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RESEARCH ARTICLE

What Do Central Banks Know about Inflation Factors?

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Abstract We offer a novel methodology for assessing the quality of central bank monetary policy reports. We evaluate their economic content by comparing verbally reported inflation factors with factors identified from a simple new Keynesian model. Positive correlations indicate that the reported inflation factors were similar to the model-identified ones, marking high-quality inflation reports. Although sample bank reports on average identified inflation factors correctly, the degree of forward-looking reporting varied.

Keywords Inflation targeting · Kalman filter · Monetary policy communication

JEL Classification E17 · E31 · E32 · E37

1 Introduction

One of the professed benefits of monetary policy communication in inflation-targeting central banks is the ability to anchor long-term expectations of inflation. Central bank communication about inflation factors should be clear, consistent, and verifiable against a set of publicly available stylized facts. Communication corroborated by empirical analyses is more likely to anchor expectations than that contradicted by such analyses (Bernanke and Woodford 1997; Levin 2014). We assess accuracy and reliability of monetary policy reports by comparing inflation factors reported verbally with ex-post model-identified factors. Positive correlations between the former and latter factors signal reliable monetary policy reports.

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The literature suggests various approaches to evaluating the quality of monetary policy reports. While some focus on the formal quality of the text, others measure the volume of information disclosed, or consistency with other communication tools. Nevertheless, these approaches only proxy reports' accuracy and reliability. The reports can be both voluminous and coherent, but if they do not reflect a "believable" state of the world they are unlikely to anchor expectations.

We propose a three-step methodology for assessing whether central bank communication provides a believable snapshot of the state of the world. First, the monetary policy report verbally describes inflation factors using a real-time information set. Second, we estimate analogous inflation factors using a new Keynesian (NK) model. Third, we compare both sets.

Inflation-targeting central banks communicate factors that are expected to affect *future* inflation and these analyses are rooted in the NK framework (Woodford 2003; Beck and Wieland 2010).[1] We identify and manually code *forward-looking* inflation factors in each monetary policy report, transforming the factors into numerical variables and aggregating them into three groups: demand, supply, and exchange rate factors.

The fact that central bank forecasts are chiefly informed by the NK framework simplifies our search for believable state-of-the-world estimates – we employ the oft-used version by Berg et al. (2006).[2] To this end, we decompose the observed inflation rate into the contributions of each factor – analogous to the reports' factors – using the Berg et al. framework and inflation accounting of Smets and Wouters (2007), Appendix 2. To the extent these factors are derived from an uncontroversial model and ex-post data they represent a *believable* estimates thereof. Of course, these estimates are not unique – a different model or a different calibration of the same model would have produced different factors.

Comparisons of these two sets of factors are complicated by lags. On the one hand, central banks report forward-looking inflation factors to back up their forecasts; however, the leads are rarely specified and they tend to differ between slow-moving demand and erratic exchange rate factors. On the other hand, the factors identified from the NK model always refer to the current period. The precise pairing is thus unknown and we are left to compare contemporaneous model-based factors with lagged reported factors.

Positive correlations between the reported and model-identified factors indicate accuracy and reliability of monetary policy communication. Naturally, not every insignificant or negative correlation indicates unreliable monetary policy reports – some of these results can be attributed to opportunistic disinflations, unforeseen shocks, large ex-post data revisions, or a failure of the NK model to capture the state of the world at a given point in time.

We apply our methodology to eight central banks, calling their policy objectives "inflation targets," from 2000 to 2009, before communication innovations, such as forward guidance, took place. The ECB, Riksbank, and the Bank of England represent industrial countries, while Banco Central de Chile, the Czech National Bank, Magyar Nemzeti Bank, the National Bank of Poland, and the Bank of Thailand represent

[1] The sample central banks are flexible inflation-targeting central banks, attempting to bring inflation back to the target without undue implications for the real economy. The monetary policy reports provide information about how they are managing the short-run output-inflation tradeoff (Freedman and Laxton 2009).

[2] Wren-Lewis (2015) wrote: "Why do central banks like using the New Keynesian (NK) model? The answer is very simple: the model helps these banks do their job […]."

emerging market countries. In the sample countries inflation deviated from the targets, often driven by idiosyncratic factors and domestic policies (Fig. 1).[3]

Our findings suggest that monetary policy reports have been mostly accurate and reliable; however, all banks occasionally struggled. All but one bank identified the overall balance of inflation factors in a forward-looking manner, with a 2–4 quarter lead. The identification of the subcategories of factors was less precise, however. The correlations between the reported inflation factors and the model-identified ones varied spatially and over time – there is no single central bank for which we could consistently match the reported and model-identified factors.

