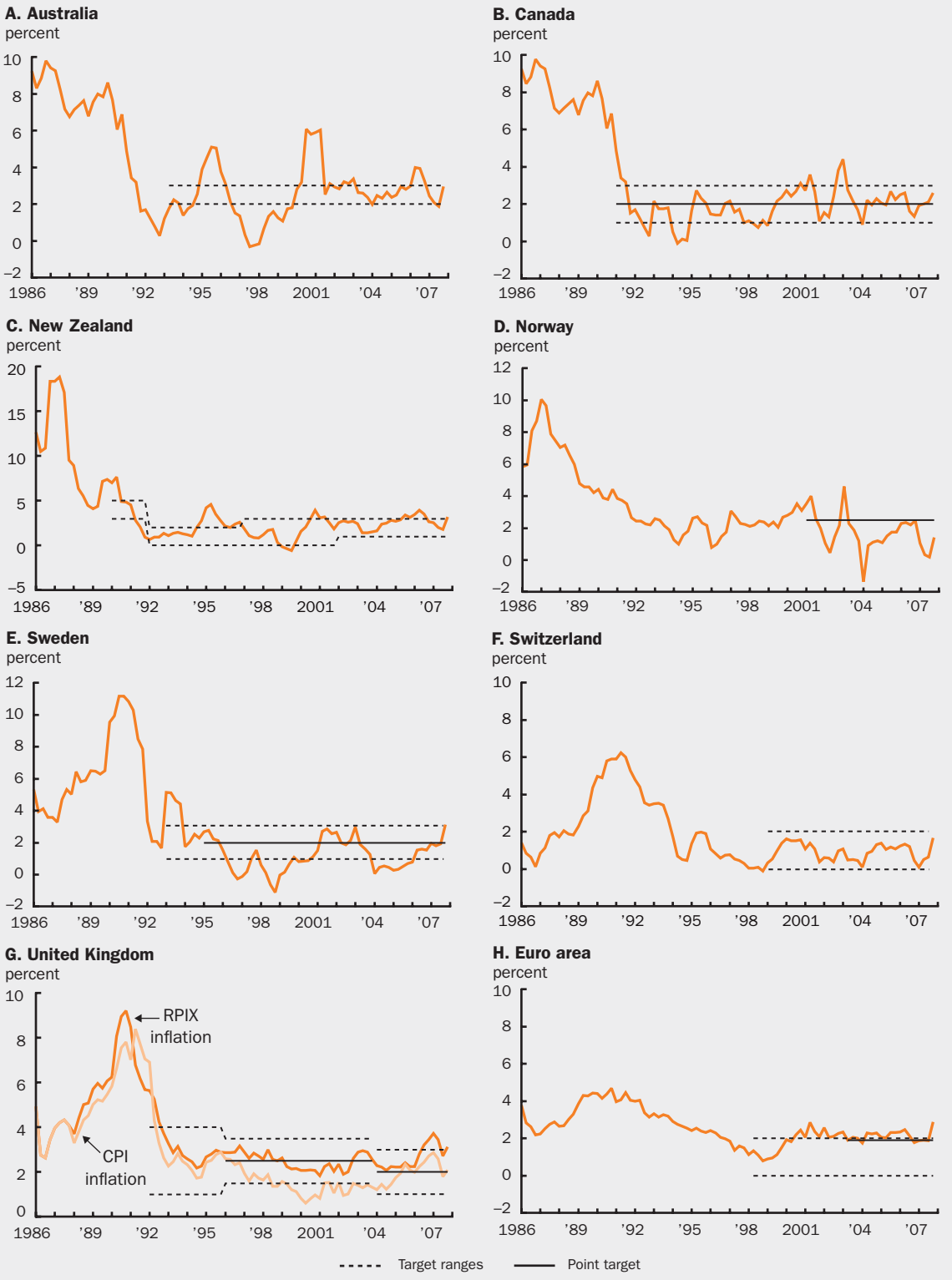
Notes: The euro itself was introduced in January 1999. However, the monetary policy strategy of the European Central Bank was announced in November 1998. In the United Kingdom, CPI is the Consumer Prices Index, and RPIX is the Retail Prices Index excluding mortgage interest payments. The last two columns define the target forecasts and the sample of forecast evaluation.
Sources: Roger and Stone (2005); and Swiss National Bank, www.snb.ch/en/iabout/monpol.

