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Bank of Canada communication and the predictability of Canadian monetary policy

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Bank of Canada Communication and the Predictability of Canadian Monetary Policy

Abstract

We explain changes in the Canadian target rate using macroeconomic variables and Bank of Canada (BOC) communication indicators. Econometrically, we employ an ordered probit model of a Taylor rule to predict 60 target rate decisions between 1998 and 2006. We find that BOC communication is forward-looking, with a horizon that goes beyond the next meeting. Speeches and testimonies by Governing Council members have a statistically significant impact, whereas the less frequent monetary policy reports are insignificant. These communication variables significantly explain target rate changes but have no additional explanatory power over a standard Taylor rule. Prior to the introduction of Fixed Announcement Dates, BOC communication contained more information on upcoming policy moves. Communications by the U.S. Federal Reserve Bank (Fed)—which are much more frequent—outperform our Canadian communication indicators in predicting Canadian target rate decisions. We conclude that if the BOC is interested in improving the predictability of its monetary policy decisions, it should follow the Fed and use informal types of communication more frequently.

JEL: E43, E52, E58

Keywords: Bank of Canada, Central Bank Communication, Interest Rate Decision, Monetary Policy, Ordered Probit Model, Taylor Rule

1. Introduction

The recent history of Canadian monetary policy is well-suited for a case study on central bank communication. Starting with the first oil crisis in 1973, Canada had inflation rates of 4 percent or higher. With the introduction of the inflation target (IT) in 1991, the Bank of Canada (BOC) was successful in keeping inflation below 3 percent.[1] However, the move to IT and the emphasis on reducing inflation rates was accompanied by, perhaps even contributed to, a weak economic performance (Curtis, 2005). In addition, several smaller steps intended to enhance central bank transparency have been undertaken: from September 1998 onward, the Bank of Canada has intervened in the foreign exchange market only under exceptional circumstances. In September 2000, it introduced Fixed Announcement Dates (FAD); previously, target rate[2] changes could effectively occur on any business day.[3] With the introduction of FADs, the BOC seemingly became more 'independent' from the Federal Reserve Bank (Fed). The BOC has not explicitly referred to any prior decisions by the Fed in its post-meeting statements since May 2000.

Today, communication occurs via several formal and informal channels: post-meeting statements accompanying target rate decisions and the quarterly monetary policy report, as well as congressional hearings and speeches by members of the Governing Council.[4] Usually, these are based on an 18–24-month economic outlook for the Canadian economy. In recent years, it has become common practice to indicate the future course of BOC monetary policy. The more formalized channels, such as statements and monetary policy reports, are used infrequently (eight and four publications per year, respectively) and thus it is chiefly speeches that are the main channel for conveying new information to private economic agents. Canadian financial market returns and volatility are affected by these less formal types of communication (see Hayo and Neuenkirch, 2009a).

In this study, we explain Canadian monetary policy using (1) a Taylor rule incorporating macroeconomic data and (2) BOC communication. The purpose is to analyze whether central bank communication improves the predictability of target rate decisions. Our sample starts with the first target rate decision in 1998 (January 30) and ends with the last one in 2006 (December 5). Accordingly, our first research questions are: Does BOC

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[1] Source: Bank of Canada.

[2] The Bank of Canada used the bank rate as the key policy target until April 2001; thereafter, the overnight rate. For simplicity reasons, we use the term 'target rate'.

[3] The Bank of Canada had four key objectives when it introduced the new system for announcing target rate decisions: reduced uncertainty in financial markets, more emphasis on medium-term monetary policy, increased transparency regarding the BOC's interest rate decisions, and greater focus on the Canadian rather than the U.S. economic environment (Parent et al., 2003).

[4] Until 1999, the monetary policy report was published semi-annually like in the United States.

communication provide information additional to that already incorporated in a real-time Taylor rule? If yes, does the FAD system (establishing a system of regular statements about future monetary policy) lessen the importance of informal intermeeting communication?

Another feature of this paper is that it takes into account the fact that Canada is still closely integrated with the United States, both in real and financial terms.[5] Given the relative size of the two economies, it is interesting to study the influence of U.S. variables on Canadian interest rate decisions. This leads to our second research question: Can Canadian monetary policy be explained by changes in the federal funds target rate, U.S. macroeconomic variables, or communication by the Fed—even after introduction of the FAD system?

The remainder of the paper is organized as follows. In the next section, we summarize previous work in this area and outline our contributions to the field. Section 3 describes the construction of our communication indicators and the other variables, as well as the econometric methodology. Section 4 analyzes the relationship between communication and actual target rate changes. Section 5 studies the extent to which communication helps explain and predict target rate changes. Section 6 presents further specifications and robustness checks; Section 7 concludes.

2. Related Literature and Our Contribution

In this section, we review two branches of the existing literature, which we combine with a focus on the BOC.

One branch of the literature deals with estimating monetary policy reaction functions or Taylor rules (Taylor, 1993) for Canada. Curtis (2005) calculates a Taylor rule and finds that the constant term and the reaction to the current core CPI inflation rate are declining over time (1987–1994 and 1995–2000 subsamples), reflecting the success of the IT. The coefficient for the change in the Canadian dollar/U.S. dollar (CAD/USD) exchange rate becomes insignificant in the second subsample, which suggests that the BOC no longer tightens the target rate to prevent a depreciation of the exchange rate. Finally, the BOC eases its monetary policy stance when the unemployment rate is higher than its natural rate. This coefficient is increasing over time, mirroring the enlarged scope of expansionary monetary policy after the reduction in the average rate of inflation.