The remainder of the paper is organized as follows. First, we review the relevant literature. Second, we formulate a set of testable hypotheses, explain our methodology, and present the model. Third, we discuss the results. The final section concludes.

2 Literature Overview

The consensus among central bankers is "that transparency is not only an obligation for a public entity, but also a real benefit to the institution and its policies" (Issing 2005). Central bankers have the ability to move the markets with their analyses (Blinder et al. 2008) and transparent policymakers tend to have lower expected inflation (Hayo and Mazhar 2014). Various approaches have been offered to assess monetary policy reports. One possibility is to measure the volume of information disclosed (Geraats 2009). Another possibility is to look at the formal quality thereof. Some banks write better than others (Fracasso et al. 2003) and well-written texts have a better chance of being understood as intended (Jansen 2011; Bulíř et al. 2013). Bulíř et al. (2012) looked at consistency among various communication tools, such as monetary policy reports and press releases, finding that banks with well-developed policy analysis systems write more clearly.

Verbal identification of inflation factors is challenging. Ehrmann and Fratzscher (2007) and Bulíř et al. (2012) argued that central banks possess knowledge about the overall balance of inflation risks rather than about the detailed factors. Institutions facing financial crises have technical difficulty disentangling the various factors and political difficulty to communicate their findings (Bulíř et al. 2013).

Even coherent communications may fail to anchor expectations due limited accuracy and reliability. Policymakers' objectives can differ from those stated officially, for example, when central banks pursuing opportunistic disinflation fiddle with output gap estimates to justify its stance (Orphanides and Wilcox 2002; Ireland 2007). Obsessively transparent central banks may communicate all information, even that which they understand imperfectly, with "noise" crowding out the signal component (Dale et al. 2008). Worse, some banks send signals that are either inconsistent or contradictory, or both (Rozkrut et al. 2007), perhaps because the analytical framework is weak. Some central banks may be simply unlucky, either owing to major data revisions (Orphanides 2001) or to sizable indirect tax changes (Szilágyi et al. 2013). These above communication shortcomings make it less likely that the central bank can manage public expectations of inflation.

[3] Förster and Tillmann (2014) showed that the national rates of inflation have been driven primarily by idiosyncratic determinants as opposed to one common global factor.

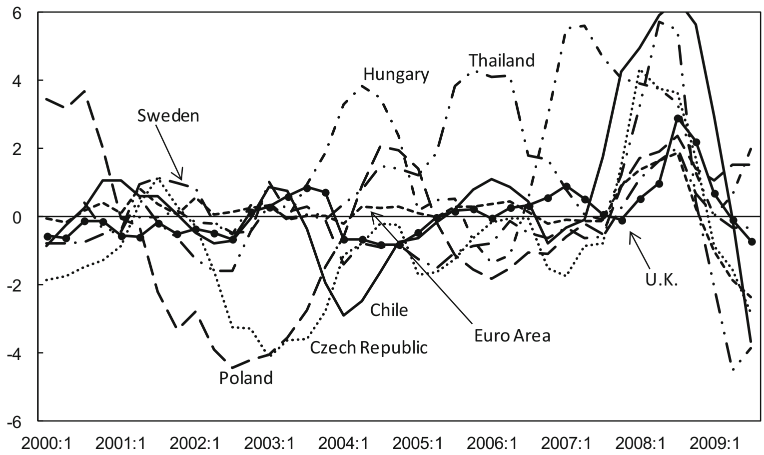


Fig. 1 Deviations from the inflation target (In percentage points)

3 The Methodology: Are "Reports" Validated by "Models"?

We assess the accuracy and reliability of monetary policy reports by comparing the inflation factors published in the context of quarterly macroeconomic forecasts (at time *T* in Fig. 2) with the corresponding ex-post, model-identified inflation factors derived from an underlying NK model. Although shocks may buffet the economy during the short lag between *T*-period forecast preparations and *T*-period data releases, we see the problem as immaterial.