We also report results for the U.S., where inflation is often measured with the core Personal Consumption Expenditures (PCE) Price Index—a broad measure of consumer prices that excludes the more volatile and seasonal food and energy prices. Although the Federal Reserve does not have an inflation target, many market participants and economists assume that the U.S. central bank's price stability mandate can be associated with numerical values for the core PCE inflation rate: Some have argued that this rate is close to 2 percent,[4] while others think that the Federal Reserve may have a "comfort zone" that is between 1 percent and 2 percent. Figure 2 shows that core PCE inflation was indeed close to these numerical values over the last decade. So, for comparison, we also assess the forecasting performance of two selected "constant forecast benchmarks" for the U.S.—one of core PCE inflation at 2 percent and the other at 1.5 percent (which is the midpoint of the alleged "comfort zone").

Our results provide support for inflation targeting as a monetary policy strategy. In all the countries in our sample and in the euro area, forecasting that inflation will be at the inflation "target" implies a smaller forecasting error than alternative models. This is true for both one- and two-year horizon forecasts. Forecasting inflation to be at the target also beats the mean of professional economists' forecasts published in *Consensus Forecasts* for the euro area, Canada, and Sweden, as well as for two-years-ahead forecasts in Switzerland and in the United Kingdom.[5] In the case of the U.S., forecasting core PCE inflation to be a constant benchmark (either at 2 percent or 1.5 percent) also implies a relatively small error on average over the past 12 years.

FIGURE 1

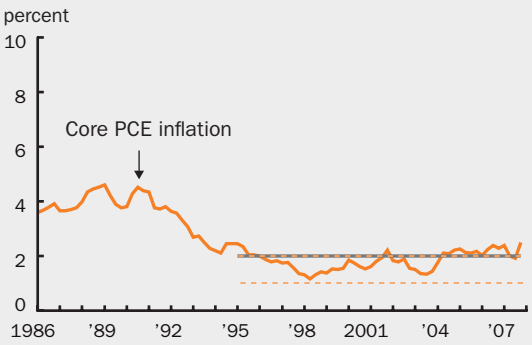
Inflation and quantified inflation objectives



Notes: For panel G, in the United Kingdom, CPI is the Consumer Prices Index, and RPIX is the Retail Prices Index excluding mortgage interest payments. See tables 1 and 2 for details on the inflation objectives over the time period.
Sources: Roger and Stone (2005) and authors' calculations based on data from Haver Analytics.

FIGURE 2

Inflation and selected constant forecast benchmarks for the U.S.



Notes: The U.S. Federal Reserve System does not have an inflation target. Core PCE is the Personal Consumption Expenditures Price Index excluding food and energy prices. See the text for further details on the selected constant forecast benchmarks.
Source: Authors' calculations based on data from Haver Analytics.

To our knowledge, this article is the first one to show that, while inflation is never exactly at the target, the central bank's target has provided an ex ante reliable and, to a large extent, unbeatable inflation forecasting device in countries that have adopted a quantified inflation objective. When agents in the economy choose the inflation target as their expectation of future inflation, it is more likely that the target is actually hit or at least that low and stable inflation is maintained.

In the next section, we discuss the role of inflation targets in the formation of inflation expectations. Then, we describe the forecasting models and report the results of a "horse race" of inflation forecasts, comparing the error incurred by taking the target as a forecast with other widely used forecasting approaches.

Rule-of-thumb expectations and inflation targets

The formation of inflation expectations plays a large role in the success of monetary policy. Since all prices and wages cannot be readjusted constantly, anchoring inflation expectations at a low level is essential to ensure price stability.

The academic debate on inflation expectations has centered on the operational mode of expectation formation. However, inflation expectations are not observable. As a result, several views on expectation formation that are mutually exclusive cannot easily be proven to be inconsistent with the data (Lindé, 2001).

The most popular view has long been that inflation expectations are rational. Rational expectations take two complementary meanings. First, expectations need to fulfill certain criteria to be *rational*. Thus, rational expectations cannot be systematically or persistently *wrong*. As a result, a good approximation of rational expectations is the result of a regression of future realizations of inflation on past and present observable economic variables. By construction, this procedure yields expectation errors that are zero on average. In addition, if the set of economic variables taken into account is comprehensive enough, this procedure is consistent with the requirement that expectations take into account all available information. The second meaning of rational expectations formulates that in any given model of the economy, agents form their expectations in a way that is consistent with the functioning of the model.