[5] About two-thirds of total portfolio investments in Canada are due to U.S. investors. The trade share with the United States is large (68 percent in 2006). In 95 percent of all currency transactions, Canadian dollars are converted into U.S. dollars and vice versa. Sources: IMF Coordinated Portfolio Investment Survey, IMF Direction of Trade Statistics, BIS Triennial Central Bank Survey (2007), and own calculations.

Muscatelli et al. (1999) use recursive least squares to estimate a Taylor rule for the period 1975–1996. When including the federal funds rate into the equation, the coefficients for expected inflation and output gap are insignificant. The authors also restrict the sample to the period after the money supply targeting regime in Canada (1982–1996 subsample), which yields significant and positive coefficients for the output gap and the CAD/USD exchange rate, but not for inflation expectations.

Fougere (2001) concludes that BOC monetary policy is characterised by both forward-looking and backward-looking behaviour after the introduction of IT. His estimates also reveal that the BOC gives significant weight to output stabilisation, since the coefficient on the output gap is about 40 percent of the summarised inflation gap coefficients.

Nikolsko-Rzhevskyy (2008) estimates a real-time forward-looking Taylor rule for the period 1988–2007. The coefficient for the inflation forecast is significant in all specifications and larger than unity when not including the federal funds rate. The output gap is either insignificant (once he allows for interest rate smoothing) or unexpectedly negative, suggesting misdirected monetary policy. Changes in the CAD/USD exchange rate do not significantly explain interest rate setting.

The second relevant branch of the literature involves incorporating communication into a Taylor rule for the European Central Bank (ECB) and the Fed. Jansen and de Haan (2009) examine whether ECB communication is useful in predicting its policy decisions. Using ordered probit models, they find that statements about the main refinancing rate and future inflation are significantly related to interest rate decisions. An out-of-sample evaluation shows, however, that communication-based models do not outperform models based on macroeconomic data in predicting decisions. Heinemann and Ullrich (2007) integrate an indicator measuring the 'hawkishness' of the ECB's monthly press conferences into a Taylor rule ordered probit model. They show that the wording indicator can improve the model's fit when added to the standard explanatory variables. However, a model based solely on this indicator performs worse than the baseline Taylor rule.

Hayo and Neuenkirch (2009b) explain changes in the federal funds target rate using macroeconomic variables and Federal Open Market Committee (FOMC) communication indicators. Using an ordered probit model of a Taylor rule, they show that Fed communication indicators significantly explain target rate changes and improve explanatory power over a baseline Taylor rule, both in and out of sample. Pakko (2005) examines the predictive content of post-meeting statements in a Taylor rule setting. He finds that statements convey useful information for forecasting changes in the federal funds target rate, even after controlling for

policy responses to inflation and the output gap. Lapp and Pearce (2000) investigate the information content of asymmetric directives in post-meeting statements for the likelihood of intermeeting changes in policy during the Greenspan chairmanship. They show that a bias in FOMC policy decisions significantly affects the probability that the target will be changed in the period between two meetings.

In this paper, we explain changes in the Bank of Canada target rate using macroeconomic variables and all types of BOC communication, the latter of which are analyzed on the basis of their written content. Econometrically, we use an ordered probit model to take into account the discrete nature of Canadian target rate changes. Our sample starts on 30 January 1998 and ends on 5 December 2006 and includes 60 target rate decisions. To our knowledge, there are no other studies explaining Canadian target rate changes using a discrete approach and all types of BOC as well as Fed communication.

3. Data and Econometric Methodology

Our analysis takes advantage of a new data set introduced by Hayo and Neuenkirch (2009a) that includes indicator variables for 119 speeches and congressional hearings, covering all members of the Governing Council, as well as 60 post-meeting statements and 32 monetary policy reports. The communications are sorted into two categories depending on whether they indicate likely increases or decreases in the BOC target rate. Communications that directly reference monetary policy are easily interpreted; others are not so straightforward. For example, speeches presenting a bright economic outlook can be read as an indication of future rate hikes because in good economic times, the BOC needs to take steps to prevent the economy from overheating. Hayo and Neuenkirch (2009a) point out that the BOC typically does not talk extensively about rate cuts and, therefore, a speech on a negative economic outlook can be a particularly useful indicator of this possibility.[6]

We employ a ternary variable for every communication event that takes the value +1 when the central bank leans toward a rate hike, 0 when the monetary policy will likely remain unchanged, and –1 when loose monetary policy is a strong possibility.[7] Our sample contains 60 target rate decisions. Sometimes, more than one communication event takes place in the

[6] In a very few cases, a positive economic outlook coincides with a trend toward loose monetary policy or a pessimistic outlook is communicated together with tighter monetary policy. As the monetary policy stance is a more direct indicator of future target rate decisions, we code these rare cases based on monetary policy stance.

[7] We could also use a scale up to +2 (down to –2) when both monetary policy and economic outlook point in the same direction. As pointed out earlier, the BOC gradually increased the frequency and the content of its communication during our sample. So, a scaling up to +2 could distort the results as earlier speeches sometimes lack a monetary policy part. Furthermore, it is questionable whether an indication via both variables makes a rate change more likely. Finally, some preliminary estimations show that the +1/0/–1 coding approach is more appropriate.

period between BOC meetings and we thus need to construct an indicator that captures the monetary policy stance over the entire intermeeting period. For this purpose, we net out the instances of tighter and looser monetary policy inclinations and code the communication indicators accordingly.[8] If the number of positive and negative news events is the same or if no communication occurs during an inter-meeting period, the variable is coded as 0.

