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Forecasting Performance vs. Signals

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Abstract
Focusing on a set of central banks that publish their internal macroeconomic forecasts in real time enables one to shed light on the expectations channel of monetary policy. The main contribution of this paper is to assess whether central bank forecasts influence private forecasts. The response is positive for inflation forecasts in Sweden, the UK and Japan. To disentangle the sources of influence of central banks, two concepts are proposed: *endogenous influence*, which is due to more accurate central bank forecasts, and *exogenous influence*, which is due to central bank signals on either future policy decisions or private information. Original empirical evidence on the central bank forecasting performance relative to private agents is provided, and estimates show that in Sweden, more accurate inflation forecasts generate specific central bank influence that is different from the influence from signals. The publication of forecasts may therefore refer to two central banking strategies that aim to shape private expectations: forecasting or policymaking.

Keywords: Monetary Policy; Imperfect Information; Communication; Endogenous Influence; Exogenous Influence.

JEL Classification: E52, E58

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1. Introduction

In recent decades, there has been strong interest in transparency and information issues in monetary policy, with emphasis on the role of expectations in policy outcomes. The expectations channel of monetary policy has become increasingly important in the most recent macroeconomic models, which consider central banking as the management of expectations. Can central banks influence private expectations? Are central banks able to convey information to private agents? Is greater transparency sufficient to influence private expectations? What are the sources of influence of central banks? These questions are essential because they contribute to the assessment of the importance of one of the most uncertain and subtle channels of monetary policy.

A large body of literature has dealt with the costs and benefits of publishing forecasts, among which are Faust and Svensson (2001, 2002), Geraats (2002, 2005), Woodford (2005) and Eusepi and Preston (2008). With the development of inflation targeting policies, central bank forecasts have become a central tool of central bank communication. Theoretically, an influential central bank is supposed to make monetary policy implementation more effective due to its impact on private expectations, at least in terms of the interpretation of policy actions, reduction in transmission lags and reputation. However, few studies have empirically assessed whether central bank forecasts influence private forecasts. This question is important: Bernanke and Woodford (1997) and Muto (2011) reached opposite conclusions on the effects of the direction of the link between central bank forecasts and private forecasts. The former showed that a monetary policy that is influenced by private expectations could lead to indeterminacy, while the latter argued that when private forecasts follow central bank forecasts, policymakers must respond more strongly to expected inflation to achieve macroeconomic stability. In addition, focusing on the informative value of prices, Amato and Shin (2006) developed a model for influence; they emphasized that as the policymaker, the central bank shapes private expectations. Finally, central bank influence may cause private agents to stop forming their specific sets of information and only refer to information from the central bank. Morris and Shin (2002) argued that there might be a crowding-out effect of public information on independent sources of information.

The main contribution of this paper is to assess whether central bank forecasts influence private forecasts in five countries: Sweden, the United Kingdom, Canada, Japan, and Switzerland. These are countries in which central bank forecasts are published in real time. We focus specifically on this set of communicating central banks because they make their macroeconomic forecasts public, which enables the emphasis of the expectations channel and the influence of central banks. Some studies have tested whether central bank forecasts or the degree of central bank transparency have impacts on private forecasts. Fujiwara (2005) showed that the Bank of Japan influences private forecasts, while Ehrmann, Eijffinger and Fratzscher (2009) analyzed whether central bank transparency reduces dispersion in private forecasts. However, both analyses focused on the dispersion of forecasts. In this paper, we evaluate the influence of central bank forecasts on private forecasts and provide original empirical evidence on the direction of the leader-follower scheme of the monetary process.

In related analyses, Levin, Natalucci and Piger (2004), Gürkaynak, Levin and Swanson (2010), Jansen and De Haan (2007), Cecchetti and Hakkio (2009) and Capistran and Ramos-Francia (2010) assessed the effect of increased communication and transparency on private expectations. Crowe (2010) found that inflation targeting adoption leads to better private forecasts. Kelly (2008) found that in the UK, the link between inflation and inflation expectations disappears after the implementation of inflation targeting[1] and forecast communication, and that private expectations are better anchored in this situation. Boero, Smith and Wallis (2008) found that private forecasters tend to follow the GDP growth forecasts of the Bank of England. The present paper focuses specifically on the quantitative communication of central banks: their macroeconomic forecasts, and proposes to assess whether private and central bank forecasts influence each other.

If central bank forecasts influence private forecasts, then the next question is why this is the case. This paper proposes a distinction to disentangle the sources of central bank influence. Central bank forecasts may influence private forecasts because they are more accurate or because they convey signals. We first define endogenous influence as the central bank forecasting influence arising from superior central bank forecasts. It is rational for private agents to follow a central bank if the central bank has a better forecasting record because it enables them to improve their forecasts of future macroeconomic variables. Second, we define exogenous influence as the influence stemming from central bank signals, either on future policy decisions or on private information, independent of the central bank forecasting performance. In an environment of imperfect information, it is optimal for private agents to form their forecasts based on central bank forecasts even if the information is noisy because these forecasts could contain useful information for private agents.

This proposed distinction enables the disentanglement of whether central bank forecasts influence private forecasts because of the quality of the forecasts or because of the signals that are sent. In terms of general economic implications, this distinction is important because endogenous influence would drive private expectations toward the true value of variables, whereas exogenous influence would drive them away. In terms of policy implications, this distinction could be important for uncovering the sources of the influencing ability of private expectations through forecast communication. The shaping of private expectations could result from two different strategies, both of which are based on publishing central bank forecasts: forecasting or policymaking. Central bank forecasts could be published to give a more accurate vision of the economic outlook, or they could be used as tools by policymakers to send policy signals or reveal private information. Therefore, the theoretical implications for aggregate dynamics and the policy implications for central banks to manage private expectations and to stabilize their objective variables may be essential.

To shed light on the sources of influence, the second step of this paper is to provide original empirical evidence on the relative forecasting performance of these five central banks, which publish their forecasts in real time, compared to private agents. Because this is a situation in which central bank information is published, and information is supposed to be symmetric, it also enables the assessment of whether more accurate central bank forecasts are compatible with forecast communication or depend on low transparency. Many authors, following the seminal work of Romer and Romer (2000), have assessed the relative forecasting performance of the US private sector and the Federal Reserve, a central bank that publishes[2]

[1] Coibion and Gorodnichenko (2010) suggest that there is no robust evidence that inflation targeting increases inattention in inflation expectations of private forecasters.

[2] It may be argued that the Federal Reserve is not a less transparent central bank because it releases its policymaker (FOMC) forecasts twice per year with a three-week lag, in addition to its statements and minutes. However, Gavin and Mandall (2001) and Romer and Romer (2008) show that those forecasts do not contain useful information to predict future outcomes. Thus, the Federal Reserve is transparent and releases its non-predictive forecasts (FOMC forecasts), which have policy contents, while it publishes its predictive forecasts (Greenbook forecasts) after a five-year embargo. The five-year embargo confirms that the Greenbook forecasts have some value added. In the end, analyzing whether this relative opacity is good or bad is beyond the scope of this work.

its Greenbook forecasts after five years, thus benefiting from an informational advantage. However, this study has not been extended to communicating central banks. Finally, the third step consists of assessing whether the weight put on central bank forecasts by private agents is conditional on their relative accuracy. The proposed distinction between both sources of influence rests on the hypothesis that more accurate central bank forecasts cause specific central bank influence independently of policy signals and the central bank private information that is revealed through central bank forecasts.

This paper exploits data collected from five developed countries in which central banks are credible without inflationary bias and communicate their macroeconomic forecasts in real time. More precisely, these central banks publish their forecasts with very short delays. Private agents do not always know the central bank forecast when they form their own forecasts, but the central bank forecast of the previous quarter is always available. Surveys of Consensus Forecasts (CFs) are used for private sector forecasts as well as Prospera AB in Sweden for robustness purposes.

Central bank forecasting influence is identified with influence tests for fixed events, taking into account the effect of new information released between forecasts at date *t-1* and forecasts at *t* following the methodology used in finance literature for fixed horizons. The results constitute original empirical evidence and are straightforward for three out of five countries: Sweden, the UK and Japan, in which central bank inflation forecasts influence private forecasts. There is no evidence of central bank influence in Switzerland or Canada. These estimates are robust to different horizons and lags and to timing and sampling variability issues. Finally, there is no empirical support for the influence of private forecasts on central bank forecasts.

The relative forecasting performance of central banks and the private sector is assessed through unconditional and conditional comparisons, following Romer and Romer (2000). We found that one out of five communicating central banks, the Riksbank from Sweden, has more accurate inflation forecasts. This result is robust to many specifications and datasets. This finding suggests that while its forecasts are public information, the Riksbank may have a specific competence in gathering or processing information between each forecast's release, reconstituting a private information set. Superior forecasting performance is then compatible with high transparency. The third series of estimates tests whether central bank influence is dependent on the central bank forecasting performance in the case of Sweden and shows that more accurate inflation forecasts cause central bank influence.

These outcomes suggest that the proposed distinction makes sense to disentangle the sources of influence in the cases of Sweden, and of the UK and Japan. The central bank of Sweden influences private forecasts through the quality of its inflation forecasts, while the latter needs no forecasting advantage to influence private expectations and use signals. These findings raise interesting implications for the rationale and policy of forecast communication.

The rest of this paper is organized as follows: section 2 describes the distinction between the sources of influence. Section 3 presents the data. Sections 4, 5 and 6 focus on the estimation of central bank influence, their relative forecasting performance and their relevant interactions. Section 7 concludes the paper.

However, it is reasonable to consider that the Federal Reserve is less transparent concerning its predictive (Romer and Romer, 2000; 2008) projections.

2. Endogenous and Exogenous Sources of Influence

This section describes the theoretical framework of the subsequent empirical analysis. The considered environment supposes rational expectations and imperfect information. The central bank communicates its macroeconomic forecasts to the public, which may include them based on their marginal utility in its forecasting function. Moreover, persistent forecast errors of both the central bank and private agents are possible due to information. This paper is articulated around two questions:

1. Do central bank forecasts influence private forecasts?
2. If yes, why? What are the sources of central bank influence?
   a. Is it because central bank forecasts are more accurate?
   b. Is it because central bank forecasts convey signals?

Let us suppose that the central bank forecast, called $E_t^{CB} y_{t+h}$, is the forecast of the central bank made at date t for a variable y (either inflation or real GDP) at date $t+h$:

$$E_t^{CB} y_{t+h} = (y_{CB} + \varepsilon_{CB} + s) \mid I_{CB}, \tag{1}$$

where y_{CB} is the central bank's private signal on the future realization of the variable y, ε_{CB} is the noise associated with this signal, s is a stochastic term representing the policy signal[3] the central bank may want to disclose to the public, and I_{CB} is the information set of the central bank available at date t (does not contain the current inflation or GDP because the central bank and private agents forecast current variables; this is case h=0). The average absolute forecast error is denoted $\sigma_{CB} = \frac{1}{n}\sum_{1}^{n}(\mid E_t^{CB} y_{t+h} - y_{t+h} \mid)$, where n is the sample size.

Private agents observe their own private signal, y_{PS}, on the future realization of a variable y and central bank forecasts and form their own forecasts as a linear combination of both:

$$E_t^{PS} y_{t+h} = \alpha(y_{PS} + \varepsilon_{PS} \mid I_{PS}) + \delta(E_{t-1}^{CB} y_{t+h+1}), \tag{2}$$

where $E_t^{PS} y_{t+h}$ is the forecast of the private sector made at date t for a variable y (either inflation or real GDP) at date $t+h$, y_{PS} is the private sector's private signal on the future realization of the variable y, ε_{PS} is the noise associated with this signal, I_{PS} is the information set of private agents available at date t, and $E_{t-1}^{CB} y_{t+h+1}$ is the forecast made at date $t-1$ by the central bank for horizon $t+h+1$ (the forecast made on the same date is not necessarily available to private agents, as shown in section 3; the focus is therefore on forecasts that are definitely available to private agents). The average absolute private forecast error is denoted as σ_{PS}. Central bank forecasts might enter the private forecasting function (and then influence private agents) for two reasons: (a) the good forecasting performance[4] of future realized variables by the central bank or (b) the content of signals of central bank forecasts.

We therefore define *endogenous influence* as the central bank forecasting influence arising from more accurate central bank forecasts. Central bank forecasts might have lower forecasting errors than private forecasts and might therefore be used by private agents to

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[3] Whether the final objective of central bank forecasts is to produce good forecasts or to disclose policy signals is beyond the scope of this paper. For more on this topic, see the debate between Romer and Romer (2008) and Ellison and Sargent (2010) for FOMC forecasts.

[4] The interaction between central bank influence and relative forecasting performance highlights two other situations in addition to endogenous and exogenous influences. They are the situation where the central bank has no forecasting advantage and does not influence private agents and the situation where the central bank has a forecasting advantage but does not influence private agents, which reveals either a communication problem or a weak reputation of the central bank.

produce more accurate forecasts of the economic outlook. The mechanism characterizing endogenous influence appears simple and sound, and one would expect that rational private agents would be influenced by the central bank if it has a better forecasting record[5] when forming their own expectations. In addition, one might suppose that relatively better central bank forecasts would enhance its credibility and therefore further legitimize its capacity to influence. Endogenous influence would then be characterized by the following proposition: central bank forecasts influence private forecasts because they are more accurate, or:

$$\delta > 0 \because \sigma_{CB} < \sigma_{PS}$$

We define *exogenous influence* as the central bank forecasting influence arising from the content of signals from central bank forecasts. Central bank forecasting influence is labeled *exogenous* to the extent that it is independent of the central bank's forecasting performance. Central bank forecasts might therefore convey signals on policymakers' preferences, objectives, future decisions or strategies and on their private information.

First, the publication of forecasts allows the dissemination of information about the preferences, models and objectives of the central bank[6] and justifies the following behavior of private agents who are able to infer future intentions (Geraats 2005 or Woodford 2005[7]). Central bank forecasts may therefore be influential not as forecasts *per se* but as signals of future policy decisions, even if published forecasts are unconditional, and central bank communication is not pre-commitment. Gürkaynak, Sack and Swanson (2005), Swanson (2006) and Orphanides and Wieland (2008) provide empirical evidence that policymakers' forecasts in the US convey signals on future policy decisions.

Second, central bank forecasts may be influential if the information sets that are used to construct the forecasts are not nested. Influence might also derive from the statistical properties of the forecasts because they contain specific information. Even if the central bank forecast errors are larger than those of private agents, it might be optimal for private agents to update their own forecasts after the publication of central bank forecasts as long as they could contain marginal information outside the information set of private agents. Exogenous influence is characterized by stating that it is rational that the weight placed on central bank forecasts is positive when central banks send signals and/or information sets are not nested:

$$\delta > 0 \, if \; s \neq 0 \vee I_{CB} > I_{PS}$$

Moreover, a key difference between these two types of influence is that exogenous influence is exclusive, whereas endogenous influence is non-exclusive, according to the criteria of the superior accuracy of central bank forecasts. An endogenously influential central bank could also send signals as long as they do not deteriorate its forecast accuracy below the level of accuracy of private forecasts.