Although the assumption of rational expectations is frequently used in model construction and simulations, the empirical relevance is still controversial.[6] In particular, inflation expectations seem to depend significantly on past and present values of inflation (for example, Estrella and Fuhrer, 1999). Hence, some economists have advocated that expectations should be approximated by simpler expectation mechanisms, such as projecting inflation to be at the level observed in the past.

Note that such "rule-of-thumb" expectations are not necessarily irrational to the extent that rules deriving future inflation from its past values may be the most efficient use of current available information to derive the outlook for inflation. A good rationale for such a rule of thumb is precisely that inflation proves extremely difficult to forecast with multivariate economic models.[7] Simple rules of thumb may therefore optimally solve the trade-off between accuracy of the expectations and effort spent to derive them.[8] However, especially at times of persistent changes in inflation, such backward-looking rules will lead to recurring forecast errors of persistent signs.

In countries where the central bank has announced an inflation target, a natural rule of thumb consists of expecting that future inflation would be at the target. The forecast error of this rule of thumb is given by the deviation of realized inflation from the preannounced target. It is different from zero because the central bank cannot deliver an inflation rate that is exactly on target every period. However, the degree of forecast error will depend on which benchmarks are used and, in particular, on whether alternative forecasts are better or worse.

How well do you forecast inflation if you believe in the central bank's target?

We first check how accurate "forecasts" of agents taking the central bank's target for granted (henceforth, "target forecasts") would perform compared with forecasts based on six alternative benchmarks: random walk; a track record or past mean inflation; three specifications of an autoregressive (AR) model of inflation, that is, a model where past and current inflation help forecast future inflation; and, finally, the mean inflation forecast published in *Consensus Forecasts*. These models, which are standard benchmarks in the forecast evaluation literature, have proved difficult to beat when trying to forecast inflation (Stock and Watson, 2003; and Banerjee, Marcellino, and Masten, 2003).

The quantified inflation objectives of central banks

An inflation target takes the form of either a numerical value or a range for inflation and a commitment by the central bank to stabilize inflation close to the target level. Central banks that have a quantified inflation objective put it at the core of the communication of their monetary policy.[9] Table 1 (p. 34) reports the current (as of January 2008) definitions of the central banks' inflation objectives taken from their websites. Table 2 (p. 35) shows the timing of the adoption of the targets and how they have changed over time. Figure 1 (p. 36) shows how the targets compare with actual inflation. The central banks' inflation targets are now typically between 1 percent and 3 percent. Some central banks target a range (Australia, euro area, and Switzerland) and others a specific rate (Norway). Some banks have changed the definition of their objective over time (euro area and UK), while some have not (Australia). Changes have involved the range target (New Zealand and euro area) or even a change in the index for which the target is defined (UK).[10]

Going from the definition of the inflation targets to a target forecast requires two main assumptions. The first one is to choose a numerical value for the target. We choose the effective point target when the central bank has defined one (Canada, Norway, Sweden, and the UK from 1996 onward) or, in the case of countries with inflation range targets (Australia, New Zealand, Switzerland, and UK before 1996), we use the midpoint of the range in order to have a point estimate to which actual inflation can be compared (following Castelnuovo, Nicoletti-Altimari, and Rodrígues-Palenzuela, 2003). In the case of the euro area, the choice of a specific number for the inflation quantified objective is somewhat more delicate. In 1998, the ECB had defined its inflation objective as a positive inflation rate less than 2 percent over the medium run. In May 2003, the ECB clarified its inflation objective as below but close to 2 percent.[11] We set the inflation objective for the euro area at 1.9 percent. While this choice is somewhat arbitrary and not necessarily in line with the perception of the ECB objective between 1999 and 2003, we believe it is consistent with the ECB strategy both before and after May 2003.

Finally, we also analyze the case of the U.S. As noted earlier, in contrast with the other central banks we study in this article, the Federal Reserve does not set a target for inflation. However, some observers have suggested that the Federal Reserve has an implicit target of 2 percent for core PCE inflation.[12] Some others consider that the Federal Reserve has a "comfort zone" that is between 1 percent and 2 percent. We thought it would be interesting to apply the same type of test to the forecasting performance of these working assumptions as we do to the official inflation targets of other countries, purely as an academic exercise. We therefore assess the size of the errors implied by forecasting core PCE inflation rates to be constant, either at 2 percent or 1.5 percent.