The data are described in detail in Section 4. Compared with the actual target rate changes, there is a bias toward target rate hikes in the communication data. This bias is related to the BOC representative's sometimes too positive economic outlook. Jansen and de Haan (2008) and Hayo and Neuenkirch (2009b) find a similar phenomenon for the ECB and the Fed. Our econometric methodology employs a discrete choice variation of the interest rate setting rule proposed by Taylor (1993). Nikolsko-Rzhevskyy (2008) emphasizes the importance of using real-time data, instead of ex post revised data, for Taylor rules describing the BOC and we thus use real-time data (Orphanides, 2001) that are available at the time of interest rate decision making.

Our Taylor rule incorporates the core CPI inflation rate (which excludes the more volatile food and energy components) as the BOC emphasizes the importance of this measure. The unemployment rate is used to proxy real economic conditions (Curtis, 2005). As the BOC also focuses on the external value of the Canadian dollar in its mission statement (*low and stable inflation, a safe and secure currency, and financial stability*) we add the deviation of the CAD/USD exchange rate from its long-run trend to our equation. To deal with potential endogeneity problems, we instrument all three variables by their respective lagged values.[9] Preliminary regressions show that our Taylor rule yields the best fit when including the forecasts of today's values instead of more forward-looking horizons (e.g., six-month or one-year). This contradicts the findings by Fougere (2001) and Nikolsko-Rzhevskyy (2008), who emphasize the forward-looking component in Canadian monetary policy.[10]

To ensure stationarity of our variables (Hu and Phillips, 2004), we apply both the augmented Dickey-Fuller (1979) test and the KPSS test (Kwiatkowski et al., 1992). The results consistently show that the first differences of the core CPI inflation rate and the

[8] In our view, four indications of higher monetary policy, for example, do not result in a four-times-higher probability of a rate hike. Consequently, we use the +1/0/–1 scale and ensure the validity of our results with extensive robustness tests.

[9] Auxiliary regressions show that the first, eighth, ninth, and tenth lags of core CPI inflation rate, the first and third lags of the unemployment rate, and the first lag of the deviation of the CAD/USD exchange rate from its long-run trend should be used as instruments. Tests for overidentification and weak instruments (Staiger and Stock, 1997) support this choice of instruments.

[10] Both authors rely on quarterly data, which are too infrequent to be useful in our setting. Using Nikolsko-Rzhevskyy's (2008) data set in our context reveals that quarterly forward-looking data generally fail to explain BOC target rate decisions (which take place every six to eight weeks).

unemployment rate, as well the CAD/USD gap, are stationary (see Table A1 in the Appendix).[11] Econometrically, we use an ordered probit model to account for the discrete nature of Canadian target rate changes (Jansen and de Haan, 2008; Hayo and Neuenkirch, 2009b). Our specification is as follows:

$$(1)\ \Delta i_t^* = \alpha_1 \Delta i_{t-1} + \alpha_2 \Delta U.S.\ Target\ Rate_t + \beta_1 \Delta Core\ CPI\ Inflation\ Rate_t + \beta_2 \Delta Unemployment\ Rate_t + \beta_3 CAD/USD\ Gap_t + \gamma_1 Last\ Statement_t + \gamma_2 Monetary\ Policy\ Report_t + \gamma_3 Speeches\ \&\ Testimonies + \varepsilon_t$$

where Δi_t^* is the latent continuous variable representing the preferred change in the BOC target rate. Again, we use a ternary variable (+1 represents a rate hike; 0 an unchanged rate; –1 a rate cut) to describe the change in monetary policy.[12] Target rate changes occur only if the value of the index function is either below a lower unobserved threshold τ_1 or higher than an upper unobserved threshold τ_2.

Our Taylor rule incorporates three groups of explanatory variables. First, lagged target rate changes are included to capture interest rate smoothing behaviour (α_1).[13] The impact of changes in the federal funds target rate[14] since the previous BOC meeting is described by α_2 (see Figure A1 in the Appendix for a comparison of Canadian and U.S. target rates). Second, changes in the core CPI inflation rate (β_1), changes in the unemployment rate[15] (β_2), and the CAD/USD gap[16] (β_3) capture real-time macroeconomic information. Third, communication enters the equation via three variables: lagged post-meeting statements (γ_1), monetary policy report (γ_2), and our communication indicator based on speeches and testimonies (γ_3). The residuals ε_t are assumed to follow a standard normal distribution, which implies that the probabilities of the different outcomes can be written as:

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[11] The CAD/USD gap is derived based on its trend, estimated by a Hodrick-Prescott filter (1997), for 1995–2008 (λ = 14,400).

[12] During our sample period, the BOC raised or lowered the target rate once by 100 bps, once by 75 bps, five times by 50 bps, and 33 times by 25 bps. Instead of the ternary variable, we could use a septuplicate (+4/+2/+1/0/–1/ –2/–3) variable to describe the BOC behaviour. As it turns out, the modelling describes very well whether rate changes occur, but it largely fails to differentiate between small and large interest rate steps.

[13] We employ a lagged dependent variable rather than an autoregressive error specification (Rudebusch, 2002) based on results presented by Castelnuovo (2003). However, the interpretation of interest rate smoothing behaviour is still a subject of debate (Rudebusch, 2006).

[14] Coded as 3/2/1/0/–1/–2/–4 for changes of 75/50/25/0/–25/–50/–100 bps in the federal funds target rate in the intermeeting period of two BOC meetings.