3.1 Correlations

We test whether the real-time, policy-report factors (α) can be validated by ex-post, model-identified factors (ξ). The ξs are "believable" factors, obtained using the NK

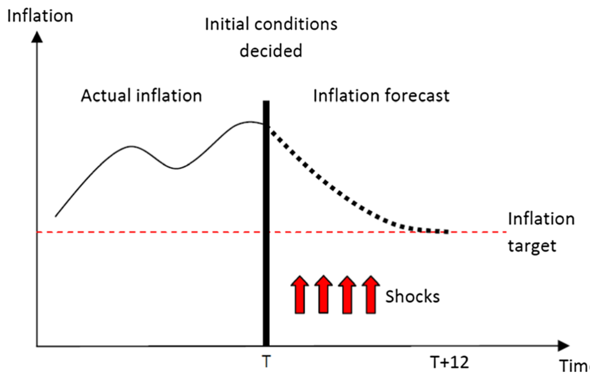


Fig. 2 Inflation forecast. At time T central banks publish inflation forecasts, building on a set of initial conditions. Forward-looking policy rules ensure that the inflation forecast approaches the target by the end of the policy horizon. Whether actual inflation at T + i is close to the forecast depends on the magnitude and direction of shocks that are unknown at T

model and revised data. To compare the consonance between the two sets of factors, we compute the Pearson (product-moment, r) and Spearman (rank, ρ) correlation coefficients, measuring the linear and non-parametric strength of the relationship, respectively. We consider both full-sample correlations based on 40 quarterly observations and rolling, 16-quarter correlations.

What are the possible outturns? The correlation coefficient can be positive and large ($\kappa < r(\alpha,\xi) < 1$), where κ corresponds to a "sufficiently strong" coefficient, the threshold value of which we will discuss later. For $\kappa < r$ we argue that the monetary policy report communicated "believable" factors. In contrast, a coefficient smaller than the threshold value ($r(\alpha,\xi) < \kappa$) suggests that the report failed to communicate "believable" factors.

3.2 Selecting the Threshold Value for Our Correlations

We see a number of data issues that may bias downward our estimated correlation coefficients. Measurement errors, such as noisy real-time series, the policymaker spinning the story to suit her political objectives (Romer and Romer 2008; Ellison and Sargent 2012), or our miscoding of otherwise correctly reported factors, affect α's.[4] The NK may not be the "correct" model of these economies or it may fail during periods of exchange rate regime switches, structural changes, and so on, affecting ξ's.

Given the abundance of measurement error issues, by setting the threshold value too high we would make too many Type I errors, that is, wrongly rejecting the null hypothesis of accurate reports. If we set the threshold value too low, we would fail to reject the null hypothesis even when we should (Type II error). Given our dominant concerns about the Type I error, we set a rather low threshold value for κ at 0.2, corresponding to the 20 % significance level and indicating a medium-strength relationship (Doucouliagos 2011). To summarize, finding $r > \kappa$ and a statistically significant Spearman rank coefficient is indicative of accurate and reliable communication of inflation factors. Finding $r < \kappa$ and a statistically insignificant rank correlation is indicative of communication problems.

3.3 Leads and Lags in Reporting of Inflation Factors

Central banks are forward-looking institutions and factors embedded in their forecasts should lead the ex-post, model-identified factors. How long is the lead, however? Are the leads identical for all types of factors, given that some of them appear to be more predictable than others?

In principle, the distinction between backward- (BL) and forward-looking (FL) factors is straightforward: all monetary policy reports contain separate BL and FL chapters (Fracasso et al. 2003). In practice, cyclical factors tend to be long-lasting, making it difficult to distinguish the past from the future. Some supply-side factors, such as VAT changes, are easy to foresee and report with a lead, because governments need to gazette them. Others, such as administrative price adjustments, can be risky to

[4] Our coding for the ECB is highly correlated with the KOF Monetary Policy Communicator and the Rosa and Verga (2007). Anyway, if we misinterpret some of the factors, so would the public (Fracasso et al. 2003).

communicate with a lead if implementations of past adjustments were erratic. Collection lags in accrual fiscal spending may lead to BL reporting, and so on.

It is unlikely that monetary policy reports would attempt to identify inflation factors with a lead of more than 1 year and that collection lags require more than a six-month lag. To this end, we construct the correlation coefficients between the two sets of factors over zero-to-four-quarter leads and a two-quarter lag. Given the preparation lags of the reports, we classify contemporaneous correlations as indicating FL reporting.[5]

3.4 Data Transformation

We use datasets of the Czech Republic, Chile, the Euro Area, Hungary, Poland, Sweden, Thailand, and the United Kingdom. While the ECB is not an inflation targeting central bank, its communication strategy (a price stability objective, publication of monetary policy reports, and so on) makes it comparable to the rest of the sample. The sample period from the late 1990s to 2009 is determined by the availability of consistent data (Appendix Table 5) and our concerns about the impact of post-2009 communication innovations.