The second assumption we need to make is our choice of forecast evaluation period. Given the medium-term nature of the central banks' objectives, which we interpret as a two-year horizon, we start our forecast evaluation period two years after the inflation target has been announced. Hence, in the case of Australia, where the inflation targeting strategy was launched in 1993, the forecast evaluation commences for forecasts of inflation for the first quarter of 1995. In the case of the euro area, we record forecast performances from 2001 onward. The level of the inflation forecast and the first date of the forecast evaluation are reported in table 2 (p. 35). In the case of the U.S., we arbitrarily start the forecasting evaluation in 1995.

Forecasting models

The target forecast model ("Target" in tables 3–5 on pp. 41–42) is simply:

$$\pi^{t+h}{}_{t} = \pi^{*},$$

where $\pi_t = \left(\frac{P_t - P_{t-4}}{P_{t-4}} \right) \times 100$, that is, it is the inflation rate for four quarters, h is either four quarters or eight quarters, P is the level of the price index, and π^* is the inflation quantified objective defined in the next to last column of table 2. The range of $t + h$ dates for which the model is evaluated is given in the last column of table 2.

We should stress that the forecasts are the same whatever the horizon of the forecast. In this article, we report results only for *h* equal to four and eight quarters ahead.[13]

We compare the target forecast performance with the forecasts from our six alternative measures. The first of these is the random walk forecast; that is, we forecast inflation to be equal to the inflation observed over the year to the date when the forecast is made:

$$1) \quad \pi^{t+h}_{\ t} = \pi_t.$$

This forecasting model is sometimes formulated in the first difference of inflation, that is, changes in inflation from one period to the next. We stick to a level formulation, however, because inflation shows no trend for the sample over which the forecast evaluation is conducted. We also record the forecast performance of considering that future inflation would be well approximated by the average inflation level over the past five years (or 20 quarters). This naive forecast considers that the recent track record of inflation is the most informative about where inflation should be:

$$2) \quad \pi^{t+h}_{\ t} = \left(\sum_{i=1}^{20} \pi_{t-i} \right) / 20.$$

The main advantage with respect to the first model (equation 1) is that it may smooth out temporary noise in current inflation.

We then base inflation forecasts on three autoregressive models.[14] The first of these models simply relates current inflation to its lag levels, where the minimum lag is defined by the forecasting horizon. It is:

$$3) \quad \pi_t = C + \alpha\pi_{t-h} + \beta\pi_{t-h-4} + \varepsilon_t,$$

where *C*, α, and β are parameters and ε an error term, which are to be estimated recursively by ordinary least squares over the sample from the first quarter of 1986 to *t*.

This simplifies the forecasting procedure as it can be computed in one step rather than rolling the model over intermediate forecasts:

$$3a) \quad \pi^{t+h}_{\ t} = \hat{C} + \hat{\alpha}\pi_t + \hat{\beta}\pi_{t-4},$$

where the coefficients with ^ have been estimated.

We also present results for two variants of this model. First, we formulate the autoregressive model on the first difference of inflation. This formulation has the advantage that any change in the level of inflation would affect the forecasting performance of the model only for one observation (Banerjee, Marcellino, and Masten, 2003):

$$4) \quad \Delta\pi_t = C + \alpha\Delta\pi_{t-h} + \beta\Delta\pi_{t-h-1} + \varepsilon_t,$$

$$4a) \quad \pi^{t+h}_{\ t} = \pi_t + \hat{C} + \hat{\alpha}\Delta\pi_t + \hat{\beta}\Delta\pi_{t-1},$$

where $\Delta\pi_t = \pi_t - \pi_{t-4}$.

Second, in line with Labhard, Kapetanios, and Price (2007), we take into account potential breaks in the mean of inflation due to announcements of changes in the inflation objective by the central banks.[15] Hence, we enrich the AR model by allowing for changes in the intercept eight quarters after a change to the inflation targeting regime. In the case of Australia, for instance, the central bank announced its objective in 1993. We therefore include a one-step dummy taking a zero value before 1995 (1993 plus eight quarters) and one thereafter. We refer to this second set of models as "AR models with breaks." They are:

$$5) \quad \pi_t = C + \sum C_i Ind_i + \alpha\pi_{t-h} + \beta\pi_{t-h-4} + \varepsilon_t,$$

$$5a) \quad \pi^{t+h}_{\ t} = \hat{C} + \sum \hat{C}_i Ind_i + \hat{\alpha}\pi_t + \hat{\beta}\pi_{t-4},$$

where Ind_i is a dummy variable that takes a value 1 from eight quarters after the announced change in the target.