[15] We evaluated several other variables reflecting the economic conditions in Canada, none of which turned out to perform well in explaining target rate decisions: monthly GDP and several variations of it, the IVEY purchasing manager index (available since December 2000), and the quarterly capacity utilization rate.

[16] The use of the monetary conditions index and some variations of it did not reveal significant coefficients. The index was used by the BOC until the end of 2006 to guide monetary policy decisions. It was constructed as a weighted sum of the changes in the short-term interest rate (the 90-day commercial paper rate) and the exchange rate (as measured by the C-6 index) from a given base period.

$$\Pr[\Delta i_t = -1|z_t] = \Phi(\tau_1 - z_t'\beta)$$
$$\Pr[\Delta i_t = 0|z_t] = \Phi(\tau_2 - z_t'\beta) - \Phi(\tau_1 - z_t'\beta)$$
$$\Pr[\Delta i_t = 1|z_t] = \Phi(\tau_2 - z_t'\beta)$$

where Φ denotes the cumulative standard normal distribution and z_t is our vector of explanatory variables. The ordered probit models are estimated by maximum likelihood (Maddala, 2006) and the threshold variables are obtained simultaneously with the vector of explanatory variables β. In Section 5, we present the empirical results of estimating different variations of Equation (1), including: (i) a pure Taylor rule; (ii) a pure communication model; and (iii) a joint model including both macroeconomic and communication variables.

4. Consistency of BOC Communication

In this section, we evaluate how consistent BOC communication is with actual policy decisions. We examine every communication event and relate it to target rate decisions in four different ways. We investigate whether the communication content is consistent with (1) the decision in the last BOC meeting and/or (2) with the upcoming BOC decision. We call these 'backward-looking' and 'forward-looking' target consistency (Ehrmann and Fratzscher, 2007; Hayo and Neuenkirch, 2009b), respectively. As communication could refer to a horizon farther away than the previous or the next meeting, we also evaluate 'path consistency', i.e., whether (3) BOC communication is in line with its *last* target rate *change* and/or (4) with its *next* target rate *change*. The top part of Table 1 shows the consistency of different communication forms; the bottom part shows consistency over time.

Table 1: Consistency of BOC Communication

	Last Decision	**Next Decision**	**Last Change**	**Next Change**
Overall	40 / 56%	41 / 57%	50 / 69%	53 / 74%
Monetary Policy Reports	15 / 56%	14 / 52%	19 / 70%	19 / 70%
Speeches & Testimonies	25 / 56%	27 / 60%	31 / 69%	34 / 76%
1998	2 / 50%	3 / 75%	2 / 50%	3 / 75%
1999	0 / 0%	3 / 75%	0 / 0%	3 / 75%
2000	9 / 100%	5 / 56%	9 / 100%	5 / 56%
2001	9 / 75%	9 / 75%	10 / 83%	9 / 75%
2002	6 / 55%	4 / 36%	6 / 55%	8 / 73%
2003	5 / 50%	8 / 80%	8 / 80%	8 / 80%
2004	3 / 43%	3 / 43%	3 / 43%	5 / 71%
2005	1 / 14%	2 / 29%	5 / 71%	5 / 71%
2006	5 / 63%	4 / 50%	7 / 88%	7 / 88%

Comparing the figures for target consistency (Columns 1 and 2 of Table 1) and path consistency (Columns 3 and 4), we find that the latter dominates the former for both forward-looking and backward-looking indicators. This is particularly true for the subsample (2001–2006), a period during which the BOC followed a regular schedule (FAD) of deciding on its target rate. We conclude that communication has a longer horizon than one BOC meeting, whether the previous meeting or the next one in the future. Turning to the question of whether the BOC communicates forward- or backward-looking, Table 1 shows that forward-looking path consistency dominates backward-looking path consistency overall, as well as in the speeches and testimonies category. Over the whole sample, 76 (70) percent of the speeches and testimonies (monetary policy reports) are consistent with the next target rate change.

In our sample, the forward-looking measure is generally a better predictor. The only noticeable exception is 2000–2001, when the BOC communicated a mostly bright economic outlook, failing to anticipate the recession in Canada (second half of 2001) and the even sharper downturn in the United States.

Our communication indicator is visually illustrated in Figures 1a–1c, where the BOC target rate is the black line and our communication indicators are symbolized by + (indicator suggests rate increase), 0 (rate expected to be constant), and – (rate predicted to decrease). As mentioned in Section 3, there is an upward bias in the data that is chiefly due to those communications expressing an overly optimistic economic outlook, as in times of unchanged monetary policy our indicator is sometimes positive (see in particular Figure 1a where the post-meeting statements are shown). This does not necessarily violate path consistency, but it does violate target consistency. Furthermore, we find that the BOC is very cautious about mentioning rate cuts. Only when a rate cut is truly imminent do the majority of speeches signal such a decision. In our modelling framework, this bias should not negatively affect predictability, as in an ordered probit model we only expect the upper threshold to be absolutely higher than the lower threshold.

In the intermeeting period before an increase of the target rate (19 target rate hikes), one or more types of communication mention such a possibility. At least one of these indicators turns negative or changes from positive to neutral when the BOC lowers its target rate at the next meeting (20 target rate cuts). Figures 1c and 1b also show the low frequency of speeches and, in particular, of monetary policy reports; there are many intermeeting periods during which no communication events occur.