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[5] One might suppose that the mechanism of endogenous influence might be self-maintained. If a central bank has a forecasting advantage (for any reason), then private agents will not invest in information processing because they know that central bank forecasts are more accurate. They will be influenced by these central bank forecasts. Because the private agents do not improve their forecasting ability, it makes their future forecasts inferior to those of the central bank and justifies the fact that they follow the forecasts of the central bank.

[6] Exogenous influence may attest to the credibility[6] of the monetary policy regime and arise from coordination games between economic agents to form their expectations in a context of imperfect information and higher order expectations. In a similar context, Phelps (1983), Wilson and Rhodes (1997) and Demertzis and Viegi (2008) show that monetary policy can be viewed as a coordination game between the central bank and private agents, that a commonly accepted leader provides a focal point for followers and that monetary policy with quantitative communication might provide individuals with better anchors for coordinating their expectations, respectively. Diron and Mojon (2008) provide empirical evidence of the notion of central bank targets as a focal point for expectations to converge.

[7] See Walsh (2007) or Baeriswyl and Cornand (2010), who focus on the signaling role of central bank actions.

The test for endogenous influence consists of assessing whether the weight placed on central bank forecasts can be decomposed between the effect of superior forecasts (the fact that $\delta > 0$ *because* central bank forecasts are better) and the effect of signals. Endogenous influence requires the testing of whether influence, δ, is conditional to superior forecast accuracy. The test for exogenous influence would assess whether the weight of central bank forecasts is higher than the weight justified by the signal precision.

Combining these relationships to the data requires some identifying assumptions: (i) because the precision of policy signals is not quantifiable, it is assumed that when central bank forecasts are not more accurate, a positive and significant weight characterizes an influence from central bank signals, independent of the forecasting performance; and (ii) to test for endogenous influence, it is assumed that private agents decide to incorporate or not incorporate central bank forecasts based on an index of the forecasting performance for the previous period (not the average performance) to obtain variations from the data and disentangle periods of better or worse forecasting performance and their effect on δ. The empirical analysis is therefore structured into three questions:

1. Do central bank forecasts influence private forecasts, i.e., $\delta > 0$?
2. Are central bank forecasts more accurate, i.e., $\sigma_{CB} < \sigma_{PS}$?
3. Does central bank influence depend on its forecasting record, i.e., $\delta > 0 \because \sigma_{CB} < \sigma_{PS}$?

The proposed distinction consists of disentangling the sources of the central bank's influence and whether the influence arising from better forecasting performance can be differentiated from the influence due to signals alone. This distinction is important because it would enable the differentiation of influence moving private expectations toward the fundamental value of future variables from the opposite: a self-fulfilling, expectations-based value. In the case of exogenous influence, central bank forecasts are influencing but move private expectations away from the fundamental value of variables. This distinction refers to the rationale for publishing central bank forecasts. The core reason for publishing these forecasts is to shape private expectations, and section 4 attempts to shed light on this issue. However, the shaping of private expectations can be accomplished in various ways, and the main implication of the proposed distinction is to suggest that the publication of central bank forecasts stems from two different strategies: forecasting or policymaking. Central bank forecasts may be published to provide a more accurate vision of the economic outlook, or they may be used as tools by policymakers to send policy signals or reveal private information.

3. Data

In this paper, we focus on five developed countries[8] for which the central bank publishes forecasts: Sweden, the UK, Canada, Japan and Switzerland. Some initial and general remarks are made before the focus turns to diverse issues raised by forecast characteristics.

[8] ECB is absent from this study because it started to publish its Eurosystem Staff Macroeconomic Projections only recently and only on a semi-annual basis. In addition, Svensson (2000, 2001) argues that these forecasts are inferior to those of inflation targeting central banks because they involve all national central banks, not only the ECB staff or the Executive Board. The Federal Reserve's policy for data explains its absence in this comparison: with the five-year embargo on central bank forecasts, it is pointless to assess the potential forecasting influence of the Greenbook forecasts.

3.1 Preliminary remarks

First, the focus is on central banks that publish their forecasts in real time, i.e., with very short delays. Private agents do not always know the central bank forecast when they form their own forecasts, but the central bank forecast of the previous quarter is always available.

Second, the private forecasts are those of the CF's surveys. The mean of the point forecasts[9] collected are considered throughout this investigation, while individual forecasts are used for the robustness analysis.

Third, two types of forecasts exist: the fixed-event scheme and the fixed-horizon scheme. CFs provide both, while the central banks of Sweden, the UK and Canada focus mostly on fixed-horizon forecasts (however, they also publish fixed-event forecasts), and the central banks of Japan and Switzerland[10] only publish fixed-event forecasts. Fixed-horizon forecasts have many advantages: they provide more observations and possibilities of comparison, and they are not contaminated by the effects of varying lead times. It is generally believed that fixed-horizon forecasts are the most appropriate format to compare forecasts. Therefore, throughout this paper, we focus on fixed-horizon forecasts for Sweden, the UK and Canada and on fixed-event forecasts (for the current and future years) for Japan and Switzerland.

Fourth, the sample data[11] start in 1999Q3 and end[12] in 2007Q4. The relatively small size of the time dimension of the overall sample is compensated for by the number of different forecasts for various horizons available for each date. Small samples lead to greater standard errors and because the empirical tests consist of testing whether the coefficients associated with central bank forecasts are positive and significant, the bias goes against the identification hypotheses, and the evidence supporting the hypotheses would be even more significant. Further details on the characteristics of each dataset are provided in Appendix A.1.

Fifth, the period considered here falls within the Great Moderation period and predates the impact of the commodities prices' rise and fall as well as the financial and economic crisis. It could then be argued that the task of forecasters was made easier during this period. However, even if this were true, we compare forecasters' performances *ceteris paribus*. Stock and Watson (2007) show that this assumption is not relevant because it is very difficult to beat simple and naïve forecast models during periods of macroeconomic stability. Inflation should have become easier to forecast with the drop in volatility, but is more difficult because it now evolves as a random walk. Discrepancies between the private sector and the central bank over a stable sample would then be even more significant.

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[9] Engelberg, Manski and Williams (2009) find point forecasts to be generally more optimistic (lower inflation and higher output growth) than the corresponding density forecast mean. However, Boero, Smith and Wallis (2008) note that analyses of errors in the density forecast mean and in point forecasts are similar.

[10] The Swiss National Bank recently started to publish fixed-horizon forecasts in addition to its fixed-event forecasts. Therefore, forecasts for the next twelve quarters have been available since 2008Q3.

[11] Stationary tests have been conducted for each group of series: the null hypothesis that each variable assumes a unit root process is always rejected at the 10% level (usually at the 5% level). The investigation is conducted with the Augmented Dickey-Fuller's and Phillips and Perron's tests. The latter proposes an alternative (nonparametric) method of controlling for serial correlation when testing for a unit root. These results are available upon request.

[12] We voluntarily excluded 2008-2009, during the financial and economic crisis, for which the forecasting performance of private forecasters has been extremely poor and whose inclusion would have automatically biased the results in favor of central bank forecasts. Concerning this phenomenon, Kishor (2010) shows that recessions favor the superiority of Greenbook forecasts when analyzing its relative forecasting performance.

3.2 Central bank forecasts: staff or policymakers?

In Sweden, the UK, Canada and Switzerland, the publication of forecasts is made through formal *Inflation Reports,* while forecasts in Japan are published in the *Outlook for Economic Activity and Prices* and reflect each Policy Board member's forecast. More precisely, Riksbank's forecasts are produced by the staff and revised by the Executive Board; they are a mix of technical and judgment approaches. The Bank of England's forecasts are made by the staff and agreed upon by the Monetary Policy Committee. They note that this is not a mechanical exercise: they use a model to help them produce these projections, but the final forecast involves some judgment. In Canada, the published forecasts are staff projections and include a recommendation on the appropriate level of the key policy rate. Alternative scenarios are also provided. In Switzerland, forecasts involve staff and policymakers. Finally, in Japan, the forecasts that are made available to the public are those of policymakers only. Globally, these five central banks, which communicate their forecasts in real time, publish staff forecasts that are revised by policymakers in Sweden, the UK and Switzerland, staff forecasts in Canada and policymaker forecasts in Japan. Ellison and Sargent (2010), in response to Romer and Romer (2008), support the idea that policymakers' forecasts have stronger strategic and policy contents than staff forecasts, which are predictions of future outcomes.

3.3 Central bank forecasts: Which interest rate scenario?

There are three potential scenarios on which central bank forecasts may be based: the constant interest rate, the interest rate expected by financial markets, and the central bank's projected interest rate. The former two give rise to *conditional forecasts* (because they are conditioned on a path of interest rates that does not usually match the central bank's projected interest rate), while the latter generates *unconditional forecasts*. By construction, conditional forecasts are not the best predictors of future outcomes. Moreover, it appears from the literature that unconditional forecasts should be preferred, as Woodford (2000) argues that central bank forecasting based on private expectations gives too much weight to forward-looking variables. Faust and Leeper (2005) show that unconditional forecasts are more effective communication tools than conditional forecasts. Faust and Wright (2008) provide specific tests for conditional forecasts and consider that these types of forecasts "represent a substantial impediment to the analysis of their quality"[13].

The Riksbank's forecasts from Sweden were based on a constant interest rate scenario before October 2005 and on implicit forward rates until February 2007 (the interest rate expected by financial markets). Since then, the forecasts have been based on its preferred path for the future interest rate. The Riksbank publishes a fan chart of this projected path. The Bank of Canada also bases its forecasts on a projected path for its central bank rate but without releasing its trajectory. Forecasts in Japan and Switzerland are based on the assumption of a constant interest rate, while the Bank of England uses two scenarios[14]: a constant interest rate since 1993Q1 and a scenario based on the interest rate expected by markets since 1998Q1; it also publishes a fan chart of its projections.

These differences might make forecast comparisons difficult because the last three central banks produce conditional forecasts (scenario of a constant interest rate), and Riksbank has produced this type of forecast during most of the sample period. First, this type of forecast

[13] Other criticisms to conditional forecasts are that the procedure that is used to construct forecasts is different from the procedure that is actually used to determine interest rate setting to satisfy the target criterion, that forecasts therefore lack credibility and that constant and market interest rate scenarios are not consistent with the existence of a unique equilibrium in forward-looking models (Gali 2010).

[14] We report mean square forecasts errors of both scenarios but focus on the constant interest rate scenario.

penalizes the central bank's forecasting performance. The purpose of this investigation is to underline the superiority of central bank forecasts, so the bias goes against our hypothesis, and the evidence supporting the hypothesis would be even more significant. More importantly, if the delays of transmission of monetary policy are longer than the horizons of the considered forecasts, then regardless of the interest rate scenario, it may be reasonably argued that in the end, all of these forecasts are close to being unconditional. This empirical analysis therefore focuses on forecast horizons from the current quarter to four quarters ahead, whereas conventional wisdom states that monetary policy may show its real effect at 12 months for the GDP and between 18 and 24 months for inflation.

A focus on these shorter horizons resolves another issue. The central bank has an instrument that gives it some control over the forecasted variables. For instance, a central bank that has a good ability to manage inflation through interest rate movements may therefore have a good forecasting record. This bias is avoided when the horizon of forecasts is shorter than the transmission lag of monetary policy because the central bank has no effective control on variables forecasted and is in a symmetric position relative to private forecasters. Central bank forecasts therefore represent unbiased and uncontrolled predictions of future evolutions of inflation and GDP, for which it seems reasonable to assume that forecasters seek to maximize their predictions' accuracy.

3.4 Timing issue

The timing issue deserves some attention. Concerning the assessment of influence, we do not compare the forecasts within the same quarter, so the timing of publication within the quarter has no relevance for this specific question. The three influence tests described hereafter assess whether the forecasts of private agents made at quarter *t-1* influence forecasts of the central bank made at quarter *t* or are the opposite. Nevertheless, as the second mover publishes its forecasts later, it should contain more information (second mover advantage), and there might be a bias to the extent that the second mover's forecast should be more prone to influencing subsequent forecasts. We control for this effect in section 4.

When assessing the relative forecasting performance, we compare private and central bank forecasts within the same quarter, but both are not produced on exactly the same date, and this condition favors the central bank that publishes its forecasts second. It appears that in the UK, Japan and Canada, the private sector is the second mover, and it benefits from an informational advantage. As the focus of section 5 is to determine whether the central bank has superior forecasting performance, this bias goes against the central bank, so evidence in favor of the central bank would be even more convincing[15]. In the case of Sweden, in two quarters out of four, the central bank is the second mover, and in the two others, the private sector is the second mover. Therefore, there is no clear second mover advantage in this configuration, and we control for this issue. Because no specification makes central bank and private forecasts exactly comparable, the assessment of forecast accuracy in both cases enables us to test the validity of the Swedish result by deliberately putting the Riksbank in a disadvantaged position and evaluating whether it still outperforms private forecasts. For Switzerland, the central bank is always the second mover, and evidence in this case should be analyzed cautiously.

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[15] An alternative argument would be that with a one- or two month-gap (for Canada and the UK, respectively), the central bank forecasts *cannot* outperform private forecasts. As shown in Table 4, the timing correction placing the BoC in a deliberate timing advantage does not lead to a relatively better forecasting performance of the central bank. The same result appears when placing the BoE in a deliberate two-month timing advantage (estimates available upon request). This finding confirms that the timing configuration is not responsible for the relative forecasting performance of these central banks.

4. Do Central Bank Forecasts Influence Private Forecasts?

This section assesses whether central bank forecasts influence private forecasts, or from equation (2), whether δ is different from zero, independent of the relative forecast accuracy. The question of whether it is desirable for private agents to use more accurate forecasts to form their own expectations is beyond the focus of this paper. The focus of the following tests is on the influence of central banks and whether private forecasters place any weight on central bank forecasts.

4.1 Influence test for fixed events incorporating released news

We assess the influence of the central bank (resp. the private sector) through its forecasts for a *given* event in the determination of the private forecasts (resp. the central bank) for the *same* event but one period later.[16] In other words, this test may also be interpreted as the influence of the central bank forecasts (resp. private) on the revision of private sector forecasts. The equation estimated is the following, with *i* being the time lag:

$$(CB_t^h \text{ } or) \, PS_t^h = \alpha + \beta_I \cdot I_{t-1\leftrightarrow t} + \beta_{CB} \cdot CB_{t-1}^{h+1} + \beta_{PS} \cdot PS_{t-1}^{h+1} + \varepsilon_t \, , \quad (3)$$

where CB_t^h is the central bank forecast made at date *t* for *h* horizons later, and PS_t^h is the equivalent for the private sector. The potential influence of central bank forecasts is assessed regarding whether for each specification, the coefficient β_{CB}, which is associated with the central bank forecast to determine the private sector (PS) forecast, is significantly different from zero and vice versa[17].