We estimate the models from the first quarter of 1986 onward with year-on-year inflation rates.[16] The out-of-sample forecast evaluation is then carried out in *pseudo* real time. For example, the models are estimated from the first quarter of 1986 through the fourth quarter of 1994. Based on this estimation, we calculate forecasts at horizons four quarters and eight quarters ahead. Then we store the associated forecast errors and the one of taking the inflation forecast equal to the central bank's quantified objective π^*, defined as follows:

$$\pi^{1995Q1}_{\ 1994Q1} - \pi_{1995Q1} \quad \text{and} \quad \left[\pi_{1995Q1} - \pi^*\right],$$
$$\pi^{1996Q1}_{\ 1994Q1} - \pi_{1996Q1} \quad \text{and} \quad \left[\pi_{1996Q1} - \pi^*\right].$$

The setup is brought forward sequentially by one quarter until the end of the evaluation sample.

Finally, we compare target forecasts to the *Consensus Forecasts* (hereafter, referred to as the

"consensus"), which is the mean of the forecasts surveyed by Consensus Economics Inc. from F professional forecasters.

$$6) \quad \pi^{t+h}{}_t = \left(\sum_{f=1}^{F} \pi^{t+h}{}_t \right) / F.$$

The consensus should represent informed forecasts produced on the basis of comprehensive information sets. Notably, respondents to the survey should be aware of the central bank's inflation objective. In principle, differences between the views of economists on future inflation and the central bank's stated objective can indicate that such an objective lacks credibility. However, inflation targets could be credible, albeit only in the medium run. For shorter horizons, economists may take into account a variety of factors that make actual inflation deviate temporarily from the target.

Data on the professionals' forecasts for future inflation (for the current and following years) are available since 1990 for Canada, Norway, Sweden, Switzerland, and the UK and since 2002 for the euro area. However, we compile pre-2002 data as averages of country-level data (except Luxembourg), with fixed weights corresponding to the countries' share in euro area consumption.[17] This current and following year framework differs from the rolling forecast horizon used to evaluate models 1–5. In order to compare the performance of the consensus with the degree of accuracy that target forecasts would have yielded had they been formed at the same time as the consensus surveys, we need to pay attention to the calendar of inflation data releases and the timetable of the consensus surveys. Publication delays of inflation data differ from one country to another and, in some cases, have changed over the period we study here. However, inflation data are typically published about one month after the end of the reference period. Meanwhile, the consensus survey results for a month, M, correspond to answers collected up to the middle of the previous month $M - 1$. We can therefore make the following comparisons. Consensus forecasts of inflation in the current year published in February rely on inflation data up to December of the previous year. Therefore, we need to forecast the whole year. We then compare these forecasts with four-quarters-ahead target forecasts. Similarly, we compare forecasts of inflation in the following year published in February with eight-quarters-ahead target forecasts.

Results

Tables 3 and 4 show the mean absolute errors (MAEs) and the root mean square errors (RMSEs)[18] of the target forecast and the five alternative quarterly models laid out in equations 1–5. Table 5 compares similar statistics for *Consensus Forecasts* and the target forecasts at an annual frequency. These statistics are computed for the forecast evaluation periods that begin either in 1995 or eight quarters after the instauration of the inflation quantified objective. For most countries, this is from 1995 through 2007—that is, for 52 quarterly forecasts for tables 3 and 4 and for 13 annual observations for table 5. However, the forecast evaluation starts only in 2001 for the euro area and Switzerland and in 2003 for Norway. In the case of the UK, the forecast evaluation is split in 2004 to reflect the change in the underlying price index.

For each row in tables 3–5, the numbers in bold indicate the smallest forecast errors. In tables 3 and 4, for each column we also compute the mean performance of each model across countries as the mean distance to the best performing model for each country.

Our results provide strong support for the inflation target forecasts as good devices for inflation forecasting. This is especially true at the eight quarters horizon, where forecasting the target systematically beats all other forecasting approaches (that is, has both the smallest MAE and smallest RMSE) except in the UK, where the best model for the Consumer Prices Index (CPI) is the simple AR model in equation 3. But one should take this particular result for the UK with a grain of salt because our evaluation is conducted only over 16 observations (from 2004 through 2007).