Figure 1a: Bank of Canada Target Rate and Last Post-Meeting Statement

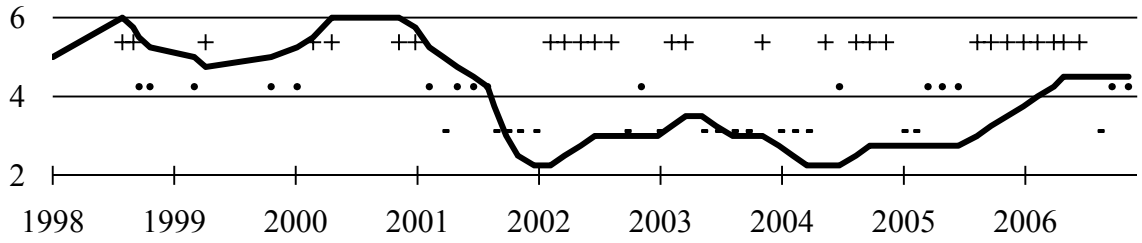


Figure 1b: Bank of Canada Target Rate and Monetary Policy Reports

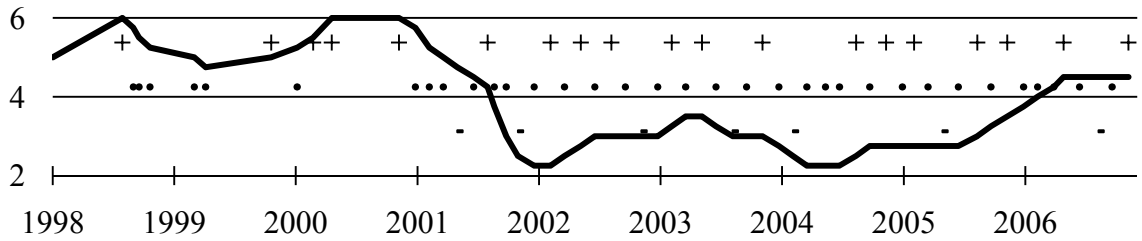
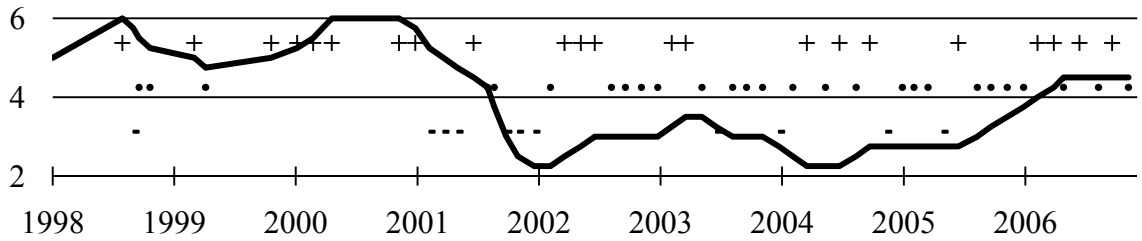


Figure 1c: Bank of Canada Target Rate and Speeches & Testimonies Indicator



5. Predicting BOC Target Rate Changes with Communication

In this section, we present the results of our empirical estimations employing different specifications based on Equation (1). Column (1) of Table 2 shows the model based on macroeconomic news only, Column (2) incorporates communication variables only, and Column (3) uses both types of information. Measured by the pseudo R^2, the joint model (Column (3)) has a slightly better fit than the macro model in Column (1), whereas the communication model (Column (1)) is marginally the worst. Reflecting the mentioned economic outlook bias, the upper thresholds are larger in absolute terms than the lower ones in Models (2) and (3). Surprisingly, this is also the case for Model (1).

Interest rate smoothing is evident in all three specifications, as lagged target rate decisions help predict current ones. In all specifications, there is a positive impact of movement in the U.S. federal funds rate since the last BOC meeting. The coefficients of changes in the core CPI inflation rate and the unemployment rate are significant in the Taylor

rule model and they remain significant at a 10 percent level in the joint model. The CAD/USD gap is also significant in Models (1) and (3), with similar coefficients. An increasing core CPI inflation rate and a decreasing unemployment rate lead to higher interest rates as the BOC reacts either to contain inflationary pressures or stabilize the business cycle, respectively. In the case of an undervalued currency (with respect to its long-run trend), the BOC tightens monetary policy so as to strengthen the Canadian dollar. These results deviate somewhat from findings of Curtis (2005), Muscatelli et al. (1999), Fougere (2001), and Nikolsko-Rzhevskyy (2008) as in each of those studies at least one macroeconomic variable is not significant.

Table 2: Predicting Bank of Canada Target Rate Changes with BOC Communication

	(1)		**(2)**		**(3)**	
	Taylor Rule		**Communication**		**Joint Model**	
Last Rate Decision	1.48	***	1.09	***	1.52	***
U.S. Rate Change	1.62	***	1.11	***	1.70	***
Δ(Core CPI Inflation Rate)	1.58	**	---		1.72	*
Δ(Unemployment Rate)	–2.09	**	---		–1.88	*
CAD/USD Gap	0.24	***	---		0.23	***
Last Statement	---		0.56	**	0.20	
Monetary Policy Reports	---		0.13		0.19	
Speeches & Testimonies	---		0.74	**	0.77	**
Lower Cut Point	–0.77	**	–0.90	***	–0.80	**
Upper Cut Point	1.98	***	1.91	***	2.66	***
LR Statistic	43.94	***	30.93	***	40.14	***
Pseudo Log-Likelihood	–26.50		–28.35		–23.82	
Pseudo-R^2	0.60		0.57		0.64	
Overidentifying Restrictions	5.07		---		3.48	

Notes: */**/*** denote significance at the 10/5/1 percent level. Huber (1967)/White (1980) robust standard errors are used.