The variable $I_{t-1\leftrightarrow t}$ represents the information set released between dates *t-1* and *t* to test that the influence is robust to the inclusion of the news released between date *t-1*, when the first forecasts are made, and date *t*, when the potentially influenced forecasts are made. This specification with a news variable allows us to distinguish between the influence from previous forecasts and the influence from the news released during this time interval. The variable $I_{t-1\leftrightarrow t}$ is constructed as the difference between the actual data in *t* and the forecast for *t* made in *t-1*, following the literature on the impact of economic news (Pearce and Roley (1985), McQueen and Roley (1993) and Balduzzi, Elton and Green (2001)), which assume that a variable of economic data announcements could be computed as the difference between realized values and forecasted values.

Table 1 displays the benchmark influence[18]. For Sweden, it clearly shows for the Consumer Price Index (CPI) that private forecasts are never significant when the central bank forecasts are the dependent variable, while the latter is significant at 1% in the private sector equation. Concerning the GDP, there is no robust pattern to evidence central bank influence (only coefficients for h=0 and h=1 are significant). For the UK, it shows that for the RPIX[19] and CPI-H, there is a strong influence of the central bank because forecasts are very significant for the determination of private forecasts, but the inverse is not true. For the GDP, there is only weak evidence of central bank influence (which was not confirmed by robustness tests). For Canada, in the base specification (for which there is a timing advantage of 2 months for CFs),

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[16] Due to differences between the frequency of publication and the horizon of forecasts, the forecast for the next horizon (the next year) that is supposed to give information on the forecast for the current year is shifted back 4 periods for Switzerland (quarterly publication) and 2 periods for Japan (biannual publication).

[17] To make sure that results are not a statistical artefact because forecasts may be highly correlated, we always estimate the opposite equation to estimate whether private forecasts (with respect to central bank forecasts) influence those of the central bank (with respect to those of the private sector).

[18] Coefficients to be compared to determine influence are highlighted in bold type in Tables 1, 2 and 3.

[19] Retail Price Index (RPI) excluding mortgage interest payments.

private forecasts are sometimes significant for the CPI, but the effect vanishes when the timing correction specification is considered. There is no regular pattern that shows an influence from either side. For Japan, the outcomes are straightforward. Regardless of the forecasts for the CPI or GDP, the BoJ influences the private sector. These results are consistent with those of Fujiwara (2005). For Switzerland, this baseline estimation shows the influence of central bank forecasts but is not robust to complementary tests, as shown later.

One additional striking result is noteworthy: while in all countries except for the UK, private agents form their forecasts on the basis of the new information set released, private agents in the UK only consider central bank forecasts and do not use new information released during the interval of time between *t-1* and *t*. This finding suggests inefficient forecasting by private forecasters and somehow high credibility of the Bank of England.

4.2 Robustness analysis

First and foremost, small sample biases go against the estimation of the coefficients of central bank influence by increasing standard errors. In addition, to oppose the possibility that samples drawn from the same overall population would give different estimates, estimates are always provided for different horizons. If the same result appears for all horizons, we consider that the estimation of coefficients is not biased by sampling variability issues. We assume an outcome is robust when a pattern with similar results is evidenced for many horizons.

Two complementary tests[20] assess the robustness of the benchmark estimation: an influence test at fixed horizons and an influence test for fixed events with no news variable. The influence test at fixed horizons corresponds to a standard test of Granger-causality between private and central bank forecasts:

$$(CB_t^h \ or)\ PS_t^h = \alpha + \beta_{CB} \cdot CB_{t-1}^h + \beta_{PS} \cdot PS_{t-1}^h + \varepsilon_t \quad (4)$$

We test the hypothesis that central bank forecasts are significantly different from zero in the private forecast equation and not the opposite. While this test compares forecasts at the same horizon, for which there is a weak *practical* rationale that forecasts for the current (or next) quarter are influenced by forecasts on the previous date for the same horizon, this test is theoretically consistent because agents are supposed to incorporate all of the information available at date *t* in their decision-making process.

The influence test for fixed events with no news variable is extended to additional horizons *h* at lags *i* to assess the robustness of the results concerning the timing issue:

$$(CB_t^h \ or)\ PS_t^h = \alpha + \beta_{CB} \cdot CB_{t-i}^{h+i} + \beta_{PS} \cdot PS_{t-i}^{h+i} + \varepsilon_t \quad (5)$$

Table 2 presents the estimates of the influence test at fixed horizons, while Table 3 shows the influence test for fixed events with no news variable. The results are strongly confirmed for three central banks: the Riksbank (for the CPI), the Bank of England (for the RPIX and CPI-H) and the Bank of Japan (for the CPI and GDP). The forecasts of these central banks are always very significant to determine subsequent private forecasts.

In general, it is worth noting that influence is more significant from the nearest forecasts (those made in *t-1* and *t-2*), consistent with the hypothesis that agents form expectations with the largest and most recent set of information. Moreover, influence is more significant for

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[20] Estimates are only shown for the CPI in Sweden, the RPIX and CPI in the UK and the CPI and GDP in Japan, for which the benchmark estimation show evidence of influence. All other tables of these two tests are available upon request.

forecasts at very short horizons. Finally, evidence of some influencing ability of GDP forecasts is weak (except for the case of Japan). The latter two results seem to be related to the greater uncertainty of forecasting at long horizons or forecasting the GDP.

Concerning the timing issue, in the UK and Japan, the private sector is the second mover and has an informational advantage. In these cases, a bias should favor private sector forecasts to influence those of the central bank. The fact that there is no evidence of influence of private forecasts and robust evidence of central bank influence acts like a control for first/second mover effects and confirms the robustness of the results. In the case of Sweden, there is no clear second mover effect because the central bank and the private sector play each role half of the time, so the estimations should not be biased by this effect. However, as shown in Table 3, when one considers different previous quarters *t-1*, *t-2*, *t-3* or *t-4*, which represent a mix of cases where either the central bank is the second mover or the private sector is the second mover, the influence of central bank forecasts always remains significant, while there is no evidence in favor of private forecasts.

4.3 Discussion

The cases of Sweden, the UK and Japan provide evidence of the influence of central bank forecasts on private forecasts, mainly through inflation forecasts, while in Canada and Switzerland, there is no evidence of central bank influence. In other words, in the former three countries, central bank forecasts induce future revisions of private forecasts. The private sector revises its forecasts to bring them in line with central bank forecasts. These estimates provide original empirical evidence on the influencing capacity of central bank forecasts on private forecasts, which is a key issue for policymakers, and constitute empirical support for the wide theoretical literature that states that monetary policy is about managing private expectations. Moreover, regarding the literature on the direction of the leader-follower scheme of monetary policy, there is no clear empirical support for the influence of private forecasts on central bank forecasts. This does not mean that policymakers do not pay attention to private expectations or that monetary policy is not influenced by private expectations, but it suggests that central bank forecasts are not influenced in this way.

5. Sources of Influence: the forecasting performance hypothesis

This section assesses whether central banks produce better forecasts (from section 2, whether $\sigma_{CB} < \sigma_{PS}$) using two methods: unconditional comparisons with Mean Square Errors and conditional comparisons through regressions along the lines of Nelson (1972), Cooper and Nelson (1975), Fair and Shiller (1989, 1990) and Romer and Romer (2000). We provide results for both methods for all five countries and present the results of robustness tests[21] when benchmark estimates provide evidence of superior forecasting performance, as in the case of Sweden.

The analysis of the relative forecasting performance of central banks compared to the private sector[22] started with the seminal work of Romer and Romer (2000), who found that Greenbook forecasts are more accurate than private forecasts[23]. Outside the US, few studies

[21] Robustness tests for other countries are available upon request.

[22] Another recent strand of the literature compares the DSGE forecasting performance to either central bank forecasts or private ones: Smets and Wouters (2004), Lees, Matheson and Smith (2007), Edge, Kiley and Laforte (2010), Christoffel, Coenen and Warne (2010), Wieland and Wolters (2010) and Edge and Gürkaynak (2010).

[23] Gavin and Mandal (2001), Sims (2002) and Peek, Rosengren and Tootell (1998, 2003) supported this analysis. D'Agostino and Whelan (2008) and Gamber and Smith (2009) found that this advantage decreased recently, while

have assessed the relative forecasting performance of the central bank and the private sector. In the UK, Boero, Smith and Wallis (2008) analyzed the Survey of External Forecasters (SEF) and found that its average point inflation forecasts outperform the Monetary Policy Committee's forecasts. They noted that the SEF's error is smaller than any (regular) individual errors, supporting pooled surveys. Casillas-Olvera and Bessler (2006) found a similar result with density forecasts[24]. Finally, Andersson et al. (2007) showed that inflation forecasts of the central bank of Sweden[25] are more accurate than those from other institutions and simple statistical models. To my knowledge, there is no other empirical assessment of the relative forecasting performance of the central bank with that of the private sector.

5.1 Unconditional Comparisons: Mean Square Errors

The simplest method to compare forecast accuracy is to measure Mean Square Errors, which constitute unconditional comparisons. One advantage of this method is to be the most neutral or uncontroversial method. To calculate the *p-value* for the test of the null hypothesis that central banks and private forecasts MSEs are equal, we follow Romer and Romer (2000) and estimate this equation:

$$(Y_{t+h} - CB_t^h)^2 - (Y_{t+h} - PS_t^h)^2 = \alpha + \varepsilon_t \, , \tag{6}$$

where Y_{t+h} is the actual value of inflation or GDP growth, CB_t^h is the central bank forecast made at date t for h horizons later, PS_t^h the equivalent for the private sector, and α is the difference between the squared errors of forecasts of both actors. It allows the calculation of the standard errors for α, corrected for serial correlation with the Newey-West HAC method[26]. Robust *p-values* can be obtained for testing the null hypothesis that $\alpha = 0$ and determine whether forecast errors are significantly different.

5.2 Conditional Comparisons: Regressions

The second method consists of a regression of the actual variables on both central bank and private forecasts to assess whether some forecasts contain useful information to predict future realized values. This method is applied from Nelson (1972), Cooper and Nelson (1975), Fair and Shiller (1989, 1990) and Romer and Romer (2000) to quantify the marginal contribution of one forecast compared to another and assess to what extent knowing one of the forecasts enables the production of better forecasts. The estimated equation is:

$$Y_{t+h} = \alpha + \beta_{CB} \cdot CB_t^h + \beta_{PS} \cdot PS_t^h + \varepsilon_t \tag{7}$$

We test the hypothesis that central bank forecasts contain useful information if its associated coefficient β_{CB} is significantly different from zero and contain additional information compared to private forecasts if β_{CB} is superior to β_{PS} and is close to a value of one. Standard errors are also computed using Newey-West's HAC method to correct for serial correlation.

Joutz and Stekler (2000), Atkeson and Ohanian (2001), Faust, Swanson and Wright (2004), Baghestani (2008) and, to a lesser extent, Amornthum (2006), arrived at a different conclusion. Gavin and Mandal (2001) and Romer and Romer (2008) compared Greenbook forecasts (from the Federal Reserve staff) to Federal Open Market Committee (FOMC) forecasts, which are policymakers' forecasts. It appears that Greenbook forecasts outperform FOMC forecasts.

[24] Groen, Kapetanios and Price (2008) compared Bank of England (BoE) forecasts to real-time model forecasts but not to private forecasts. They found that simple univariate models perform better than BoE's GDP forecasts, while inflation forecasts of the BoE are strongly dominant.

[25] Adolfson et al. (2007) compare the forecasting performance of the Riksbank to that of the BVAR and DSGE models. The latter appear to outperform the former.

[26] In these regressions, the problem due to the correlation between forecast errors leads to the calculation of robust standard errors to serial correlation. When forecasts for four quarters ahead miss an unexpected change in the variable, there would cause forecast errors all in the same direction. Forecasts are then declared serially correlated. To deal with this problem, when considering forecasts for inflation h quarters ahead, the standard errors are computed by correcting for heteroskedasticity and serial correlation according to the Newey and West's *HAC Consistent Covariances* method.

Unconditional comparisons test which forecast is more accurate, while conditional comparisons test which forecast gives more information to correctly predict future variables given multiple forecasts. Because the focus of this section is on the relative performance rather than the absolute performance, and the focus of this paper is on the interaction between central bank forecasts and private forecasts, the analysis focuses on conditional comparisons. Moreover, the overall sample corresponds to the Great Moderation period. Therefore, significant evidence would be even more noteworthy because inflation and the GDP growth rate have been extremely stable in this sample. Finally, there is no credibility issue for the central banks considered here and no particular decisions that could favor central banks to the detriment of the private sector (Atkeson and Ohanian (2001) argue that private agents' view that the Federal Reserve will not succeed in fighting strong inflation in the beginning of the 1980s favored its relative forecasting performance).

5.3 Benchmark Results

Table 4 displays Mean Square Errors, and Table 5 displays regressions similar to Romer and Romer (2000). For Sweden, Riksbank's inflation forecast errors are smaller than those of the private sector but are similar for the GDP. Regressions confirm these findings for the CPI, while the evidence for the GDP is mixed and not robust, with the presence of a significant negative coefficient. This finding is probably due to the correlation between the two forecasts, and a robustness test is performed to confirm that this issue does not bias inflation estimates.

For the UK, forecast errors are globally very similar and not significantly different for inflation or the GDP. One can only note that for inflation at long horizons[27] (Q+4, Q+6), private forecasters have very little advantage over the Bank of England (BoE). This finding might be explained by the timing advantage of private agents. Regressions do not show evidence of superior forecasting performance. For Canada, one must keep in mind that the private sector benefits from a strong timing advantage. CFs produce slightly better forecasts at short horizons (current quarter and Q+1), but there is equivalent accuracy at longer horizons for both the CPI and GDP. The regression analysis shows that private forecasts have a weak advantage on short horizons (which is more visible for the GDP) with the base timing, while with the timing correction, there is no evidence of better forecasting performance in any case. For Japan, the results do not provide a regular pattern, and there is no evidence of superior forecasting performance. For Switzerland, there is no evidence of better forecasting performance of the central bank, especially given that the central bank is the second mover.

5.4 Robustness Analysis[28]

We assess the validity of the main positive outcome and test whether the superior forecasting performance of the central bank of Sweden is robust to the following:

(i) multicollinearity, following Granger and Newbold (1977), as central bank and private forecasts are correlated;

(ii) the inclusion of an autoregressive term of the dependent variable to assess whether central bank forecasts provide additional forward-looking information;

(iii) the partition of the sample between upward and downward economic phases because forecasts are usually known to have mean reversion properties (see, among others, Fama and Bliss (1987), Kim, Nelson and Startz (1991) and Kilian and Taylor (2003)) and fail

[27] This result is confirmed at the two-year horizon by the SEF. This table is available upon request.