At the four quarters horizon, the performance of forecasting the target remains very impressive. This model is the best performing one in terms of either mean absolute errors (table 3) or root mean square errors (table 4) in Canada, Norway, and Switzerland. In both tables 3 and 4, the performance of forecasting the target is very close to the best model in most other cases: less than 0.05 percentage points above the best model in the euro area and Australia and less than 0.10 percentage points above the best model in New Zealand and Sweden. In the UK, the target forecast has an MAE and RMSE about 0.20 percentage points above the best model for the either the RPIX or the CPI. However, even at a four quarters horizon, the target forecast is the most robust approach in the sense that it is, on average, the closest to the best performing model of each country.

The target forecasts yield significantly more accurate forecasts than any of the autoregressive models and, hence, given the evidence reported in Stock and Watson (2003) and Banerjee, Marcellino, and Masten (2003), than most inflation forecast models (see note 7).

TABLE 3

Mean absolute errors at four quarters and eight quarters horizons

	Four-quarters-ahead forecasts						Eight-quarters-ahead forecasts					
		Alternative models						Alternative models				
	Target	1	2	3	4	5	Target	1	2	3	4	5
Euro area	0.36	0.43	0.46	0.46	**0.33**	0.47	**0.36**	0.51	0.53	0.64	0.52	0.65
Australia	1.11	1.55	**1.10**	1.46	1.59	1.56	**1.11**	1.84	1.15	2.04	2.53	2.42
Canada	**0.65**	1.05	1.19	0.86	1.23	0.75	**0.65**	0.97	1.57	1.35	1.05	1.34
New Zealand	0.99	1.12	1.19	**0.91**	1.77	0.95	**0.99**	1.31	1.55	1.11	1.31	1.16
Norway	**0.91**	1.43	1.00	1.06	2.13	1.04	**0.91**	1.20	1.09	1.01	1.06	1.18
Sweden	1.06	**0.97**	1.70	1.48	1.29	1.21	**1.06**	1.42	2.10	2.70	1.41	1.87
Switzerland	**0.39**	0.60	0.42	0.61	0.54	0.55	**0.39**	0.71	0.45	1.17	0.70	0.84
UK CPI	0.57	0.45	0.69	**0.38**	0.46	0.46	0.57	0.63	0.77	**0.48**	0.82	0.66
UK RPIX	0.54	0.33	0.85	0.85	**0.32**	0.56	0.54	**0.41**	1.19	2.37	0.45	1.70
Mean difference with best model	**0.07**	0.22	0.29	0.23	0.41	0.18	**0.02**	0.30	0.45	0.73	0.39	0.61

Notes: In the United Kingdom, CPI is the Consumer Prices Index, and RPIX is the Retail Prices Index excluding mortgage interest payments. The forecast comparison is conducted in real time over the period 1995:Q1–2007:Q4 for Australia, Canada, New Zealand, and Sweden; over the period 2001:Q1–2007:Q4 for the euro area and Switzerland; over the period 2003:Q1–2007:Q4 for Norway; over the period 2004:Q1–2007:Q4 for UK CPI; and over the period 1995:Q1–2003:Q4 for UK RPIX. The numbers in bold indicate the best model.
Model 1 is the random walk, current year inflation; model 2 is the mean inflation over the last five years; model 3 is an autoregressive (AR) model in levels; model 4 is an AR model in first differences; and model 5 is an AR model in levels with breaks in the mean *f* inflation. See equations 1–5 in the text for the exact specification of the forecast.

TABLE 4

Root mean square errors at four quarters and eight quarters horizons

	Four-quarters-ahead forecasts						Eight-quarters-ahead forecasts					
		Alternative models						Alternative models				
	Target	1	2	3	4	5	Target	1	2	3	4	5
Euro area	0.46	0.53	0.58	0.56	**0.42**	0.57	**0.46**	0.68	0.68	0.84	0.71	0.89
Australia	1.51	1.97	**1.50**	1.88	1.94	1.98	**1.51**	2.41	1.57	3.62	3.23	3.96
Canada	**0.86**	1.32	1.80	1.18	1.66	0.99	**0.86**	1.15	2.37	2.78	1.48	2.75
New Zealand	1.25	1.43	1.66	**1.18**	2.43	1.25	**1.25**	1.67	2.42	1.46	1.88	1.51
Norway	**1.23**	1.95	1.31	1.42	2.88	1.38	**1.23**	1.54	1.40	1.24	1.34	1.50
Sweden	1.28	**1.22**	2.19	2.00	1.55	1.59	**1.28**	1.61	2.74	3.78	1.72	2.99
Switzerland	**0.45**	0.72	0.49	0.73	0.64	0.66	**0.45**	0.83	0.56	1.44	0.81	1.11
UK CPI	0.70	0.53	0.82	**0.45**	0.54	0.53	0.70	0.73	0.92	**0.57**	0.95	0.77
UK RPIX	0.64	0.42	1.11	0.97	**0.41**	0.68	0.64	**0.49**	1.50	2.83	0.57	2.23
Mean difference with best model	**0.07**	0.26	0.42	0.29	0.53	0.21	**0.03**	0.34	0.68	1.16	0.51	1.07