Monetary policy reports are insignificant in both the communication and the joint model, which reflects the low frequency of this type of communication (26 nonzero observations). Previous statements, as well as speeches and testimonies, significantly explain target rate decisions in Model (2), whereas previous statements become insignificant in Model (3), indicating collinearity with the macroeconomic variables. A joint statistical test rejects the exclusion of statements and monetary policy reports from Model (3) ($\text{Chi}^2(2) = 5.02^*$).[17] The estimated coefficients are difficult to interpret, as they measure the influence of the explanatory variables on the latent variable Δi_t^*. Furthermore, we can make no conclusions as

[17] When excluding one of these variables from Model (3), the other variable remains insignificant.

about the impact on the middle category of our ternary variables. Therefore, Table 3 shows the average marginal effects.

Table 3: Average Marginal Effects for Models (1)–(3)

	Prob[Rate Cut]	Prob[No Change]	Prob[Rate Hike]
(1) Taylor Rule			
Last Rate Decision	–0.19 ***	0.08 ***	0.11 ***
U.S. Rate Change	–0.21 ***	0.09 **	0.12 ***
Δ(Core CPI Inflation Rate)	–0.21 **	0.09	0.12 ***
Δ(Unemployment Rate)	0.27 ***	–0.11 *	–0.16 *
CAD/USD Gap	–0.03 ***	0.01	0.02 ***
Correct Predictions	19/20	15/21	14/19
(2) Communication			
Last Rate Decision	–0.14 ***	0.04	0.10 ***
U.S. Rate Change	–0.15 ***	0.04	0.11 ***
Last Statement	–0.07 **	0.02	0.05 **
Monetary Policy Reports	–0.02	0.004	0.01
Speeches & Testimonies	–0.10 **	0.03	0.07 **
Correct Predictions	17/20	16/21	15/19
(3) Joint Model			
Last Rate Decision	–0.15 ***	0.07 **	0.09 ***
U.S. Rate Change	–0.17 ***	0.07 **	0.10 ***
Δ(Core CPI Inflation Rate)	–0.17 *	0.07	0.10 *
Δ(Unemployment Rate)	0.18 *	–0.08	–0.10
CAD/USD Gap	–0.02 ***	0.01	0.01 **
Last Statement	–0.02	0.01	0.01
Monetary Policy Reports	–0.02	0.01	0.01
Speeches & Testimonies	–0.08 **	0.03	0.04 *
Correct Predictions	18/20	14/21	16/19

Notes: The figures show the average of marginal effects over all observations. */**/*** denotes significance at the 10/5/1 percent level.

In the Taylor rule specification of Model (1), a one-point higher value for the last target rate decision (i.e., no change instead of a rate cut, or a rate hike instead of no change) decreases (increases) the probability of a cut (unchanged target rate/hike) today by 19 (8/11) percentage points. A 25 bps change in the U.S. target rate during the intermeeting period influences today's rate decision by about the same amount (–21 percentage points for cuts; +9 for an unchanged target rate; +12 for hikes). A 1 percentage point higher core CPI inflation rate lowers (raises) the chance of a rate cut (hike) by 21 (12) percentage points. If the unemployment rate goes up by 1 percentage point, a rate cut (unchanged target rate/hike) is more (less) likely by 27 (11/16) percentage points. Finally, a 1 percent undervaluation of the

Canadian dollar with respect to its long-run trend reduces (raises) the probability of a rate cut (hike) by 3 (2) percentage points.

When using only communication variables to predict BOC decisions, the importance of interest rate smoothing decreases (–14 percentage points for rate cuts; +10 for rate hikes), as does that of U.S. influence (–15 for cuts; +11 for hikes). Some information in the lagged rate changes is captured by the influence of lagged post-meeting statements. A one-point change in the last statement causes a rate cut (hike) to be less (more) likely by 7 (5) percentage points. The speeches and testimonies indicator affects the probability of target rate movements in a similar way. (–10 percentage points for rate cuts; +7 for rate hikes). In the joint model, lagged Canadian and U.S. target rate changes significantly influence the probabilities of all three categories. The average marginal effects of speeches and testimonies as well as those of statements become less significant and insignificant, respectively.

Table 3 also shows that all three models can correctly explain target rate decisions (48 out of 60 decisions). Model (1) performs best in explaining cuts, Model (2) is the most appropriate for an unchanged target rate, and the joint model does well in anticipating hikes: 42 decisions are jointly explained correctly by all models, whereas six cases cannot be explained by any of our models. After splitting the sample into pre-FAD and post-FAD periods, we find the communication model (Model (2)) performing slightly worse pre-FAD (7/10 compared to 8/10 by Models (1) and (3)) and marginally better after 2001 (41/50 compared to 40/50). Given the relatively low frequency of Canadian central bank communication, such does not contain any information additional to macroeconomic variables The opposite phenomenon can be found in the case of the U.S. Federal Reserve, where the more frequent central bank communication dominates the information content of inflation expectations and the output gap (Hayo and Neuenkirch, 2009b).

Due to the unavailability of appropriate data, we cannot study the out-of-sample performance of the models. However, to approximate an out-of-sample assessment, we re-estimate Models (1)–(3) initially for the subsample 1998–2003 and predict target rate changes for the remaining period using a rolling-window of out-of-sample forecasts that requires re-estimating the model after every period.[18] Table 4 shows that the predictive ability of the Taylor-rule-based Model (1) is the best, as 18 out of 24 interest rate decisions are correctly anticipated. For instance, all hikes are correctly predicted, whereas Models (2) and (3) fail to forecast two hikes.