[28] We only provide robustness tests for Sweden to confirm the superior forecasting performance of the Riksbank. For the other countries, these robustness tests are available upon request.

to forecast turning points (see Neftci (1982), Diebold and Rudebusch (1989), Hamilton (1989) and Lahiri and Wang (1994)). The first property could lead to a bias in the benchmark regression because the projections are underestimated in the upward phases and overestimated in the downward phases, while the second property shows large forecast errors when a turning point occurs;

(iv) the second mover informational advantage, as in the case of Sweden, where there is no clear second mover advantage: the central bank publishes its forecasts after the private sector in March and October and the private sector after the central bank in June and December;

(v) a comparison with individual forecasters composing the surveys of CFs, as Kim, Lim and Shaw (2001) show that surveys do not completely capture the full set of new information available to the pool of individual forecasts and therefore tend to reveal inefficiency;

(vi) another private forecast dataset by Prospera AB.

These tests are described in detail in Appendix A.2. These robustness tests confirm that the Riksbank's inflation forecasts are more accurate than private forecasts. All of the estimates are presented in Appendix A.3[29]. In addition to the robustness tests presented above, the figures of Appendix A.4 present the absolute forecasting errors across time of the Riksbank and CFs for the five horizons considered. Those graphs visually confirm the fact that inflation forecast errors are smaller throughout the sample. Private forecasts are generally worse, and the superiority of the Riksbank is not due to particular episodes or outliers[30].

5.5 The Swedish Puzzle

The better forecasting performance of the Riksbank may be considered as a puzzle, as forecasts are communicated to private agents and central bank information is therefore public. A different current-quarter forecast accuracy is justified because private agents and the central bank have different sets of information. However, for next-quarter forecasts, private agents should use published information. However, estimates show better forecasting performance for every horizon.

We test three hypotheses to explain this puzzle: *(i)* the low credibility of the central bank, which tempers private agents to use central bank forecasts; *(ii)* private agents' inability to extract information contained in central bank forecasts, either because these forecasts are considered as a black box or because of the large amount of data received by private agents, which they are unable to deal with; and *(iii)* the gathering of new information between each forecast's release by the central bank, which constitutes a new private information set.

The first argument is refuted by the influence of the Riksbank's inflation forecasts on private agents. We then test whether the private sector is able to incorporate either information released by the central bank's forecast or new information revealed between *t-1* and *t* by estimating equation (7) with a timing advantage for the private sector:

$$\pi_{t+h} = \alpha + \beta_{CB} \cdot CB_{t-1}^{h+1} + \beta_{PS} \cdot PS_t^h + \varepsilon_t \qquad (8)$$

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[29] In Table A.i, the R^2 of the univariate regressions shows a higher predictive power of the Riksbank's inflation forecasts. Table A.ii shows that the Riksbank's inflation forecasts are still significant and provide marginal forward-looking information when adding a lagged dependent term. Table A.iii confirms the main result when the sample is divided according to economic phases. Table A.iv focuses on the second mover informational advantage and shows that the central bank outperforms the private sector across both sets of results. Individual forecasts from Table A.v confirm that the superiority of the Riksbank is not only over the mean of the CF's respondents but also over each individual respondent. Finally, when comparing the Riksbank forecasts with Prospera AB's survey in Table A.vi, the CPI forecasts' errors of the central bank are lower than those from all respondents and are only similar to those from money market players at the two-year horizon.

[30] The equivalent graphs for other countries confirm the outcome that neither the central bank nor private agents have more accurate forecasts and are available upon request.

Table A.vii in Appendix A.5 exhibits significant β_{PS} and insignificant β_{CB}, which invalidates the hypothesis of low information processing and extraction capacity of private agents and so invalidates the second argument. Moreover, the previous section shows that private forecasts are influenced by central bank forecasts and confirms that private agents can extract information from central bank forecasts.
By the process of elimination, this analysis suggests that the superior inflation forecasts of the Riksbank stems from some expertise in gathering new private information (or a better use and information extraction of public data) between each forecast[31]. Therefore, the puzzle vanishes: if the central bank is better at collecting and analyzing data than private agents, it will update its forecasts for all horizons and continue to outperform private agents despite making its information public.

5.6 Discussion

This section provides evidence that the Riksbank's inflation forecasts outperform private forecasts. There is no evidence of any advantage for Canada and Japan, whereas for the UK and Switzerland, the evidence is mixed, and private agents seem to have slightly better inflation forecasts for long and short horizons, respectively. This finding is consistent with Boero, Smith and Wallis (2008), who showed that private inflation forecasts outperform BoE forecasts at long horizons. In general, the relatively good forecasting performance of surveys legitimizes the choice to consider them as proxies of private forecasts[32]. Moreover, Blix, Wadefjord, Wienecke and Adahl (2001) made a comprehensive study on the forecasting performances of 250 major institutions and found, among other patterns, that growth is more difficult to forecast than inflation. This result was confirmed for 4 out of 5 analyzed countries, with the central bank and private agents in Canada having a better record for GDP forecasts. Finally, D'Agostino and Whelan (2008) and Gamber and Smith (2009) found less evidence of Greenbook superiority in the US during small and recent stable samples. The fact that the result by Romer and Romer (2000) was dampened during short and recent samples reinforces the findings of the Riksbank's superior forecasts on the short and stable sample of the 2000s.

Concerning the possible sources of superior forecasting performance, Sims (2002) proposed three hypotheses: the central bank makes better use of the same public data, collects better data, and/or exploits its private and prior knowledge of its future policy decisions. Concerning the last proposition, which is favored by Sims, two arguments can be put forward. First, the forecast horizons considered here are shorter than the transmission lag of monetary policy. Second, the constant interest rate scenario unfavorably biases the forecasting performance of central banks. It might be argued that central banks base their forecasts on interest rates that are constant or expected by markets precisely to avoid revealing their private information about future policy paths, but this action decreases their forecasting performance. In this study, prior knowledge does not lead to better forecasting performance for 4 out of 5 central banks. The only central bank that experiences a significantly better forecasting performance, the Riksbank, publishes explicit interest rate paths[33] and so makes this information public. In a similar vein, the results by Romer and

[31] The idea that the central bank is always one step ahead and the private forecasters never catch up is confirmed by Table A.ii of Appendix A.3: each new forecast release comprises a substantial proportion of new information that is not predictable knowing the previous information set (or previous central bank forecast).
[32] One might even consider that the respondents of these surveys are generally better informed agents through a selection bias. This consideration reinforces the use of these surveys when assessing relative forecasting performance with respect to the central bank.
[33] One can wonder whether the Riksbank delivers relevant and private information to the public through its interest rate path projections, as they generally differ from realizations (Svensson (2009)).

Romer (2000) suggest that the Federal Reserve forecasts' release with a 5-year lag enhances its relative information set. However, the Riksbank's transparency example suggests that this is not a sufficient condition. Estimates of subsection 5.5 suggest that the Riksbank is able to collect better data or extract information from public data, which is the source of its more accurate inflation forecasts.

Going back to the sources of central bank influence, it is noteworthy that the absence of evidence of more accurate central bank forecasts in Canada and Switzerland is consistent with the lack of evidence of central bank influence. Second, despite the statistical and econometric caveats and according to the identifying assumption that *if central bank forecasts influence private forecasts but are not more accurate, then their influence stems from central bank signals either on future policy or private information*, these results suggest that central banks of the UK and Japan may experience exogenous influences. Third, the simultaneous evidence of influence and superior forecasting performance suggests that the central bank of Sweden might experience endogenous influences. The next section aims to test whether the central bank's influence in Sweden is conditional on its forecasting ability.

6. Testing for Endogenous Influence in Sweden

The third step of this study is to assess the causal relationship between superior forecasting performance and the influence defining the concept of endogenous influence. We test whether a relatively better forecasting record enables central bank influence to evidence the *specific* weight placed on central bank forecasts when those forecasts are more accurate. The alternative hypothesis is that influence is independent of forecasting performance.

We estimate the two following equations, for which the common idea is to assess whether the influence of central bank forecasts depends on its past relative accuracy:

$$(CB_t^h \ or) \ PS_t^h = \alpha + \beta_{CB} \cdot CB_{t-1}^{h+1} + \beta_{PS} \cdot PS_{t-1}^{h+1} + \beta_{RFP} \cdot RFP + \beta_{CB \cdot RFP} \cdot CB_{t-1}^{h+1} \cdot RFP + \varepsilon_t \quad (9)$$

$$(CB_t^h \ or) \ PS_t^h = \alpha + \beta_{CB} \cdot CB_{t-1}^{h+1} + \beta_{PS} \cdot PS_{t-1}^{h+1} + \varepsilon_t \begin{cases} \Delta RMSE(F^{t-1}) > 0 \\ \Delta RMSE(F^{t-1}) \leq 0 \end{cases} \quad (10)$$

The *RFP* (*Relative Forecasting Performance*) variable is a dummy variable that takes a value of 1 when the central bank has a better forecasting accuracy compared to private forecasters, i.e., $\Delta RMSE(F^{t-1}) > 0$, and a value of 0 when the central bank has a lower or equivalent forecasting accuracy compared to private agents. The $\Delta RMSE(F^{t-1})$ variable corresponds to the difference between both average absolute forecast errors of the central bank and CFs whose horizons were *t-1*, that is to say, the forecast made at *t-5* at the horizon *h*=*4*, the forecast made at *t-4* at the horizon *h*=*3* and so on until the forecast made at *t-1* for the current horizon. The $\Delta RMSE(F^{t-1})$ variable represents the relative forecasting performance at a given date. A positive $\Delta RMSE(F^{t-1})$ means the central bank made smaller forecast errors for *t-1*. This variable goes from -0.35 to 0.61, with a mean of 0.10 and a median of 0.08. Those values are consistent with the relative forecasting performance analysis of section 5 for Sweden. In both regressions, it is as if private agents know the relative forecasting performance of the central bank at *t-1* and use it to disentangle between forecasts made at *t-1* when forming their forecasts at *t*.

Because of the interaction term, the purpose of equation (9) is to assess whether the effect of central bank forecasts on private forecasts depends on the relative forecasting performance of the central bank. β_{CB} indicates the effect of central bank forecasts on private forecasts when central bank forecasts are not superior (*RFP*=0), $\beta_{CB.RFP}$ indicates the effect of central bank forecasts on private forecasts when central bank forecasts are superior (*RFP*=1), and β_{CB} + $\beta_{CB.RFP}$ indicates the total influence of central bank forecasts. The significance level of the interaction term designates whether $\beta_{CB.RFP}$ is different from β_{CB} but not from zero.

The purpose of equation (10), a split sample regression, is to confirm the interaction term regression by comparing the values of β_{CB} associated with central bank forecasts made at *t-1* when the central bank has either superior or inferior forecasting performance. Sample sizes become smaller than in equation (9) by construction, but the bias always goes against our hypothesis.

Table 6 presents the results of both series of estimation. For the two shorter horizons, the results clearly show that central bank forecasts influence private forecasts only when they are superior. In the left column, the interaction term regression exhibits a non-significant β_{CB} (no influence when central bank forecasting performance is not superior) and a significant $\beta_{CB.RFP}$, which highlights that the effect of central bank forecasts on private forecasts (central bank influence) depends on the relative forecasting performance of the central bank. The right column for the split sample approach confirms that when previous central bank forecasts are superior, central bank forecasts are significant. For longer horizons, the coefficients associated with central bank forecasts are similar regardless of the forecasting performance of the central bank. Two interpretations of this outcome are possible: first, for long horizons, when the uncertainty is greater, the reputation of the central bank and the effect of its superior forecasts show some hysteresis; and second, forecasts of a central bank that experiences endogenous influence may also comprise policy signals and/or central bank information.

This section shows that a relatively better forecasting record generates a specific central bank influence at short horizons and suggests that there is a causal relationship between forecasting performance and influence, which defines the concept of endogenous influence. Therefore, the proposed distinction between the two sources of central bank influence appears statistically likely.

7. Conclusion

This paper provides original empirical evidence on the ability of central bank forecasts to influence private forecasts. We find that in three of five countries for which central banks publish their forecasts in real time (Sweden, the UK and Japan), central bank inflation forecasts influence private forecasts, while in Canada and Switzerland, there is no evidence of such an influence. We find that the opposite is never true. To disentangle the possible sources of central bank influence, we propose the concepts of endogenous and exogenous influence, for which influence stems from superior forecasting performance and signals, respectively. The second step of this paper is to provide an empirical assessment of the relative forecasting performance of central banks and private agents in these five countries. We find that the Riksbank has more accurate inflation forecasts and seems to benefit from a specific expertise to constitute new private information between each forecast's release. Third, we find that relatively better forecasting performance generates specific central bank influence.

At the level of aggregate dynamics stabilization, the proposed distinction on the sources of central bank influence is important because it would enable the differentiation of influence moving private expectations toward the fundamental value of future variables from the opposite: a self-fulfilling, expectations-based value. A second implication, which is more policy oriented, is that the shaping of private expectations that can be accomplished through the publication of central bank macroeconomic forecasts may stem from two different central banking strategies: forecasting or policymaking. Central bank forecasts may be published to give a more accurate vision of the economic outlook, or they may be used as tools by policymakers to send policy signals or reveal private information.

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Table 1 - Influence Test for Fixed Events with News Released

SWEDEN

	CPI CB^h_t	CPI PS^h_t	GDP CB^h_t	GDP PS^h_t
	h=0		h=0	
CB^1_{t-1}	0.985***	**0.672*** **	0.789***	**0.511*** **
	(0.074)	(0.172)	(0.203)	(0.126)
PS^1_{t-1}	**0.074**	0.391**	**0.493**	0.544
	(0.084)	(0.166)	(0.597)	(0.378)
$I_{t-1\leftrightarrow t}$	0.815***	0.501***	0.564**	0.220
	(0.065)	(0.106)	(0.213)	(0.146)
R^2	0.95	0.93	0.70	0.80
	h=1		h=1	
CB^2_{t-1}	0.803***	**0.377*** **	0.775**	**0.393** **
	(0.196)	(0.071)	(0.254)	(0.143)
PS^2_{t-1}	**0.310**	0.736***	**0.835**	0.629
	(0.229)	(0.058)	(0.752)	(0.351)
$I_{t-1\leftrightarrow t}$	0.772***	0.488***	0.648**	0.093
	(0.089)	(0.068)	(0.227)	(0.099)
R^2	0.89	0.90	0.68	0.74
	h=2		h=2	
CB^3_{t-1}	0.781***	**0.534*** **	0.572	0.234
	(0.184)	(0.070)	(0.357)	(0.188)
PS^3_{t-1}	**0.270**	0.585***	1.306*	0.664*
	(0.254)	(0.102)	(0.710)	(0.362)
$I_{t-1\leftrightarrow t}$	0.702***	0.374***	0.580***	0.057
	(0.168)	(0.079)	(0.174)	(0.093)
R^2	0.86	0.85	0.56	0.38
	h=3		h=3	
CB^4_{t-1}	0.726***	**0.353*** **	0.841***	0.216
	(0.214)	(0.092)	(0.215)	(0.194)
PS^4_{t-1}	**0.467***	0.763***	0.887	-0.124
	(0.253)	(0.147)	(0.720)	(0.217)
$I_{t-1\leftrightarrow t}$	0.689***	0.206***	0.417**	-0.086
	(0.140)	(0.060)	(0.182)	(0.064)
R^2	0.83	0.70	0.62	0.21