3.4.1 Reported Inflation Factors

We quantify the reported factors using content analysis (Guthrie and Wright 2000; Bulíř et al. 2013) employing a unique new database based on monetary policy reports. Each FL factor is catalogued into a supply, demand, or foreign exchange factor and classified as pushing the future rate of inflation either higher (+1), lower (−1), or neither (0). The observations are aggregated to obtain the "stock of communication" of the inflation factors (Ehrmann and Fratzscher 2007; Conrad and Lamla 2010). We give each inflation factor an equal weight in the summary index to avoid judgments made by Rosa and Verga (2007).

The sample banks reported broadly similar inflation factors: the series were both autocorrelated and spatially correlated (Table 1). Only Hungary and the United Kingdom stand apart from the rest: the inflation factors identified by these two central banks were only loosely correlated with the other European banks.

3.4.2 Model-Identified Inflation Factors

To obtain the model-identified factors, we build country-specific NK models akin to the typical forecasting models used in most inflation targeting central banks. The properties of such frameworks are well understood and they are known to predict inflation as well as micro-founded or estimated models (Berg et al. 2006). The models and their calibrations are detailed in the working paper version of this article (Bulíř et al. 2014).[6] The structure of these models is such that they capture virtually all inflation factors central banks look at.

[5] For example, a sample bank published the first-quarter report of 2009 in mid-February 2009, with information available as of January 23, 2009. The corresponding model-identified factors are based on end-March data.

[6] All model codes, including calibrations, initial and steady-state conditions, and so on are available at: https://www.dropbox.com/s/qzqg7935hnln04k/BHS%20files%20for%20posting.zip?dl=0.

Table 1 Common trends in reported factors. (Correlation coefficients of the inflation factors)

	Chile	Euro Area	Hungary	Poland	Sweden	Thailand	United Kingdom
Czech Rep.	0.72	0.95	0.15	0.79	0.70	0.54	0.11
Chile		0.80	0.54	0.64	0.82	0.94	0.56
Euro Area			0.06	0.73	0.80	0.58	−0.21
Hungary				0.16	0.73	0.72	0.92
Poland					0.70	0.60	0.39
Sweden						0.88	0.76
Thailand							0.78

The larger the coefficients the closer are the reported assessments between the sample banks

Source: Authors' calculations

The model consists of four behavioral equations (aggregate demand, aggregate supply, the uncovered interest rate parity condition, and a forward-looking policy reaction function) and numerous identities. The first three equations were used to obtain the demand, supply, and exchange rate factors. The model structure encompasses both nominal and real deterministic trends so as to avoid any ad hoc pre-detrending. The nominal trend is unique and is determined by the domestic and foreign inflation targets. Four real trends are used to replicate the observed data: real GDP growth, the CPI-based real exchange rate, and domestic and foreign real interest rates. Real trends, shocks to these trends, and the business cycle are jointly estimated as unobserved variables using the multivariate (Kalman) filter.

Country models draw on nine observable series (Table 2): the domestic and foreign headline consumer price indexes; the domestic and foreign inflation targets; domestic and foreign GDP; the domestic and foreign interest rates; and the nominal exchange rate.[7] We then employ the multivariate filter to estimate the unobservable variables using the calibrated model and observed variables (Appendix 2). Each inflation factor captures the impact of the particular sequence of shocks on inflation, while the model structure defines the transmission mechanism. When the impacts of all the estimated shocks are accounted for, we get the decomposition of inflation as in Smets and Wouters (2007).

4 The Results

Communication by the sample central banks through their flagship documents is on average forward looking (FL) and the reported inflation factors are validated ex post (Table 3). The degree of forward looking reporting varied over the sample period in most central banks, presumably reflecting both changes in the nature of inflation factors and the banks' perception about the various transmission channels. The correlations for

[7] Frequent value added tax (VAT) changes – in particular in Hungary, the Czech Republic, and Poland – affected headline CPI. While headline inflation missed the target, a measure adjusted for the impact of indirect taxes may have remained closer to the target. Unfortunately, consistent series for adjusted inflation are not available.

Table 2 The list of variables

Model variable	Description; Source
Domestic prices	Consumer price index (CPI); *International Financial Statistics.*
Foreign prices	CPI in Euro Area (Czech Republic, Hungary, Poland, and Sweden) or the U.S. (Chile, Thailand, and Euro Area); *International Financial Statistics.*
Inflation target	(i) Midpoints of official target ranges; (ii) missing targets were intrapolated; (iii) Euro Area price stability objective of "close to, but below 2 %;" central bank websites.
Domestic demand	Full-model Kalman filter applied to real GDP; *International Financial Statistics.*
Foreign demand	Asymmetric band-pass filter applied to Euro Area GDP for Czech Republic, Hungary, Poland, and Sweden, and U.S. GDP for Chile, Thailand, and Euro Area; *International Financial Statistics.*
Nominal exchange rate	Spot exchange rate in domestic currency terms vis-à-vis the euro (Czech Republic, Hungary, Poland, and Sweden) and U.S. dollar (Chile, Thailand, and Euro Area); *International Financial Statistics.*
Nominal interest rate	3-month interbank rate; *International Financial Statistics.*
Foreign nominal interest rate	3-month interbank rate in Euro Area (Czech Republic, Hungary, Poland, and Sweden) and U.S. (Chile, Thailand, and Euro Area); *International Financial Statistics.*