[18] We start by estimating each model using the first 36 observations and then evaluate whether the model correctly predicts the interest rate decision at t = 37. Next, we re-estimate the models using the first 37 observations and predict the outcome at t = 38, and so on.

Table 4: Approximating Out-of-Sample Predictions Using Rolling-Window Estimations

	(1) Taylor Rule	(2) Communication	(3) Joint Model
Target Rate Cuts	2 / 3	2 / 3	2 / 3
No Change in Target Rate	7 / 12	7 / 12	7 / 12
Target Rate Hikes	9 / 9	7 / 9	7 / 9
All Rate Changes	18 / 24	16 / 24	16 / 24

Notes: The initialization period is 1998–2003 (36 rate changes) and parameters are updated every period throughout the remaining sample period 2004–2006 (24 rate changes).

Instead of using rolling-window estimations that update parameters in every period, we can test temporal stability by estimating parameters over the period 1998–2003 and using the resulting models to derive predictions by plugging in values of the relevant variables in each period. Table 5 shows that the communication model (Model (2)) performs best when holding coefficients constant, whereas the other two models, especially Model (3), suffer from a deterioration in predictive ability.

Table 5: Approximating Out-of-Sample Predictions Using a Fixed Estimation Period

	(1) Taylor Rule	(2) Communication	(3) Joint Model
Target Rate Cuts	2 / 3	2 / 3	2 / 3
No Change in Target Rate	5 / 12	8 / 12	4 / 12
Target Rate Hikes	9 / 9	7 / 9	7 / 9
All Rate Changes	16 / 24	17 / 24	13 / 24

Testing parameter instability using Chow-type tests at a 5 percent confidence level (see Figure A2 in the Appendix) does not permit rejecting constancy in the case of the Taylor rule (Model (1)) and the communication model (Model (2)). These results suggest that both models are robust and reliable devices for predicting BOC target rate changes, even out-of-sample.

6. Further Results and Robustness Tests

To assess the impact of organizational change on central bank decision making, we test whether introduction of FAD induced a significant break in the impact of central bank communication (see Table 6). Before December 2000, target rate changes were possible any business day and often replicated a Fed decision taken the day before.[19] Thereafter, the BOC committed itself to a pre-defined schedule of eight meetings a year with only one exception—the rate cut on 17 September 2001 following the market depressing incidents on 9/11. As

[19] In 7 out of 10 decisions, the BOC directly refers to a U.S. decision.

there are only 60 observations, our model fails to converge when we split all three communication variables at the same time.[20] Splitting the post-meeting statements (Model (4)) does not reveal a significant impact of this type of communication during either subsample, thus confirming the results obtained by Model (3), where the coefficient is also insignificant.

Table 6: Influence of FAD System on Target Rate Change Predictability

	(4)		**(5)**		**(6)**	
Last Rate Decision	1.62	***	1.48	***	1.76	***
U.S. Rate Change	1.71	***	1.73	***	1.71	***
Δ(Core CPI Inflation Rate)	1.72		1.77	*	2.30	**
Δ(Unemployment Rate)	–1.84	*	–1.86		–1.98	*
CAD/USD Gap	0.22	***	0.24	***	0.27	***
Last Statement	---		0.20		0.23	
…before FAD	–0.55		---		---	
…FAD	0.34		---		---	
Monetary Policy Reports	0.23		---		0.10	
…before FAD	---		7.79	***	---	
…FAD	---		0.10		---	
Speeches & Testimonies	0.77	**	0.69	*	---	
…before FAD	---		---		1.92	*
…FAD	---		---		0.44	
Lower Cut Point	–0.97	***	–0.78	**	–0.79	**
Upper Cut Point	2.75	***	2.65	***	2.76	***
LR Statistic	85.57	***	85.56	***	87.01	***
Pseudo Log-Likelihood	–23.08		–23.09		–22.36	
Pseudo-R^2	0.65		0.65		0.66	
Overidentifying Restrictions	3.14		4.27		3.87	

Notes: */**/*** denotes significance at the 10/5/1 % level. Huber/White robust standard errors are used.

Model (5) shows that monetary policy reports have a large impact before establishment of the FAD system. After the FAD was introduced, its impact is similar to the one in Model (3) and the difference between pre-FAD and FAD coefficients is statistically significant ($Chi^2(1) = 229$***). Thus, in the absence of a regular meeting schedule, even the infrequent monetary policy report (semi-annual in 1998–1999, quarterly in 2000) helps explain target rate changes. Speeches, too, are more important in the period prior to FAD and insignificant thereafter. However, due to large standard errors, we do not find a statistically significant difference ($Chi^2(1) = 1.93$). To conclude, BOC communication significantly

[20] Neither is it possible to create interaction dummies capturing the decreasing impact of communication post-FAD.

improves explanation of target rate changes in the period prior to FAD, whereas in the FAD subsample, the impact is insignificant.

We next focus on the question of whether the BOC acts independently of the Fed. Models (1)–(6) show that federal funds target rate movements that occur in the period between two meetings significantly and robustly explain BOC rate changes. In Table 7, we analyze whether other U.S. variables, such as macroeconomic news and Fed communication, provide additional explanatory power.[21] Accordingly, we add U.S. macroeconomic news (Model (7)), Fed communication (Model (8)), and both groups of variables (Model (9)) to Equation (1).