UNITED KINGDOM

	RPIX CB^h_t	RPIX PS^h_t	CPIH CB^h_t	CPIH PS^h_t	GDP CB^h_t	GDP PS^h_t
	h=0		h=0		h=0	
CB^1_{t-1}	1.257***	**0.937*** **	0.451	**0.738*** **	0.864***	0.472***
	(0.232)	(0.259)	(0.252)	(0.166)	(0.110)	(0.098)
PS^1_{t-1}	**-0.291**	0.005	**0.410**	-0.094	0.209	0.674***
	(0.302)	(0.285)	(0.302)	(0.256)	(0.178)	(0.106)
$I_{t-1\leftrightarrow t}$	0.459***	0.170	0.396***	0.320*	0.266***	0.250***
	(0.135)	(0.125)	(0.053)	(0.151)	(0.072)	(0.043)
R^2	0.76	0.82	0.85	0.81	0.81	0.90
	h=1		h=1		h=1	
CB^2_{t-1}	1.402***	**0.984*** **	0.726*	**0.756*** **	0.859***	0.375***
	(0.125)	(0.164)	(0.327)	(0.202)	(0.132)	(0.108)
PS^2_{t-1}	**-0.608*** **	-0.258	**-0.088**	-0.196	0.187	0.759***
	(0.151)	(0.232)	(0.401)	(0.240)	(0.244)	(0.135)
$I_{t-1\leftrightarrow t}$	0.418***	0.132	0.311***	0.140	0.254***	0.265***
	(0.073)	(0.094)	(0.045)	(0.121)	(0.079)	(0.061)
R^2	0.89	0.84	0.78	0.75	0.67	0.80
	h=2		h=2		h=2	
CB^3_{t-1}	1.068***	**0.716*** **	0.429*	**0.480** **	0.816***	0.275**
	(0.178)	(0.156)	(0.186)	(0.140)	(0.173)	(0.118)
PS^3_{t-1}	**-0.343**	-0.416	**0.338***	0.216	0.021	0.709***
	(0.598)	(0.671)	(0.144)	(0.165)	(0.266)	(0.182)
$I_{t-1\leftrightarrow t}$	0.422***	0.005	0.232***	0.075	0.212***	0.204***
	(0.135)	(0.129)	(0.064)	(0.083)	(0.073)	(0.055)
R^2	0.75	0.54	0.62	0.60	0.47	0.58
	h=3		h=3		h=3	
CB^4_{t-1}	0.659***	**0.271*** **	0.433	0.202	0.765***	0.082
	(0.181)	(0.050)	(0.310)	(0.427)	(0.195)	(0.109)
PS^4_{t-1}	**-1.206***	-0.322	-0.038	-0.333	-0.070	0.718**
	(0.649)	(0.196)	(0.831)	(1.057)	(0.367)	(0.306)
$I_{t-1\leftrightarrow t}$	0.177	-0.127*	0.117	0.064	0.094	0.118***
	(0.207)	(0.065)	(0.144)	(0.078)	(0.065)	(0.040)
R^2	0.47	0.54	0.25	0.03	0.36	0.42

CANADA

Base - 2months gap

	CPI CB^h_t	CPI PS^h_t	GDP CB^h_t	GDP PS^h_t
	h=0		h=0	
CB^1_{t-1}	0.304	0.352**	0.452	0.623*
	(0.226)	(0.148)	(0.334)	(0.314)
PS^1_{t-1}	0.735***	0.299*	0.721	0.139
	(0.211)	(0.157)	(0.387)	(0.301)
$I_{t-1\leftrightarrow t}$	0.132	0.226***	0.179	0.447**
	(0.120)	(0.068)	(0.171)	(0.142)
R^2	0.76	0.62	0.91	0.92
	h=1		h=1	
CB^2_{t-1}	0.111	0.176	0.630**	0.942***
	(0.213)	(0.150)	(0.226)	(0.166)
PS^2_{t-1}	1.105***	0.748***	0.715*	-0.080
	(0.182)	(0.142)	(0.333)	(0.060)
$I_{t-1\leftrightarrow t}$	0.113	0.355**	0.202**	0.559***
	(0.106)	(0.121)	(0.075)	(0.061)
R^2	0.75	0.64	0.90	0.91
	h=2		h=2	
CB^3_{t-1}	0.446	-0.192	0.829**	0.585
	(0.338)	(0.381)	(0.302)	(0.399)
PS^3_{t-1}	0.977**	1.084***	0.454	0.361
	(0.390)	(0.352)	(0.870)	(0.579)
$I_{t-1\leftrightarrow t}$	0.179*	0.296**	0.215*	0.379***
	(0.094)	(0.136)	(0.103)	(0.055)
R^2	0.63	0.58	0.84	0.79
	h=3		h=3	
CB^4_{t-1}	0.786***	0.208	-0.153	0.102
	(0.242)	(0.147)	(0.665)	(0.184)
PS^4_{t-1}	0.213	0.101	2.179	0.310
	(0.362)	(0.164)	(2.042)	(0.746)
$I_{t-1\leftrightarrow t}$	0.088	0.278	0.114	0.180**
	(0.092)	(0.037)	(0.153)	(0.042)
R^2	0.44	0.54	0.72	0.92

Timing Correction - 1month gap

	CPI CB^h_t	CPI PS^h_t	GDP CB^h_t	GDP PS^h_t
	h=0		h=0	
CB^1_{t-1}	0.985	0.788***	1.636***	1.129***
	(0.335)	(0.216)	(0.314)	(0.066)
PS^2_{t-2}	-0.160	-0.292	-0.620	-0.461***
	(0.345)	(0.262)	(0.371)	(0.112)
$I_{t-1\leftrightarrow t}$	0.207	0.260***	0.489***	0.518***
	(0.150)	(0.048)	(0.105)	(0.032)
R^2	0.66	0.63	0.89	0.96
	h=1		h=1	
CB^2_{t-1}	0.289	0.616	0.754*	1.168**
	(0.377)	(0.389)	(0.316)	(0.358)
PS^3_{t-2}	1.210***	-0.033	1.406**	-0.791
	(0.481)	(0.473)	(0.483)	(0.734)
$I_{t-1\leftrightarrow t}$	0.146	0.350**	0.387**	0.532***
	(0.105)	(0.121)	(0.115)	(0.040)
R^2	0.55	0.37	0.86	0.94
	h=2		h=2	
CB^3_{t-1}	0.892**	0.503	0.742*	0.978**
	(0.347)	(0.318)	(0.309)	(0.273)
PS^4_{t-2}	0.119	-0.189	0.240	-1.750
	(1.044)	(1.035)	(0.596)	(0.788)
$I_{t-1\leftrightarrow t}$	0.257	0.345*	0.248**	0.472**
	(0.155)	(0.188)	(0.047)	(0.082)
R^2	0.32	0.29	0.84	0.89

JAPAN

	CPI CB^h_t	CPI PS^h_t	GDP CB^h_t	GDP PS^h_t
CB^{h+1}_{t-1}	1.660***	**0.779*** **	1.659***	**1.328*** **
	(0.377)	(0.120)	(0.315)	(0.244)
PS^{h+1}_{t-1}	**-0.660**	0.325**	**-0.267**	0.373
	(0.390)	(0.134)	(0.355)	(0.333)
$I_{t-1\leftrightarrow t}$	-0.719***	-0.734***	-1.900***	-1.831***
	(0.163)	(0.097)	(0.269)	(0.435)
R^2	0.91	0.96	0.88	0.87

SWITZERLAND

	CPI CB^h_t	CPI PS^h_t
CB^{h+1}_{t-1}	1.040***	**1.009*** **
	(0.120)	(0.101)
PS^{h+1}_{t-1}	**0.000**	0.097
	(0.140)	(0.117)
$I_{t-1\leftrightarrow t}$	0.631***	0.751***
	(0.075)	(0.074)
R^2	0.89	0.91

Numbers in parentheses are robust standard errors. *,**,*** means respectively significant at 10%, 5% and 1%.

CB^h_t the forecast made by the central bank in date t for h horizons later and PS^h_t by the private sector in date t for h horizons later

Table 2 - Testing Influence at Fixed Horizons

SWEDEN

	CPI CB^h_t	CPI PS^h_t	GDP CB^h_t	GDP PS^h_t
	h=0		h=0	
CB^h_{t-1}	0.541*	**0.475****	0.915**	0.359
	(0.314)	(0.210)	(0.386)	(0.246)
PS^h_{t-1}	**0.292**	0.405**	-0.605	0.291
	(0.274)	(0.193)	(0.541)	(0.333)
R^2	0.57	0.74	0.39	0.66
	h=1		h=1	
CB^h_{t-1}	1.155***	**0.717*****	0.843**	0.344***
	(0.227)	(0.113)	(0.362)	(0.111)
PS^h_{t-1}	**-0.321**	0.128	-0.473	0.239
	(0.215)	(0.127)	(0.414)	(0.235)
R^2	0.66	0.78	0.39	0.67
	h=2		h=2	
CB^h_{t-1}	0.943***	**0.455*****	0.898***	0.198
	(0.317)	(0.123)	(0.263)	(0.140)
PS^h_{t-1}	**-0.326**	0.223	-0.688*	0.321
	(0.314)	(0.144)	(0.380)	(0.317)
R^2	0.42	0.57	0.41	0.45
	h=3		h=3	
CB^h_{t-1}	0.789**	**0.348*****	0.645**	0.078
	(0.317)	(0.096)	(0.282)	(0.144)
PS^h_{t-1}	**-0.155**	0.308**	-0.523	0.263
	(0.327)	(0.126)	(0.521)	(0.338)
R^2	0.38	0.55	0.32	0.13
	h=4		h=4	
CB^h_{t-1}	0.799***	**0.159****	0.697***	0.095
	(0.151)	(0.074)	(0.224)	(0.148)
PS^h_{t-1}	**-0.031**	0.637***	-0.687	0.239
	(0.199)	(0.139)	(0.634)	(0.276)
R^2	0.54	0.53	0.37	0.12

UNITED KINGDOM

	RPIX CB^h_t	RPIX PS^h_t	CPIH CB^h_t	CPIH PS^h_t	GDP CB^h_t	GDP PS^h_t
	h=0		h=0		h=0	
CB^h_{t-1}	0.585*	**0.616****	0.103	**0.574****	0.880***	0.499*
	(0.299)	(0.233)	(0.354)	(0.235)	(0.229)	(0.268)
PS^h_{t-1}	**0.086**	0.079	**0.473**	-0.203	-0.249	0.221
	(0.402)	(0.343)	(0.456)	(0.304)	(0.246)	(0.262)
R^2	0.40	0.59	0.38	0.34	0.50	0.62
	h=1		h=1		h=1	
CB^h_{t-1}	1.083***	**0.943*****	0.246	**0.574****	0.738***	0.135
	(0.342)	(0.242)	(0.300)	(0.220)	(0.186)	(0.173)
PS^h_{t-1}	**-0.476**	-0.342	**0.577**	0.039	-0.163	0.485***
	(0.370)	(0.249)	(0.454)	(0.373)	(0.235)	(0.170)
R^2	0.58	0.78	0.62	0.62	0.47	0.50
	h=2		h=2		h=2	
CB^h_{t-1}	0.940***	**0.896*****	0.431	**0.718*****	0.570***	0.008
	(0.247)	(0.193)	(0.330)	(0.173)	(0.157)	(0.116)
PS^h_{t-1}	**-0.463**	-0.678**	**0.374**	-0.091	-0.128	0.545***
	(0.274)	(0.289)	(0.482)	(0.260)	(0.226)	(0.140)
R^2	0.47	0.62	0.44	0.56	0.33	0.35
	h=3		h=3		h=3	
CB^h_{t-1}	0.745***	**0.321*****	0.626	**0.847****	0.502***	-0.109
	(0.199)	(0.076)	(0.398)	(0.291)	(0.146)	(0.071)
PS^h_{t-1}	**-0.319**	-0.151	**-0.128**	-0.610	-0.009	0.558***
	(0.714)	(0.192)	(0.969)	(0.744)	(0.264)	(0.172)
R^2	0.41	0.52	0.23	0.39	0.27	0.27
	h=4		h=4		h=4	
CB^h_{t-1}	0.469**	0.069	1.546***	**1.732*****	0.452***	-0.152***
	(0.174)	(0.085)	(0.346)	(0.275)	(0.162)	(0.047)
PS^h_{t-1}	-0.336	0.281	**-2.383***	-2.983***	0.019	0.721***
	(0.657)	(0.204)	(1.108)	(0.855)	(0.317)	(0.240)
R^2	0.20	0.13	0.26	0.36	0.21	0.43

CANADA

Base - 2months gap

	CPI CB^h_t	CPI PS^h_t	GDP CB^h_t	GDP PS^h_t
	h=0		h=0	
CB^h_{t-1}	-0.380	-0.277	-0.870	-1.004**
	(0.425)	(0.310)	(0.466)	(0.245)
PS^h_{t-1}	1.304*	0.815	2.151**	1.860***
	(0.639)	(0.467)	(0.826)	(0.465)
R^2	0.38	0.28	0.72	0.68
	h=1		h=1	
CB^h_{t-1}	-0.234	-0.403	-0.393*	-0.747**
	(0.365)	(0.354)	(0.177)	(0.250)
PS^h_{t-1}	1.021**	0.675	1.118***	0.946**
	(0.450)	(0.435)	(0.314)	(0.307)
R^2	0.41	0.14	0.62	0.42
	h=2		h=2	
CB^h_{t-1}	-0.365*	-0.080	0.728	0.354
	(0.186)	(0.164)	(0.433)	(0.525)
PS^h_{t-1}	0.924***	0.232	0.064	0.049
	(0.273)	(0.238)	(0.331)	(0.348)
R^2	0.36	0.03	0.36	0.09
	h=3		h=3	
CB^h_{t-1}	0.170	-0.260	0.451*	0.104
	(0.197)	(0.224)	(0.218)	(0.235)
PS^h_{t-1}	0.528**	0.536***	1.169**	1.120
	(0.197)	(0.177)	(0.363)	(0.698)
R^2	0.43	0.18	0.76	0.46
	h=4		h=4	
CB^h_{t-1}	0.665***	0.154	-0.667	-0.194
	(0.196)	(0.140)	(0.565)	(0.126)
PS^h_{t-1}	0.058	0.120	3.667	0.968
	(0.253)	(0.253)	(1.916)	(0.459)
R^2	0.49	0.06	0.66	0.39