subcategories of inflation factors were both lower and less stable across our sample and, moreover, the all-country results hide substantial differences across countries.

4.1 Overall Balance of Inflation Factors

All but one sample bank identified the overall inflation factors in an FL manner, with Hungary missing the 0.2 threshold narrowly because of the post-2005 results (Table 4).[8] Most leads were 2–4 quarters, implying that the reports identified the overall inflationary pressures well ahead. Lags for all countries, except Thailand, were insignificant (see Fig. A1.2 in Bulíř et al. 2014). The full-period correlation coefficients reflect substantial variations during the sample period: note, for example, the comparatively low rolling correlations for the ECB factors during 2002–2004 (Fig. 3). On a closer look, euro appreciation during this period was identified by the model as a significant factor; however, given its mandate, the ECB mostly refrained from commenting on the exchange rate. Bulíř et al. (2014) report detailed charts and tables summarizing all factors and various robustness checks.

4.2 Subcategories of Inflation Factors

The accord between the subcategories of reported and model-identified factors occasionally declined below the threshold, especially for the demand factors. The Riksbank, Bank of Thailand, and Bank of England had the best track record during the sample period.

[8] Szilágyi et al. (2013) attributed the identification failure to the exchange rate band that remained in place until 2008, mismeasurement of the real-time cyclical position, and poor judgment about the disinflationary forces.

Table 3 All countries: correlation between the reported and model-identified inflation factors, 2000–2009

	Correlation coefficient	All factors	Aggregate demand	Aggregate supply	Exchange rate
Contemporaneous	Pearson (*r*)	0.13	0.19	0.24	0.09
	Spearman's ρ (prob. > |t|)	0.32	0.20	0.26	0.24
Two Leads	Pearson (*r*)	0.31	0.11	0.02	0.22
	Spearman's ρ	0.16	0.29	0.39	0.30
Four Leads	Pearson (*r*)	0.29	0.01	−0.17	0.08
	Spearman's ρ	0.17	0.31	0.39	0.42
Two Lags	Pearson (*r*)	−0.12	0.10	0.14	−0.20
	Spearman's ρ	0.46	0.41	0.25	0.27

In this table we evaluate the all-country 16-quarter rolling window correlation coefficients between the two sets of factors, weighing the averages by the number of observations per country. We use the Pearson (*r*) and Spearman (ρ) correlation coefficients. The latter reports the significance level at which the null hypothesis of independence of reported and model-identified factors can be rejected

Source: Authors' calculations; detailed data for individual countries are available on request

4.2.1 Aggregate Demand Factors

One-half of our countries reported demand factors in line with the model-identified ones (Chile, Sweden, Thailand, and the UK). Industrial country central banks (Sweden and the UK) reported the factors with longer leads than emerging market banks (Chile and Thailand). In other countries, the coefficients were either lower than the threshold, unstable, or both. The rolling coefficients declined abruptly in the second half of the sample in Chile, the Czech Republic, the Euro Area, and Hungary, presumably reflecting the difficulty of measuring the business cycle during the Great Moderation.[9] The ECB's track record deteriorated as the Economic Bulletins underplayed demand pressures. In the Czech Republic reporting become temporarily more FL after 2002. Hungary's initially positive rolling correlation coefficients turned negative as the reports began to speculate that the economy is in recession. The accord was consistently low in Poland as the reports worried about expansionary fiscal policies while the economy was apparently operating below its potential.

4.2.2 Aggregate Supply Factors

The full-sample correlations were high for all countries, confirming that supply side factors are comparatively easy to identify in an FL manner. However, they were unstable in Hungary, Poland, Thailand, and the UK. Only the Euro Area and Hungary appeared to report supply-side factors with a lead of 2 quarters; in the rest these were reported either contemporaneously (Sweden) or with a 2-quarter lag (Chile, the Czech Republic, and Poland). Hungary's results seem to suggest that administrative measures, generally foreseen at a horizon of 1–2 quarters, contributed greatly to the

[9] See Minford et al. (2015) for a review.