Notes: In the United Kingdom, CPI is the Consumer Prices Index, and RPIX is the Retail Prices Index excluding mortgage interest payments. The forecast comparison is conducted in real time over the period 1995:Q1–2007:Q4 for Australia, Canada, New Zealand, and Sweden; over the period 2001:Q1–2007:Q4 for the euro area and Switzerland; over the period 2003:Q1–2007:Q4 for Norway; over the period 2004:Q1–2007:Q4 for UK CPI and over the period 1995:Q1–2003:Q4 for UK RPIX. The numbers in bold indicate the best model.
Model 1 is the random walk, current year inflation; model 2 is the mean inflation over the last five years; model 3 is an autoregressive (AR) model in levels; model 4 is an AR model in first differences; and model 5 is an AR model in levels with breaks in the mean *f* inflation. See equations 1–5 in the text for the exact specification of the forecast.

TABLE 5

Forecasting errors of target forecasts and *Consensus Forecasts*

	Mean absolute errors			Root mean square errors		
	Target	Consensus one-year-ahead forecasts	Consensus two-years-ahead forecasts	Target	Consensus one-year-ahead forecasts	Consensus two-years-ahead forecasts
Euro area	**0.27**	0.29	0.41	**0.31**	0.31	0.45
Canada	**0.29**	0.41	0.38	**0.36**	0.54	0.43
Sweden	**0.65**	0.69	0.67	**0.88**	0.95	0.88
Switzerland	0.24	**0.21**	0.41	**0.27**	0.33	0.48
UK	0.41	**0.34**	0.44	0.53	**0.42**	0.56

Notes: The forecast comparison is conducted in real time over the period 1995–2007 for Canada, Sweden, and the UK and over the period 2001–07 for the euro area and Switzerland. The consensus forecasts are the ones published in the February issue of *Consensus Forecasts* of the current year for one-year-ahead forecasts and the past year for the two-years-ahead forecasts. The numbers in bold indicate the best model.

TABLE 6

Performance of selected constant forecast benchmarks and model-based forecasts of U.S. core PCE inflation

	Constant forecast benchmarks		Alternative models				
	1.5%	2.0%	1	2	3	4	5
Mean absolute errors							
Forecast horizon							
Four quarters	0.49	0.32	**0.30**	0.57	0.33	0.37	0.32
Eight quarters	0.49	**0.32**	0.38	0.74	0.65	0.34	0.64
Root mean square errors							
Forecast horizon							
Four quarters	0.40	0.38	**0.36**	0.70	0.40	0.47	0.37
Eight quarters	0.40	**0.38**	0.45	0.92	0.87	0.42	0.86

Notes: The U.S. Federal Reserve System does not have an inflation target. Core PCE is the Personal Consumption Expenditures Price Index excluding food and energy prices. The forecasting performance of the constant forecast benchmarks for U.S. core PCE inflation is purely illustrative. The forecast comparison is conducted in real time over the period 1995:Q1–2007:Q4. The numbers in bold indicate the best model.
Model 1 is the random walk, current year inflation; model 2 is the mean inflation over the last five years; model 3 is an autoregressive (AR) model in levels; model 4 is an AR model in first differences; and model 5 is an AR model in levels with breaks in the mean *f* inflation. See equations 1–5 in the text for the exact specification of the forecast.

Table 5 shows the MAEs and the RMSEs of target forecasts and the *Consensus Forecasts*, though this time using yearly observations. For two-years-ahead inflation forecasts, using the central bank's target has yielded smaller forecasting errors than the consensus forecasts in terms of either MAEs or RMSEs for all countries under review. This is also observed at one-year-ahead forecasts, except for the UK according to both the MAE and RMSE criteria and for Switzerland according to the MAE criterion.

One caveat applying to these results is that they are based on relatively short samples because of the availability of consensus forecasts for only the past 15 years and the even more recent switch to quantified inflation objectives by central banks. However, in our view, the paths of the forecasts obtained from the autoregressive models, the consensus, and the central banks' targets suggest that the central banks' targets may constitute a new benchmark for forecast evaluation.