Timing Correction - 1month gap

	CPI CB^h_t	CPI PS^h_t	GDP CB^h_t	GDP PS^h_t
	h=0		h=0	
CB^h_{t-1}	0.908***	0.545***	1.091***	0.712**
	(0.147)	(0.140)	(0.207)	(0.241)
PS^h_{t-2}	-0.762***	-0.502**	-0.887	-0.784*
	(0.126)	(0.104)	(0.484)	(0.381)
R^2	0.47	0.38	0.49	0.36
	h=1		h=1	
CB^h_{t-1}	0.749***	0.430**	0.597	0.370
	(0.181)	(0.158)	(0.459)	(0.479)
PS^h_{t-2}	-0.501**	-0.814**	-0.293	-0.644
	(0.229)	(0.215)	(0.481)	(0.566)
R^2	0.35	0.37	0.16	0.16
	h=2		h=2	
CB^h_{t-1}	0.239	0.462***	1.038**	0.903***
	(0.280)	(0.099)	(0.305)	(0.191)
PS^h_{t-2}	-0.018	-0.834**	-0.341	-0.7445*
	(0.259)	(0.254)	(0.358)	(0.357)
R^2	0.06	0.49	0.53	0.47
	h=3		h=3	
CB^h_{t-1}	0.260	0.315	0.885	1.092
	(0.313)	(0.263)	(0.547)	(0.627)
PS^h_{t-2}	0.258	-0.545*	-0.147	-1.501
	(0.345)	(0.303)	(1.255)	(1.265)
R^2	0.24	0.18	0.55	0.44
	h=4		h=4	
CB^h_{t-1}	0.645	0.174	0.188	0.000
	(0.209)	(0.144)	(0.439)	(0.206)
PS^h_{t-2}	-0.323	-0.657**	0.625	0.500
	(0.401)	(0.243)	(1.446)	(0.865)
R^2	0.49	0.38	0.16	0.11

JAPAN

	CPI CB^h_t	CPI PS^h_t	GDP CB^h_t	GDP PS^h_t
	h=0		h=0	
CB^h_{t-1}	1.252***	**1.037*****	1.480**	**1.678****
	(0.279)	(0.132)	(0.526)	(0.584)
PS^h_{t-1}	**-0.498**	-0.285	**-0.725**	-0.693
	(0.327)	(0.203)	(0.474)	(0.611)
R^2	0.73	0.86	0.52	0.61

SWITZERLAND

	CPI CB^h_t	CPI PS^h_t
	h=0	
CB^h_{t-1}	0.060	0.162
	(0.203)	(0.176)
PS^h_{t-1}	0.712***	0.604***
	(0.142)	(0.136)
R^2	0.67	0.65
	h=1	
CB^h_{t-1}	1.016***	0.427**
	(0.310)	(0.194)
PS^h_{t-1}	-0.727**	-0.132
	(0.341)	(0.292)
R^2	0.45	0.38

Numbers in parentheses are robust standard errors. *,**,*** means respectively significant at 10%, 5% and 1%.

CB^h_t the forecast made by the central bank in date t for h horizons later and PS^h_t by the private sector in date t for h horizons later

Table 3 - Testing Influence for Fixed Events

SWEDEN

	CPI			CPI			CPI	
	CB^h_t	PS^h_t		CB^h_t	PS^h_t		CB^h_t	PS^h_t
	h=0			h=1			h=2	
CB^1_{t-1}	0.873***	0.605***	CB^2_{t-1}	0.934***	0.451***	CB^3_{t-1}	1.261***	0.645***
	(0.239)	(0.128)		(0.259)	(0.079)		(0.179)	(0.059)
PS^1_{t-1}	0.202	0.467***	PS^2_{t-1}	0.119	0.630***	PS^3_{t-1}	-0.265	0.409***
	(0.241)	(0.136)		(0.285)	(0.092)		(0.190)	(0.130)
R^2	0.79	0.86	R^2	0.72	0.80	R^2	0.71	0.77
	h=0			h=1			h=2	
CB^2_{t-2}	1.074***	0.507***	CB^3_{t-2}	0.850***	0.716***	CB^4_{t-2}	1.324***	0.670***
	(0.353)	(0.172)		(0.239)	(0.171)		(0.347)	(0.175)
PS^2_{t-2}	0.035	0.665***	PS^3_{t-2}	0.471	0.523*	PS^4_{t-2}	0.120	0.639**
	(0.388)	(0.209)		(0.288)	(0.256)		(0.343)	(0.262)
R^2	0.63	0.68	R^2	0.48	0.58	R^2	0.47	0.47
	h=0			h=1				
CB^3_{t-3}	0.956***	0.725***	CB^4_{t-3}	1.064***	0.812***			
	(0.270)	(0.155)		(0.368)	(0.232)			
PS^3_{t-3}	0.439	0.690**	PS^4_{t-3}	0.674	0.656*			
	(0.349)	(0.266)		(0.478)	(0.362)			
R^2	0.49	0.51	R^2	0.40	0.37			
	h=0							
CB^4_{t-4}	0.998**	0.945**						
	(0.469)	(0.371)						
PS^4_{t-4}	0.349	0.591						
	(0.539)	(0.447)						
R^2	0.26	0.32						

UNITED KINGDOM

	RPIX		CPIH			RPIX		CPIH	
	CB^h_t	PS^h_t	CB^h_t	PS^h_t		CB^h_t	PS^h_t	CB^h_t	PS^h_t
	h=0		h=0			h=1		h=1	
CB^1_{t-1}	1.060**	0.864***	0.246	0.574**	CB^2_{t-1}	1.265***	0.941***	0.722	0.754***
	(0.366)	(0.284)	(0.300)	(0.220)		(0.198)	(0.177)	(0.417)	(0.214)
PS^1_{t-1}	-0.205	0.036	0.577	0.039	PS^2_{t-1}	-0.602**	-0.256	-0.100	-0.202
	(0.430)	(0.348)	(0.454)	(0.373)		(0.244)	(0.253)	(0.538)	(0.255)
R^2	0.63	0.80	0.62	0.62	R^2	0.75	0.82	0.58	0.70
	h=0		h=0			h=1		h=1	
CB^2_{t-2}	0.597*	0.856***	0.299	-0.044	CB^3_{t-2}	0.740***	0.707***	0.236	-0.182
	(0.334)	(0.231)	(0.371)	(0.525)		(0.242)	(0.212)	(0.347)	(0.315)
PS^2_{t-2}	0.405	-0.106	0.552	0.732	PS^3_{t-2}	-0.328	-0.664	0.515	0.999
	(0.415)	(0.324)	(0.638)	(0.911)		(0.744)	(0.549)	(0.915)	(0.654)
R^2	0.43	0.52	0.47	0.34	R^2	0.28	0.36	0.23	0.26
	h=0		h=0			h=1		h=1	
CB^3_{t-3}	0.597*	0.585*	-0.160	-0.044	CB^4_{t-3}	0.238	0.174	-1.025	-0.898
	(0.299)	(0.289)	(0.296)	(0.291)		(0.309)	(0.201)	(1.027)	(0.859)
PS^3_{t-3}	-0.072	-0.505	1.762**	1.016	PS^4_{t-3}	-1.209	-1.420**	3.135	1.800
	(0.723)	(0.640)	(0.540)	(0.760)		(0.835)	(0.555)	(2.251)	(2.351)
R^2	0.15	0.16	0.56	0.30	R^2	0.11	0.20	0.20	0.13
	h=0		h=0						
CB^4_{t-4}	0.054	0.176	0.307	-0.223					
	(0.502)	(0.398)	(2.031)	(1.257)					
PS^4_{t-4}	-0.867	-0.743	-1.161	-0.256					
	(1.039)	(0.795)	(5.726)	(3.646)					
R^2	0.03	0.04	0.01	0.06					

	RPIX		CPIH	
	CB^h_t	PS^h_t	CB^h_t	PS^h_t
	h=2		h=2	
CB^3_{t-1}	0.976***	0.715***	0.503**	0.504***
	(0.207)	(0.147)	(0.213)	(0.131)
PS^3_{t-1}	-0.444	-0.417	0.258	0.190
	(0.656)	(0.647)	(0.319)	(0.174)
R^2	0.57	0.54	0.47	0.58
	h=2		h=2	
CB^4_{t-2}	0.322	0.332**	-0.775	-1.003**
	(0.211)	(0.148)	(0.697)	(0.318)
PS^4_{t-2}	-1.690*	-1.140*	2.565	2.572**
	(0.819)	(0.640)	(2.203)	(0.872)
R^2	0.24	0.26	0.20	0.25

JAPAN

	CPI		GDP	
	CB^h_t	PS^h_t	CB^h_t	PS^h_t
CB^{h+1}_{t-1}	1.651***	0.769***	1.538**	1.212**
	(0.473)	(0.219)	(0.604)	(0.488)
PS^{h+1}_{t-1}	-0.985	-0.007	-0.598	0.054
	(0.556)	(0.266)	(0.484)	(0.403)
R^2	0.86	0.88	0.65	0.75

Numbers in parentheses are robust standard errors. *,**,*** means respectively significant at 10%, 5% and 1%.

CB^h_t the forecast made by the central bank in date t for h horizons later and PS^h_t by the private sector in date t for h horizons later

Table 4 - Unconditional comparisons - Mean Square Errors

12-month rate

SWEDEN

CPI - 1999Q3-2007Q4

	Riksbank	CF	p-value
Current	**0.05**	0.12	0.00
Q+1	**0.21**	0.27	0.18
Q+2	**0.32**	0.44	0.18
Q+3	**0.46**	0.67	0.14
Q+4	**0.57**	0.86	0.20
Q+5	**0.80**	1.05	0.23
Q+6	**0.99**	1.43	0.08

GDP - 2003Q4-2007Q4

	Riksbank	CF	p-value
Current	0.67	**0.60**	0.69
Q+1	**0.80**	0.87	0.77
Q+2	**0.93**	0.96	0.92
Q+3	**0.71**	0.95	0.39
Q+4	**0.68**	1.03	0.25
Q+5	**0.60**	1.11	0.11
Q+6	**0.63**	1.19	0.04

UNITED KINGDOM

RPIX - 1999Q2-2003Q4

	BoE - CIR	BoE - MIR	CF	p-value
Current	**0.07**	**0.07**	0.08	0.46
Q+1	0.10	0.10	0.10	0.89
Q+2	**0.10**	**0.10**	0.11	0.78
Q+3	0.14	0.14	**0.13**	0.80
Q+4	**0.14**	**0.14**	0.15	0.96
Q+5	0.17	0.18	**0.15**	0.67
Q+6	0.24	0.25	**0.17**	0.11

CPI - 2005Q1-2007Q4

	BoE - CIR	BoE - MIR	CF	p-value
Current	0.07	0.07	0.07	0.97
Q+1	**0.13**	**0.13**	0.15	0.51
Q+2	0.20	0.20	0.20	0.95
Q+3	0.26	0.25	0.25	0.93
Q+4	0.47	0.46	**0.40**	0.04
Q+5	0.62	0.57	**0.48**	0.11
Q+6	0.59	**0.53**	0.56	0.05

GDP - 1999Q2-2007Q4

	BoE - CIR	BoE - MIR	CF	p-value
Current	**0.57**	0.58	0.68	0.38
Q+1	**0.65**	**0.65**	0.78	0.37
Q+2	**0.71**	**0.71**	0.87	0.36
Q+3	0.75	**0.74**	0.84	0.67
Q+4	0.56	**0.54**	0.64	0.67
Q+5	0.41	**0.38**	0.50	0.54
Q+6	0.36	**0.35**	0.52	0.34

CANADA

CPI - 2003Q2-2007Q4

	BoC	CF	p-value
Current	0.38	**0.22**	0.05
Q+1	0.43	**0.34**	0.17
Q+2	0.65	**0.40**	0.07
Q+3	0.48	**0.45**	0.71
Q+4	0.46	0.46	0.98

GDP - 2005Q2-2007Q4

	BoC	CF	p-value
Current	0.17	**0.10**	0.03
Q+1	0.36	**0.14**	0.01
Q+2	0.34	**0.33**	0.83
Q+3	**0.30**	0.34	0.75
Q+4	0.25	**0.19**	0.32

average annual rate

JAPAN

CPI - 2000S2-2007S2

	BoJ	CF	p-value
Curr. Year	0.039	**0.036**	0.876
Next Year	0.162	**0.103**	0.251

GDP - 2000S2-2007S2

	BoJ	CF	p-value
Curr. Year	**0.364**	0.674	0.052
Next Year	**0.313**	0.509	0.473

SWITZERLAND

CPI - 1999Q4-2007Q4

	BNS	CF	p-value
Curr. Year	0.027	**0.019**	0.077
Next Year	0.250	**0.124**	0.044

The p-value is for the test of the null hypothesis that the central bank errors and private sector errors are equal. In the case of the UK: that central bank's constant rate errors and private sector errors are equal.
CIR and MIR respectively means Constant Interest Rate scenario and Market Interest Rate scenario.

Table 5 - Conditional comparisons - Regressions *à la* Romer-Romer (2000)

12-month rate

SWEDEN

Sample start	1999Q3	2003Q4
Variable	CPI Y_{t+h}	GDP Y_{t+h}
$CB^{h=0}_t$	**0.891*****	1.162**
	(0.092)	(0.410)
$PS^{h=0}_t$	0.066	-0.965
	(0.118)	(0.603)
R^2	0.94	0.43
$CB^{h=1}_t$	**0.865*****	1.118***
	(0.237)	(0.345)
$PS^{h=1}_t$	0.154	-1.507***
	(0.256)	(0.420)
R^2	0.70	0.51
$CB^{h=2}_t$	**0.957*****	0.980**
	(0.292)	(0.421)
$PS^{h=2}_t$	0.121	-1.876***
	(0.335)	(0.577)
R^2	0.53	0.34
$CB^{h=3}_t$	**1.043*****	0.780**
	(0.253)	(0.319)
$PS^{h=3}_t$	0.171	-1.591
	(0.331)	(0.880)
R^2	0.35	0.21
$CB^{h=4}_t$	**1.085****	0.817
	(0.430)	(0.577)
$PS^{h=4}_t$	0.070	-0.023
	(0.514)	(1.735)
R^2	0.24	0.19

UNITED KINGDOM

Sample start	1999Q2	2005Q1	1999Q2
Variable	RPIX Y_{t+h}	CPI Y_{t+h}	GDP Y_{t+h}
$CB^{h=0}_t$	0.799*	0.535	0.381
	(0.381)	(0.715)	(0.415)
$PS^{h=0}_t$	-0.070	0.581	0.143
	(0.399)	(0.770)	(0.556)
R^2	0.57	0.66	0.26
$CB^{h=1}_t$	0.493	0.481	0.361
	(0.853)	(0.566)	(0.267)
$PS^{h=1}_t$	0.235	0.421	0.043
	(0.933)	(1.026)	(0.406)
R^2	0.34	0.36	0.12
$CB^{h=2}_t$	0.668	-0.297	0.335
	(0.485)	(0.836)	(0.257)
$PS^{h=2}_t$	0.022	1.501	-0.358
	(0.683)	(1.025)	(0.366)
R^2	0.31	0.29	0.05
$CB^{h=3}_t$	0.420	-0.553*	0.027
	(0.350)	(0.281)	(0.296)
$PS^{h=3}_t$	0.337	3.074***	-0.969**
	(0.687)	(0.680)	(0.394)
R^2	0.13	0.56	0.16
$CB^{h=4}_t$	0.457	0.076	-0.023
	(0.285)	(3.691)	(0.486)
$PS^{h=4}_t$	-0.499	-2.228	-1.279**
	(0.996)	(9.338)	(0.469)
R^2	0.09	0.10	0.16