Table 4 Correlation between reported and model-identified inflation factors, 2000–2009

		All factors	Demand	Supply	Exchange rate
Czech Republic	Is $r > 0.2$?	Yes	No	Yes	Yes
	Is it stable?	Yes	No	Yes	Yes
	Is it FL or BL?	Mostly FL (2q;4q)	–	BL(−2q)	FL (2;4q)
Chile	Is $r > 0.2$?	Yes	Yes	Yes	Yes
	Is it stable?	Yes	Yes	Yes	No
	Is it FL or BL?	FL (4q)	FL (0q;2q)	Mixed (0q;–2q)	FL (2q;4q)
Euro Area	Is $r > 0.2$?	Yes	No	Yes	Yes
	Is it stable?	Yes	No	Yes	No
	Is it FL or BL?	FL (0q;2q)	–	FL (0q;2q)	Mixed
Hungary	Is $r > 0.2$?	No	No	Yes	Yes
	Is it stable?	No	No	No	Yes
	Is it FL or BL?	–	–	FL (2q)	FL (2q)
Poland	Is $r > 0.2$?	Yes	No	Yes	Yes
	Is it stable?	Yes	No	No	Yes
	Is it FL or BL?	Mixed (0q;2q;4q)	–	BL (−2q)	Mixed (0q;2q;4q)
Sweden	Is $r > 0.2$?	Yes	Yes	Yes	No
	Is it stable?	Yes	Yes	Yes	No
	Is it FL or BL?	FL (2q)	FL (0q;2q;4q)	FL (0q)	–
Thailand	Is $r > 0.2$?	Yes	Yes	Yes	Yes
	Is it stable?	Yes	Yes	No	Yes
	Is it FL or BL?	FL (0q;2q)	FL (0q)	FL (0q)	FL (0q)
United Kingdom	Is $r > 0.2$?	Yes	Yes	Yes	Yes
	Is it stable?	No	Yes	No	Yes
	Is it FL or BL?	FL (4q)	FL (0q;2q;4q)	FL (0q)	FL (2q)

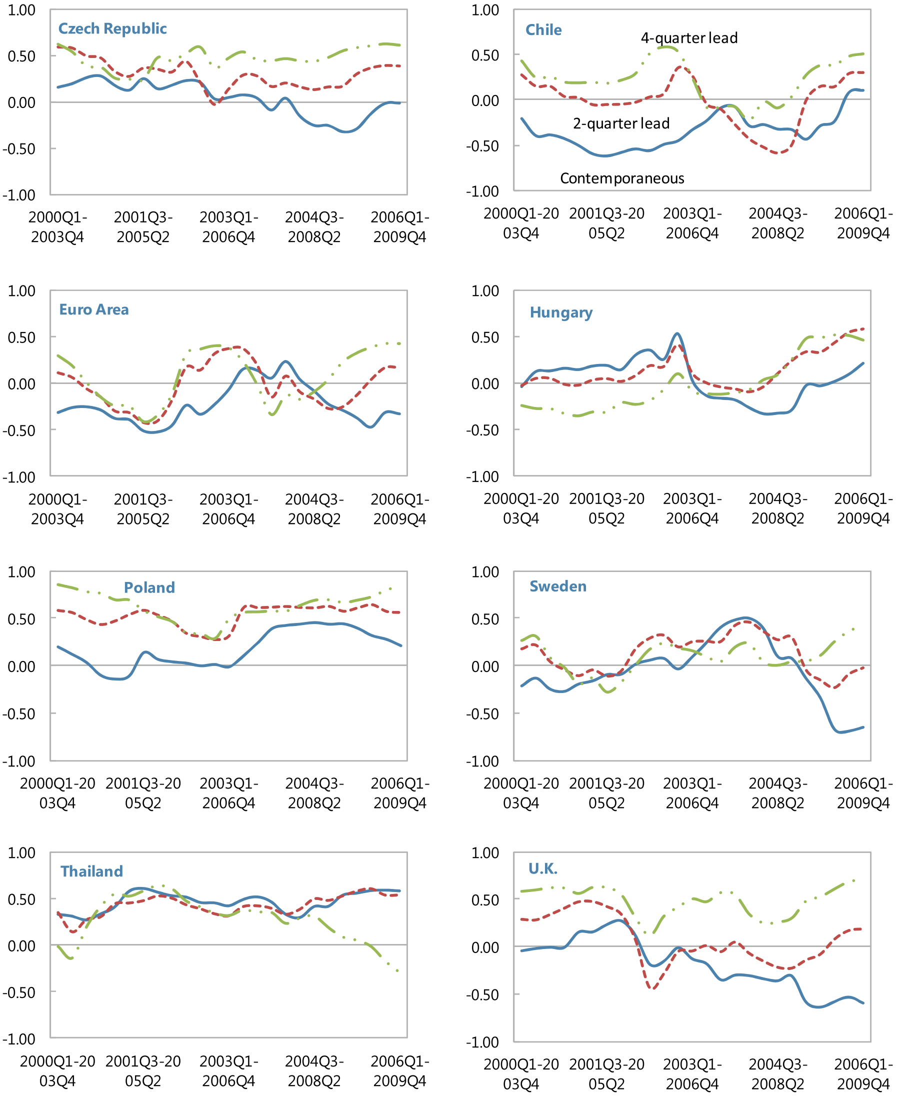
In this table we evaluate the 16-quarter rolling window correlation coefficients (Pearson, r) between the reported and model-identified inflation factors for all sample countries. Specifically, we ask whether the full-sample estimates (i) exceeded the threshold of 0.2; (ii) were stable during the sample period, that is, if $r > 0.2$ was satisfied during the full sample and also during the 2000–2004 and 2005–2009 subsamples; and (iii) whether the reported factors were mostly forward-looking, that is, leading the model-identified factors (FL), backward-looking (BL), or both. In brackets we indicate the number of quarters; negative signs indicate lags of reported factors; contemporaneous correlations are denoted as forward-looking