Finally, table 6 reports MAEs and RMSEs of the constant forecast benchmarks of 1.5 percent and 2 percent for U.S. core PCE inflation. Forecasting constant inflation at 2 percent has been the best at the eight quarters horizon and very close to the best at the four quarters horizon. These results show that, although the Federal Reserve does not have an inflation target, core PCE inflation has become remarkably stable in the U.S. since 1995.

Taking a broader perspective, our results provide concrete evidence of the success of preannounced quantified objectives for inflation. One possible interpretation of this success is that economic agents have indeed adopted the inflation target of the central bank as their inflation expectation for the general price level.

The inflation target may have become the focal point onto which decentralized inflation expectations have converged. This would occur if the target of the central bank is credible. That is, the central bank is always willing to take measures to ensure the target is reached over the specified horizon.

Conclusion

We have shown that quantified inflation objectives can be used as rule-of-thumb forecasting devices. The experience of various countries that have adopted such objectives shows that, to a large extent, such a rule of thumb yields smaller forecast errors than widely used forecasting models and the forecasts of professional experts published by Consensus Economics Inc. While inflation is never exactly at the target, the central banks' targets have provided ex ante reliable and, to a large extent, unbeatable inflation forecasting devices in countries that have adopted a quantified inflation objective. These findings suggest that the central banks that have set explicit targets for inflation have been successful in their often stated goal of anchoring inflation expectations.

NOTES

[1]This is according to the Federal Reserve Act; see www.federalreserve.gov/generalinfo/fract/sect02a.htm.

[2]See Roger and Stone (2005) for a detailed description of the inflation targeting in OECD (Organization for Economic Cooperation and Development) and emerging economies.

[3]See the discussion in Castelnuovo, Nicoletti-Altimari, and Rodríguez-Palenzuela (2003); Gürkaynak, Levin, and Swanson (2006); Levin, Natalucci, and Piger (2004); and Svensson (1999).

[4]A prominent example is Goodfriend (2007).

[5]*Consensus Forecasts*—a monthly publication by Consensus Economics Inc.—reports the forecasts of inflation by various investment banks and public and private organizations that have their own inflation forecasts. For further details, see www.consensuseconomics.com.

[6]See, for instance, Rudd and Whelan (2006) and Sargent (1993).

[7]Stock and Watson (2003); Banerjee, Marcellino, and Masten (2003); and Banerjee and Marcellino (2003) show that multivariate models of inflation—that is, models where inflation dynamics are influenced by the evolution of other economic variables (output and unemployment)—hardly ever improve the forecast of inflation with respect to univariate nonstructural models of inflation. See also Fisher, Liu, and Zhou (2002) and Brave and Fisher (2004).

[8]The recent discussion of rational inattention (Sims, 2003; Mankiw and Reis, 2002; and Maćkowiak and Wiederholt, 2005) models explicitly how the cost of information processing could cause agents to restrict the information on which they base economic decisions.

[9]Again, see Roger and Stone (2005) for a detailed description of the inflation targeting in OECD and emerging economies.

[10]In December 2003, the UK's Chancellor of the Exchequer announced that the Bank of England would change its inflation target from one based on the Retail Prices Index excluding mortgage interest payments (RPIX) to one based on the Consumer Prices Index (CPI)—also known there as the Harmonized Index of Consumer Prices (HICP).

[11]See Issing (2003).

[12]Goodfriend (2007).

[13]In a previous version of this article, we showed that the target forecast does not perform well at a one-quarter horizon—a result that is not surprising given that all central banks with an inflation target insist that inflation can be brought back to the target only over the medium run. In other words, it is widely agreed that monetary policy should not aim at cancelling the high frequency volatility of inflation.

[14]Other lag structures did not improve the forecasting results, so we use the simplest possible lag structure here.

[15]An obvious weakness of this model is that it assumes that the econometrician himself is convinced that the central bank announcement of a new target will immediately have an effect on the inflation process.

[16]Inflation time series were taken from Haver Analytics.

[17]Since respondents to *Consensus Forecasts* vary from country to country, these euro area constructs are not, strictly speaking, forecasts for the euro area economy. However, unless respondents of a particular country have systematic biases in their inflation forecast, the average inflation forecast across countries should be close to a forecast by an "average" forecaster for the average of the countries, that is, for the euro area as a whole.

[18]These two statistics are the most frequently used statistics to evaluate our sample forecasting performance.

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