CANADA

Base (2 months gap)

Sample start	2003Q2	2005Q2
Variable	CPI Y_{t+h}	GDP Y_{t+h}
$CB^{h=0}_t$	-0.161	-0.699**
	(0.435)	(0.309)
$PS^{h=0}_t$	1.101	2.345***
	(0.697)	(0.438)
R^2	0.41	0.88
$CB^{h=1}_t$	0.115	-0.925**
	(0.256)	(0.381)
$PS^{h=1}_t$	0.433	1.753***
	(0.335)	(0.416)
R^2	0.22	0.75
$CB^{h=2}_t$	-0.318	-0.420
	(0.199)	(1.130)
$PS^{h=2}_t$	0.780**	0.500
	(0.263)	(0.690)
R^2	0.21	0.05
$CB^{h=3}_t$	0.277	1.318
	(0.424)	(1.302)
$PS^{h=3}_t$	0.362	-2.065
	(0.542)	(1.084)
R^2	0.07	0.14
$CB^{h=4}_t$	0.011	0.866
	(0.326)	(1.303)
$PS^{h=4}_t$	-0.192	-2.144
	(0.772)	(5.169)
R^2	0.00	0.07

Timing Correction (1month gap)

Sample start	2003Q2	2005Q2
	CPI Y_{t+h}	GDP Y_{t+h}
$CB^{h=0}_t$	0.436	0.249
	(0.288)	(0.651)
$PS^{h=1}_{t-1}$	0.122	0.731
	(0.280)	(0.882)
R^2	0.26	0.52
$CB^{h=1}_t$	0.330	0.141
	(0.483)	(0.733)
$PS^{h=2}_{t-1}$	0.159	0.117
	(0.660)	(1.184)
R^2	0.19	0.03
$CB^{h=2}_t$	-0.264	0.391
	(0.325)	(1.249)
$PS^{h=3}_{t-1}$	0.985	-0.913
	(0.791)	(1.331)
R^2	0.08	0.02
$CB^{h=3}_t$	-0.051	-0.022
	(0.207)	(1.070)
$PS^{h=4}_{t-1}$	-0.173	-0.082
	(0.779)	(2.705)
R^2	0.00	0.00

average annual rate

JAPAN

Sample start	2000S2	2000S2
Variable	CPI Y_{t+h}	GDP Y_{t+h}
$CB^{h=0}_t$	0.551**	0.482
	(0.207)	(0.302)
$PS^{h=0}_t$	0.216	0.176
	(0.233)	(0.246)
R^2	0.87	0.78

SWITZERLAND

Sample start	2003Q1
Variable	CPI Y_{t+h}
$CB^{h=0}_t$	-0.064
	(0.270)
$PS^{h=0}_t$	0.807***
	(0.265)
R^2	0.82
$CB^{h=1}_t$	-0.196
	(0.279)
$PS^{h=1}_t$	0.537
	(0.385)
R^2	0.13

Numbers in parentheses are robust standard errors. *,**,*** means respectively significant at 10%, 5% and 1%. All samples finish in 2007Q4, except RPIX in the UK in 2003Q4 and Japan in 2007S2.

Y_{t+h} is the actual value of inflation or GDP at the date t+h, CB^h_t the forecast made by the central bank in date t for h horizons later and PS^h_t by the private sector in date t for h horizons later

Table 6 - Testing Endogenous Influence

SWEDEN - CPI

Interaction Term regression

	CB^h_t	*(se)*	PS^h_t	*(se)*
	h=0			
α	0.647	(0.501)	0.873**	(0.337)
CB^1_{t-1}	0.586	(0.364)	**0.324**	(0.241)
PS^1_{t-1}	0.176	(0.342)	0.365	(0.222)
RFP	-0.786	(0.510)	-0.963***	(0.345)
CB^1_{t-1}*RFP	0.365	(0.269)	**0.371****	(0.181)
R^2	0.81		0.89	
	h=1			
α	0.960	(0.699)	0.886*	(0.462)
CB^2_{t-1}	0.520	(0.351)	**0.103**	(0.230)
PS^2_{t-1}	0.055	(0.357)	0.548**	(0.223)
RFP	-1.149	(0.659)	-1.017**	(0.442)
CB^2_{t-1}*RFP	0.575	(0.332)	**0.462****	(0.222)
R^2	0.75		0.84	
	h=2			
α	1.317	(0.978)	0.933	(0.598)
CB^3_{t-1}	0.894**	(0.377)	**0.396***	(0.233)
PS^3_{t-1}	-0.473	(0.370)	0.237	(0.223)
RFP	-1.074	(0.821)	-0.770	(0.506)
CB^3_{t-1}*RFP	0.478	(0.418)	**0.316**	(0.258)
R^2	0.73		0.79	
	h=3			
α	-0.658	(0.862)	-0.091	(0.503)
CB^4_{t-1}	1.352***	(0.325)	**0.467****	(0.190)
PS^4_{t-1}	-0.006	(0.326)	0.612***	(0.190)
RFP	0.268	(0.738)	0.003	(0.429)
CB^4_{t-1}*RFP	-0.149	(0.395)	**-0.023**	(0.228)
R^2	0.67		0.53	

Slit-Sample regression

	CB^h_t	CB^h_t	PS^h_t	PS^h_t
	h=0			
CB^1_{t-1}	1.149***	0.213	**0.728*****	**0.255**
	(0.314)	(0.287)	(0.126)	(0.334)
PS^1_{t-1}	-0.095	0.622**	0.321*	0.447
	(0.326)	(0.212)	(0.165)	(0.305)
ΔRMSE (F^{t-1})	CB	PS	CB	PS
R^2	0.82	0.50	0.91	0.53
	h=1			
CB^2_{t-1}	1.243***	0.304	**0.545*****	**0.139**
	(0.224)	(0.383)	(0.122)	(0.163)
PS^2_{t-1}	-0.183	0.430	0.579***	0.486*
	(0.249)	(0.565)	(0.117)	(0.246)
ΔRMSE (F^{t-1})	CB	PS	CB	PS
R^2	0.75	0.28	0.84	0.32
	h=2			
CB^3_{t-1}	1.327***	0.933*	**0.550*****	**0.544****
	(0.218)	(0.425)	(0.112)	(0.212)
PS^3_{t-1}	-0.365	-0.690	0.618***	-0.582
	(0.273)	(0.676)	(0.147)	(0.367)
ΔRMSE (F^{t-1})	CB	PS	CB	PS
R^2	0.76	0.35	0.81	0.49
	h=3			
CB^4_{t-1}	1.198***	1.354***	**0.395****	**0.485*****
	(0.326)	(0.305)	(0.181)	(0.124)
PS^4_{t-1}	0.013	-0.030	0.772***	0.400**
	(0.338)	(0.574)	(0.217)	(0.152)
ΔRMSE (F^{t-1})	CB	PS	CB	PS
R^2	0.63	0.70	0.61	0.76

Numbers in parentheses are robust standard errors. *,**,*** means respectively significant at 10%, 5% and 1%.
CB^h_t the forecast made by the central bank in date t for h horizons later and PS^h_t by the private sector in date t for h horizons later. In the left columns, the RFP variable is a dummy variable that equals 1 when ΔRMSE > 0 (a positive ΔRMSE means a superior forecasting performance of the central bank). In the right columns, estimations are separated according to whether ΔRMSE is superior or not to 0, i.e. 'CB' (resp. PS) means that the central bank (private sector) had better forecasts in t-1.

Appendix

A.1. Characteristics of each dataset

For Sweden, the Riksbank provides 12-month change forecasts at different future quarters. These are regularly available for inflation (CPI) for forecasts 1 year (Q+4) and 2 years (Q+8) ahead from 1997Q1 and for all quarters from the current quarter to Q+6 from 1999Q3. Concerning the GDP, from current quarter to Q+6 forecasts are available since 2003Q4. The 12-month rate forecasts in the current and the next 6 quarters are compared to the quarterly forecasts gathered by CFs. These are available since 1999Q2 for both inflation and the GDP. For these quarterly forecast comparisons, Inflation Reports, which contain forecasts of the Riksbank, are published around March 16th, June 8th, October 10th and December 7th, and surveys of CFs are published at the end of the first half of March, June, September and December. The following results are similar if we exclude the third quarter of each year, which has the largest timing gap between the central bank and private forecasts.

For the UK, the BoE publishes year-over-year forecasts for the current quarter to the next 8 quarters only for inflation since 1993Q1 with a scenario of a constant interest rate and for both inflation and GDP from 1998Q1 with both scenarios. Moreover, the measure of inflation has been the RPIX until 2003Q4 and the CPI-H since 2004Q1. These forecasts are compared to the private forecasts of CFs, which are available until the 6th future quarter since 1999Q2 for both inflation and GDP. The switch from the RPIX to the CPI-H is made in 2005Q1. Next, because of the change in the measure for inflation, the analysis of inflation forecast accuracy is separated into two subsamples for comparisons with CFs: the first concerning the RPIX until 2003Q4 and the second for the CPI-H from 2005Q1 because the two institutions did not forecast the same measure of inflation in 2004. Finally, the issue of the timing of publications gives a slight advantage to the CFs, which consistently releases its surveys one month after the BoE. Two other private forecast sets are also used: a survey of public attitudes to inflation, conducted by Gfk NOP, and inflation and GDP forecasts of "other forecasters" for two years ahead, available in each *Inflation Report* (Survey of External Forecasters (SEF), which is the average of 25 institutions, banks and miscellaneous forecasters). Both sets confirm the results obtained with the CFs.

For Canada, the Inflation Reports are published in January, April, July and October of each year and provide projections of the Total CPI and real GDP at the year-over-year rate for the current quarter and the next four quarters, respectively, since 2003Q2 and 2005Q2. We compare the 12-month rate quarterly forecasts to similar projections made by the CFs. The timing of publication, however, is different: these quarterly forecasts are published in March, June, September and December. There is a strong timing disadvantage (and consequent information disadvantage) for the Bank of Canada (hereafter referred to as the BoC). It seems more reasonable to compare the CF's forecasts from the preceding quarter to the BoC's forecasts of a current quarter than to compare both in the current quarter. The CF's forecasts from quarter $q-1$ are closer to the BoC's forecasts of quarter q (a gap of 1 month between both) than to the BoC's forecasts of quarter $q-1$ (2-month gap). Therefore, we provide comparisons on the standard basis (the 'base specification' in the tables) and with this timing correction.

For Japan, the central bank publishes only twice per year: in the last days of April and October, the bank publishes the lower and higher forecasts of the majority of policy board members for the real GDP and CPI (excluding fresh food) on an average annual rate basis. These forecasts are available for the current year since October 2000 and for the next year at a regular frequency since October 2004. As a result, next-year forecasts are used only for MSEs and are excluded from the regressions. For this study, we use the middle point of the range, which regularly coincides with the median forecast (which started to be published more recently). The forecasts of the private sector are taken from the CFs. They publish the forecasts of various institutions at the beginning of each month, and we take the surveys of early May and November, which have the smallest publication gaps between institutions.

For Switzerland, the central bank publishes forecasts of the CPI for the current, next and following years twice per year since 1999Q4 and on a quarterly basis since 2003Q1. We compare these forecasts to the CFs of the current and next years, calculated on the same basis, the annual average rate. The Swiss National Bank publishes its Inflation Reports in the last days of March, June, September and December, while the date of publication of CF's surveys is at the end of the first half of the same months. The timing of release favors the central bank.

A.2. Description of robustness tests

(i) Multicollinearity

To check that the regressions are not distorted by multicollinearity (forecasts are correlated among themselves) as discussed by Granger and Newbold (1977), the actual variable is regressed on only one forecast at the same time:

$$Y_{t+h} = \alpha + \beta_{CB\,or\,PS} \cdot [CB_t^h \text{ or } PS_t^h] + \varepsilon_t \tag{11}$$

The objective of this univariate regression is to assess the validity of the previous regression with combined forecasts by simply comparing the explanatory power (the coefficient of determination R^2 of univariate regressions) of both forecasts, to confirm the outcomes of benchmark regressions when forecasts are compared one by one, not in combination.

(ii) Additional information beyond the last information set

It is important to assess whether the coefficient associated with private or central bank forecasts are significant due to the high correlation to actual data or because they provide information in addition to the information set known at the date of the forecast. Introducing an autoregressive term of the dependent variable (the actual data), one may assess whether the forecast really contains superior forward-looking information. In other words, is there a real added value of the forecasts beyond the lag of the dependent variable? Moreover, the variables are persistent, and this test allows the verification of the robustness of the coefficient associated with forecasts when taking into account this persistence, in the case of current quarter forecasts. The estimated equation is as follows:

$$\pi_{t+h} = \alpha + \beta_\pi \cdot \pi_{t-1} + \beta_{CB} \cdot CB_t^h + \beta_{PS} \cdot PS_t^h + \varepsilon_t, \tag{12}$$

where the analysis lies in the significance of the coefficient associated with both the central bank and private forecasts.

(iii) Economic Phases

Forecasts usually have mean reversion properties (Fama and Bliss (1987), Kim, Nelson and Startz (1991) and Kilian and Taylor (2003)) and fail to forecast turning points (Neftci (1982), Diebold and Rudebusch (1989), Hamilton (1989) and Lahiri and Wang (1994)). The former property could lead to a bias in the benchmark regression because projections are underestimated in the upward phases and overestimated in the downward phases, while the second property shows large forecast errors when a turning point occurs. One possible way to check whether the previous outcomes are not distorted by these two characteristics is to restrict ex-post the analysis to upward or downward phases of the variable of interest that is being forecasted. Heterogeneity between the upward and downward phases and turning points is therefore ruled out. The main regression is estimated by dividing the sample according to economic conditions: rising inflation and decreasing inflation.

(iv) Controlling for the Second Mover Informational Advantage
In the case of Sweden, there is no clear second mover advantage because the central bank publishes its forecasts after the private sector in March and October, and the private sector publishes its forecasts after the central bank in June and December. To verify that the superior forecasting performance of the Riksbank is not due to imbalances in the second mover advantage that would favor the central bank, we disentangle the relative forecasting performance when the central bank is the second mover and when the private sector is the second mover.

(v) Individual Forecasters' Comparison
We compare the forecasts of central banks to individual private forecasts for Sweden, for which the comparison of the survey's aggregate forecasts shows a clear advantage in favor of the central bank. The question is whether this advantage of the Riksbank holds for only some private forecasters, for a large majority or for all forecasters[35]. Kim, Lim and Shaw (2001) show that surveys do not completely capture the full set of new information available to the pool of individual forecasts and therefore tend to reveal inefficiencies (i.e., correlated with their own forecast errors). This inefficiency, associated with CFs, might then introduce a bias in favor of the central bank. First, it should be noted that this inefficiency might also apply to central bank forecasts, as Clements, Joutz and Stekler (2007) show for the Greenbook. Second, and more importantly, if the inefficient CFs favor central bank forecasts, we should find evidence of superior forecasting performance for all central banks. For 4 out of 5 analyzed central banks, there is no superior forecasting performance, so if there is a bias, it is not significant. For the only central bank (Sweden) that exhibits a superior forecasting performance (where the bias might be responsible for this result), we compare the central bank forecasts to individual forecasts to avoid this inefficiency bias.
CFs only provide individual fixed-event forecasts. Thus, the average annual rate forecasts of current and next calendar years of both actors are compared since 1999. We retain only the major individual forecasters of CFs who respond to more than two thirds of the surveys during the sample period. Due to differences in the planning of forecasting on a fixed-event scheme, the calendar forecast is compiled as the average of all forecasts made for a given year during the preceding and current years (except for the forecast of December for the current year because the Riksbank already focuses on two next years in each December report). For instance, for 2001, we compare the forecasts of March, June, September and December 2000, and March, June and September 2001.