Source: Authors' calculations; detailed data for individual countries are available on request

variance of inflation. The lack of FL reporting in some countries reflects the practice of not reporting policy-driven price adjustments until their execution: such changes are subject to cabinet and parliamentary approvals and their implementations have often been postponed or watered down.

4.2.3 Exchange Rate Factors

The exchange rate factors were the second-most consistently identified factors, mostly in an FL manner, with a 2-to-4-quarter lead. They were unstable for Chile and the Euro Area and insignificant for Sweden. The Bank of Thailand did not make FL statements,



Source: Authors' calculations.

Notes: The green and red lines denote correlations between the current-period model-identified factors and verbal factors leading by 4 and 2 quarters, respectively; the blue lines denote contemporaneous correlations.

Fig. 3 Consonance between reported and model-identified factors, 2000–09. (16-quarter rolling window, Pearson correlation coefficient)

whereas the ECB made FL statements initially, while stressing contemporaneous statements later. In the three Central European countries these were the most consistently identified factors, presumably reflecting the importance of the exchange rate channel. The differences seem to reflect central banks' communication strategies.

4.3 Policy Implications: Glass Half Full or Half Empty?

While the sample banks identified on average the thrust of the inflation factors, the occasional failures – across subcategories, countries, and time – are a reason to remain alert. The analytical power of monetary policy reports cannot be taken for granted and should be regularly evaluated, both internally and externally. The goal of such reviews is to identify past errors and learn from them. Most central banks are subject to such reviews, although they take different forms. The Swedish parliamentary Committee on Finance conducts an annual evaluation focused on the last 3 years and external evaluations are conducted every 5 years (Svensson 2009). The annual “ECB Watchers’ Conference” organized by the Center for Financial Studies in Frankfurt, fulfills a similar role for the Euro Area (http://www.ifk-cfs.de). In others, such reviews are done internally, typically on an annual basis.

The reviews should focus on two reasons that lead to identification failures of inflation factors. First, measurement errors, whereby the forecasting frameworks occasionally fail to generate the “believable” factors. Second, policymakers may knowingly report inflation factors different from those observable in the real-time data owing to their own political agenda, outside pressure, or reputation protection. Policymakers may aim for opportunistic disinflation or try to explain away bad policies by supply-side shocks. Needless to say, the second type of failures is difficult to address if the policymaker is seen as being “above criticism”.[10]

5 Conclusions

Communication about inflation that is consistent with empirical analyses is more likely to anchor inflation expectations than communication that contradicts such analyses. We assessed the quality and reliability of monetary policy reports by comparing reported inflation factors with ex-post model-identified factors, interpreting positive correlations as indicating high-quality reports. We used the new Keynesian reduced-form model to generate model-identified inflation factors for a sample of eight central banks with clearly defined inflation objectives and transparent communication.

Our results suggest that the reported inflation factors correlated with those identified from the new Keynesian model, generally with a lead of two quarters. When disaggregated, the reported and model-identified factors agreed in about one-half of all cases, with misses concentrated in the aggregate demand category. We relate such breakdowns to measurement errors in the banks’ forecasting frameworks, our de-coding of monetary policy reports, and to central banks occasionally reporting inflation factors different from those observable in the real-time data owing to the policymakers’ own agenda. The policy implication of our findings is clear: the analytical power of inflation reports cannot be taken for granted and need to be periodically evaluated.