(vi) Other Private Forecast Sets
Finally, we compare the forecasts of the central bank with a different set of private forecasts: the forecasts of Prospera AB. The Riksbank's 12-month rate forecasts for 1 year and 2 years ahead are compared to private forecasts gathered via survey by Prospera AB, which are available since 1996Q1 for inflation. These forecasts are split into two categories: all survey respondents and only market players. Prospera AB surveys are published in early March, late May, early October and late November, which correspond to the timing of the publication of the Riksbank.

[35] When forecasts of the central bank and the mean of the private sector are closer, the rationale for individual comparisons is weaker because there will inevitably be smaller individual forecast errors when the mean is close to the central bank forecast.

A.3. Estimates of robustness tests

Table A.i - Sweden - Robustness: Multicollinearity

Variable	CPI		GDP	
	Y_{t+h}	Y_{t+h}	Y_{t+h}	Y_{t+h}
$CB^{h=0}_t$	0.950***		0.487*	
	(0.027)		(0.240)	
$PS^{h=0}_t$		0.974***		0.429
		(0.087)		(0.274)
R^2	**0.93**	0.86	0.29	0.15
$CB^{h=1}_t$	0.993***		0.378	
	(0.082)		(0.215)	
$PS^{h=1}_t$		1.054***		-0.129
		(0.135)		(0.436)
R^2	**0.70**	0.61	0.16	0.01
$CB^{h=2}_t$	1.044***		0.126	
	(0.112)		(0.361)	
$PS^{h=2}_t$		1.175***		-0.606
		(0.220)		(0.583)
R^2	**0.53**	0.40	0.01	0.08
$CB^{h=3}_t$	1.128***		0.415	
	(0.180)		(0.287)	
$PS^{h=3}_t$		1.291***		-0.597
		(0.369)		(1.073)
R^2	**0.34**	0.12	0.09	0.02
$CB^{h=4}_t$	1.110***		0.812**	
	(0.325)		(0.273)	
$PS^{h=4}_t$		1.021**		1.246
		(0.493)		(0.819)
R^2	**0.24**	0.00	0.19	0.06

Numbers in parentheses are robust standard errors.
*,**,*** means respectively significant at 10%, 5% and 1%.
Y_{t+h} is the actual value of inflation or GDP at the date t+h, CB^h_t the forecast made by the central bank in date t for h horizons later and PS^h_t by the private sector in date t for h horizons later

Table A.ii - Sweden - Robustness: Additional information beyond last information set

Variable	CPI Y_{t+h}	*se*
Y_{t-1}	-0.007	(0.117)
$CB^{h=0}_t$	**0.869*****	(0.101)
$PS^{h=0}_t$	0.104	(0.169)
R^2	0.94	
Y_{t-1}	-0.252*	(0.136)
$CB^{h=1}_t$	**0.775*****	(0.240)
$PS^{h=1}_t$	0.510	(0.348)
R^2	0.72	
Y_{t-1}	-0.19	(0.212)
$CB^{h=2}_t$	**0.911*****	(0.298)
$PS^{h=2}_t$	0.386	(0.447)
R^2	0.55	
Y_{t-1}	-0.13	(0.193)
$CB^{h=3}_t$	**1.042*****	(0.254)
$PS^{h=3}_t$	0.337	(0.386)
R^2	0.36	
Y_{t-1}	-0.18	(0.283)
$CB^{h=4}_t$	**1.090****	(0.442)
$PS^{h=4}_t$	0.407	(0.810)
R^2	0.25	

Numbers in parentheses are robust standard errors. *,**,*** means respectively significant at 10%, 5%, 1
Y_{t-1} is a lag of the dependant variable the actual variable forecasted, and represent the information set known at the date when the forecast is made

Table A.iii - Sweden - Robustness: Economic Phases

Variable Y_{t+h}	CPI 24 obs	*se*
$CB^{h=0}_t$	**0.898*****	(0.142)
$PS^{h=0}_t$	0.086	(0.167)
R^2	0.94	
$CB^{h=1}_t$	**0.906*****	(0.276)
$PS^{h=1}_t$	0.102	(0.309)
R^2	0.66	
$CB^{h=2}_t$	**0.873****	(0.352)
$PS^{h=2}_t$	0.203	(0.373)
R^2	0.49	
$CB^{h=3}_t$	**0.980*****	(0.321)
$PS^{h=3}_t$	-0.028	(0.456)
R^2	0.28	
$CB^{h=4}_t$	**0.741***	(0.392)
$PS^{h=4}_t$	0.510	(0.900)
R^2	0.24	

Numbers in parentheses are robust standard errors. *,**,*** means respectively significant at 10%, 5%, 1
Upward phases are 1999Q3-2001Q3, 2002Q3-2003Q1and 2004Q1-2007Q4

Table A.iv - Sweden - Disentangling the second mover informational advantage

central bank is second mover				private sector is second mover			
Variable	CPI			Variable	CPI		
	Y_t	*se*	R^2		Y_t	*se*	R^2
$CB^{h=0}_t$	**0.756*****	(0.166)	0.95	$CB^{h=0}_t$	**1.046*****	(0.134)	0.94
$PS^{h=0}_t$	0.222	(0.193)		$PS^{h=0}_t$	-0.086	(0.167)	
$CB^{h=1}_t$	**0.781****	(0.325)	0.62	$CB^{h=1}_t$	**1.089*****	(0.333)	0.89
$PS^{h=1}_t$	0.075	(0.372)		$PS^{h=1}_t$	0.100	(0.411)	
$CB^{h=2}_t$	**1.374****	(0.477)	0.66	$CB^{h=2}_t$	**0.858***	(0.475)	0.60
$PS^{h=2}_t$	-0.304	(0.573)		$PS^{h=2}_t$	0.223	(0.490)	
$CB^{h=3}_t$	**1.041*****	(0.346)	0.29	$CB^{h=3}_t$	**0.964*****	(0.297)	0.65
$PS^{h=3}_t$	-0.215	(0.362)		$PS^{h=3}_t$	0.642	(0.592)	
$CB^{h=4}_t$	**1.580****	(0.527)	0.37	$CB^{h=4}_t$	**0.551**	(0.539)	0.14
$PS^{h=4}_t$	-0.099	(0.585)		$PS^{h=4}_t$	0.361	(0.623)	

Numbers in parentheses are robust standard errors. *,**,*** means respectively significant at 10%, 5%, 1%.

Table A.v - Sweden - Robustness: Individual Forecasters Comparison

CPI			GDP		
from 1999 to 2007			from 1999 to 2007		
		Riksbank			Riksbank
National Institute - NIER	0.14	0.14	HQ Bank	0.85	
JP Morgan	0.16		Nordea	1.12	
Morgan Stanley	0.17				1.13
Nordea	0.21		SE Banken	1.14	
MEAN	0.22		Svenska Handelsbanken	1.32	
HQ Bank	0.23		MEAN	1.35	
Merrill Lynch	0.26		Öhman	1.41	
SE Banken	0.26		JP Morgan	1.46	
Öhman	0.30		Morgan Stanley	1.52	
Confed of Swed Enterprise	0.35		National Institute - NIER	1.54	
Svenska Handelsbanken	0.41		Merrill Lynch	1.56	
			Confed of Swed Enterprise	1.90	
from 1999 to 2005			from 1999 to 2005		
Finanskonsult	0.76	**0.17**	Finanskonsult	1.77	**1.36**
from 1999 to 2004			from 1999 to 2004		
Alfred Berg	0.57	**0.17**	Alfred Berg	1.92	**1.53**
from 2000 to 2007			from 2000 to 2007		
Swedbank	0.31	**0.12**	Swedbank	1.24	**0.89**
UBS	0.25	**0.12**	UBS	0.97	**0.89**
from 2002 to 2007			from 2002 to 2007		
Skandiabanken	0.37	**0.10**	Skandiabanken	**0.50**	0.53
from 2003 to 2007			from 2003 to 2007		
SBAB	0.15	**0.11**	SBAB	0.62	**0.60**
from 2004 to 2007			from 2004 to 2007		
Econ Intelligence Unit	0.46	**0.12**	Econ Intelligence Unit	0.95	**0.74**
ING Financial Markets	0.41	**0.12**	ING Financial Markets	**0.59**	0.74

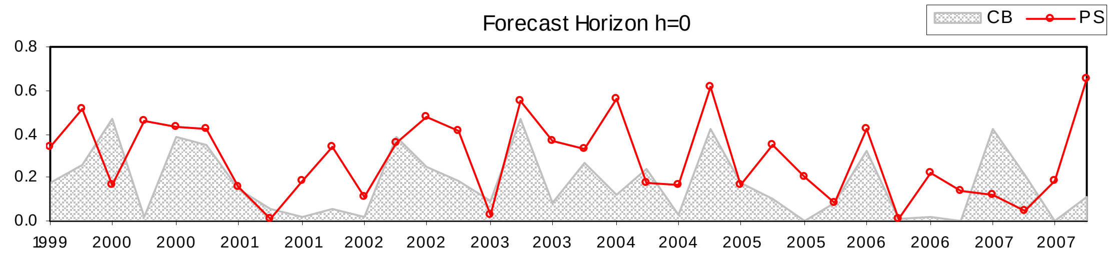
Reported values are the MSE of each individual forecasters

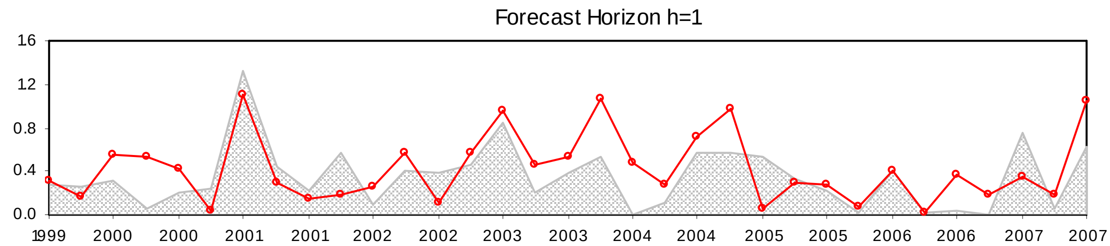
Table A.vi - Sweden - Robustness: Other Private Forecasts Set

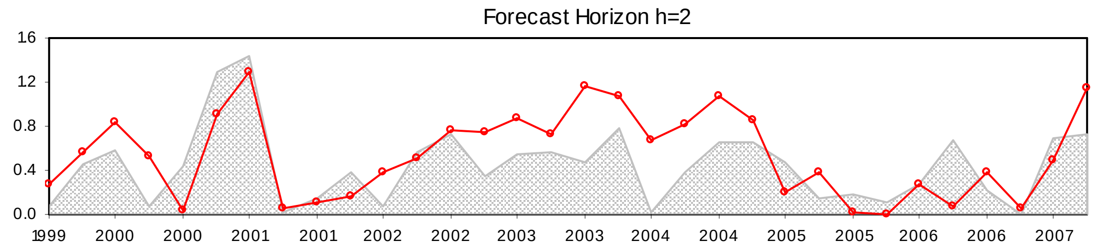
1 year ahead (Q+4) - 1996Q4-2007Q4			
		Riksbank	p-value
Prospera - ALL	1.78	**1.31**	0.11
Prospera - Money Market Players	1.44		0.45
2 years ahead (Q+8) - 1996Q4-2006Q4			
		Riksbank	p-value
Prospera - ALL	2.08	1.89	0.29
Prospera - Money Market Players	1.77		0.32

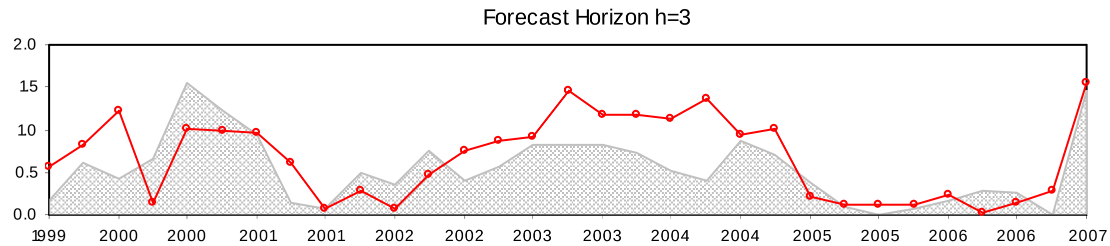
Reported values are the MSE of both categories of private forecasters and of the Riksbank. The p-value is for the test of the null hypothesis that the central errors and private sector errors are equal.

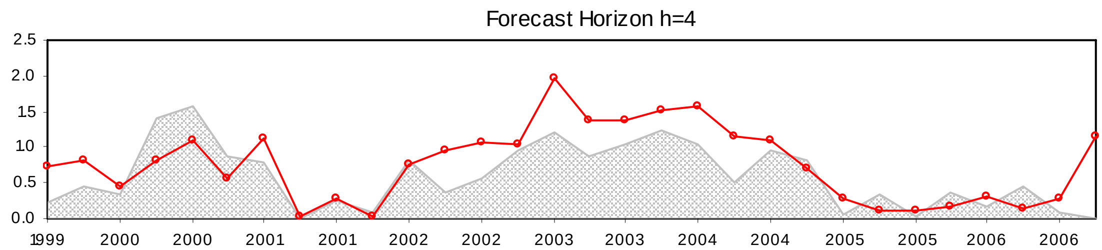
A.4. Absolute forecast errors in Sweden











A.5. The Swedish Puzzle

Table A.vii - Sweden - Timing Disadvantage of the Riksbank

Variable	CPI Y_t	*se*	R^2
$CB^{h=1}_{t-1}$	0.073	(0.201)	0.86
$PS^{h=0}_{t}$	**0.925*******	(0.163)	
$CB^{h=2}_{t-1}$	0.369	(0.237)	0.65
$PS^{h=1}_{t}$	**0.772*******	(0.229)	
$CB^{h=3}_{t-1}$	0.396	(0.259)	0.44
$PS^{h=2}_{t}$	**0.853****	(0.308)	
$CB^{h=4}_{t-1}$	0.635*	(0.325)	0.32
$PS^{h=3}_{t}$	**0.811****	(0.364)	

Numbers in parentheses are robust standard errors. *,**,*** means respectively significant at 10%, 5%, 1%.