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[10] Candid internal reviews are certainly possible; see, for example, Czech National Bank (2009).

Pierre Siklos and from participants at the 13th Annual VERC Conference at Waterloo, and IMF and CNB seminars. Keith Miao, Radu Păun, Rungporn Roengpitya, and Caroline Silverman provided excellent research assistance. The views expressed in this paper are those of the authors.

Appendix 1: Coding the Monetary Policy Reports

We extracted forward-looking verbal assessments and coded the presumed direction thereof on inflation. Each entry was reviewed and checked by two co-authors to ensure consistency and limit subjectivity, with less than one-tenth of the initial entries being reassessed. The ternary coding of inflation factors, −1, 0, +1, proceeded in two steps. First, each comment was catalogued into a major category and a subcategory: *demand* (fiscal, domestic cycle pressure, wages, external demand, domestic asset price bubbles, other), *supply* (weather and similar shocks, oil/gas prices, agricultural prices, labor supply, regulated prices, structural changes, retail competition, indirect taxes, other), or *external* (exchange rates, global financial shocks, other). Second, factors putting upward/downward pressure on inflation were denoted as +1/−1 and neutral/unclear factors were denoted as 0.

Below are typical examples of our coding. The March 2003 *ECB Monthly Bulletin* contained the following sentence: “the moderate pace of economic growth should reduce inflationary pressures” and was coded as −1 in the demand category. The January 2003 issue noted “increases in administered prices,” and was coded as +1 in the supply category.

Table 5 Sample country characteristics

Country	Inflation targeting introduced	Name, frequency, and availability of reports	Sample period for model simulations
Chile	1991	Monetary Policy Report, three times a year; http://www.bcentral.cl	1994–2011
Czech Republic	1998	Inflation Report, four times a year; www.cnb.cz	1996–2011
Euro Area	Not an inflation targeting central bank	Monthly Bulletin, 12 times a year; http://www.ecb.int	1996–2011
Hungary	2001	Quarterly Report on Inflation, four times a year; www.mnb.hu	1995–2011
Poland	1999	Inflation Report, Three-to-four times a year; www.nbp.pl	1995–2011
Sweden	1993	Monetary Policy Report, three times a year; www.riksbank.com	1994–2011
Thailand	2000	Monetary Policy Report, four times a year; www.bot.or.th	2000–2011
United Kingdom	1992	Inflation Report, four times a year; http://www.bankofengland.co.uk	1999–2011

Source: National central bank websites; World Economic Outlook

Appendix 2: Inflation Accounting

For each country we build a country-specific NK model, see Bulíř et al. (2014) for the model structure and calibration details, and then solve it for its reduced form, substituting non-predetermined forward-looking variables with a linear combination of past shocks. The reduced-form of the model serves as a starting point for the estimation of economic shocks using the multivariate (Kalman) filter and the filter extends the model's reduced form to measurement equations that map observed variables to the unobserved ones:

$$y_t = Zx_t + \varepsilon_t \tag{1}$$

$$x_t = Tx_{t-1} + \nu_t, \tag{2}$$

where x denotes the vector of unobserved state variables, y is the vector of observed (measurement) variables, ε is the process noise, and ν is the measurement noise. Conditional on the state form of the model and the observed variables, the Kalman filter identifies all unobserved variables and shocks. For linear systems the Kalman filter represents an optimum estimate in terms of the least squares criterion (Hamilton 1994). As some variables are nonstationary, without finite value variances, we employ the diffuse Kalman filter. Finally, we employ the smoothing step of the filter using the complete information (Harvey 1989).

The estimated realizations of various shocks are used for historical simulations of the model, quantifying their exact time-varying effects on inflation as in Smets and Wouters (2007). Deviations of inflation from its target are due to six unobserved components, each defined as a deviation from its steady-state value: aggregate demand, aggregate supply, the exchange rate, foreign variables, trends, and monetary policy. To this end, we recursively simulate the model using the estimated state variables, while adding only one particular sequence of estimated shocks. Inflation deviations from the target caused in the model simulation by one sequence of shocks are what we call model-identified inflation factors, capturing the interaction of each shock and the transmission mechanism. The recursive simulations are repeated for all sequences of shocks, providing us with estimates of the impact of demand, supply, exchange rate, and other shocks on the deviation of inflation from its target. By summing up all the inflation factors we recover the actual inflation rate.

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