Table 7: Influence of U.S. Variables on Target Rate Change Predictability

	(7)		**(8)**		**(9)**	
Last Rate Decision	1.71	***	1.74	***	1.86	***
U.S. Rate Change	1.61	***	1.43	***	1.39	***
Δ(Core CPI Inflation Rate)	1.63		1.94	*	1.83	
Δ(Unemployment Rate)	–1.61		–2.31	**	–2.02	*
CAD/USD Gap	0.23	***	0.26	***	0.27	***
Last Statement	0.13		0.13		0.08	
Monetary Policy Reports	0.41		0.05		0.26	
Speeches & Testimonies	0.71	*	0.65	*	0.61	
Δ(U.S. Inflation Expectations)	0.93		---		0.77	
U.S. ISM Gap	0.02		---		0.01	
U.S. Statements	---		–0.05		0.01	
U.S. Comm. Indicator	---		0.75		0.62	
Lower Cut Point	–0.85	**	–0.44		–0.51	
Upper Cut Point	2.73	***	3.22	***	3.20	***
LR Statistic	86.10	***	85.96	***	87.20	***
Pseudo Log-Likelihood	–22.82		–22.89		–22.27	
Pseudo-R^2	0.65		0.65		0.66	
Overidentifying Restrictions	5.60		4.86		6.44	

Notes: */**/*** denotes significance at the 10/5/1 % level. Huber/White robust standard errors are used.

U.S. macroeconomic variables and Fed communications are insignificant in all specifications, both individually and jointly, and provide no additional explanatory power.[22] Only Model (7) predicts one additional rate change (49 out of 60), Model (8) performs even more poorly (47 out of 60), and in Model (9) nothing changes. There appears to be some collinearity between U.S. and Canadian variables. Noteworthy is the finding that changes in U.S. inflation expectations can act as a substitute for the influence of changes in the current

[21] The U.S. macroeconomic and Fed communication variables are obtained from Hayo and Neuenkirch (2009b).
[22] The outcomes of joint significance tests for the various U.S. variables are: model (7): $Chi^2(2) = 3.34$; model (8): $Chi^2(2) = 3$; model (9): $Chi^2(4) = 4.79$.

Canadian inflation rate on BOC monetary policy decisions. Interestingly, when excluding Canadian communication variables from Model (9), the U.S. communication indicator becomes significant and the model then correctly explains 51 out of 60 BOC target rate changes. Even though U.S. and Canadian monetary policy are not always synchronised (see Figure A2, particularly years 2002–2004), the much more frequent U.S. communication better anticipates upcoming Canadian rate changes than do models incorporating only Canadian variables. Therefore, if the BOC is interested in increasing the predictability of its monetary policy decisions, it should communicate more frequently with the private sector.

7. Conclusions

In this paper, we explain changes in the BOC target rate by means of macroeconomic variables and various forms of BOC communication. We focus on the question of whether BOC communication contains information additional to that already incorporated in a real-time Taylor rule. The communication indicator is derived on the basis of post-meeting statements and the quarterly (semi-annual) monetary policy report, as well as on the content of speeches and congressional hearings by Governing Council members. Econometrically, we use an ordered probit model to take into account the discrete nature of target rate changes. The sample starts 30 January 1998 and ends 5 December 2006, covering 60 target rate decisions and a period characterized by increasing transparency in Canadian monetary policy. Our communication indicator summarizes the communication that takes place between BOC meetings and is based on a data set constructed by Hayo and Neuenkirch (2009a). Changes in the core CPI inflation rate, the unemployment rate, and deviation of the CAD/USD rate from its long-run trend are employed as macroeconomic variables.

First, we check whether the communication content reflects actual monetary policy and find that BOC communication has a longer horizon than one meeting. Communication is forward-looking and, over the whole sample, 74 percent of the speeches are consistent with the next target rate change.

Second, we insert the communication variables (lagged statements, monetary policy reports, and our speeches and testimonies indicator) into different models describing the BOC interest rate setting behaviour. These variables provide a significant and robust explanation of the BOC's target rate changes. Including the communication indicator helps predict the same number of target rate changes as does a Taylor rule or a model incorporating both types of news (48 out of 60). Regarding the different types of communication, speeches and

testimonies, as well as post-meeting statements, contain more explanatory power than the less frequent monetary policy reports.

Third, we approximate out-of-sample predictions by using rolling-window estimations and parameter constancy tests. The communication variables generate only slightly less accurate one-step-ahead forecasts than the model using only macroeconomic news: the outcome of 16 out of 24 BOC meetings over the period 2004–2006 (in comparison to 18 out of 24) is correctly predicted. Using a fixed estimation period, the communication model slightly outperforms the macro model (17/24 vs. 16/24). In addition, the coefficients of both models appear to be stable over time.

Fourth, communication (monetary policy reports, speeches, and testimonies) helps explain target rate changes to a large extent before introduction of the Fixed Announcement Days (FAD) system but not thereafter. The more formalized and regular type of communication, post-meeting statements, has no significant impact in either subsample. Therefore, under the FAD system, regularly monitoring macroeconomic news appears to be more helpful in predicting target rate decisions than relying on official communications by the BOC.

Fifth, including U.S. variables other than federal funds target rate changes reveals at least two interesting insights, even though these variables provide little additional explanatory power when added to the Canadian variables. (i) We show that U.S. inflation expectations can be used as a substitute for the Canadian core CPI inflation rate without losing any explanatory power. (ii) Using U.S. communication variables instead of Canadian ones significantly explains BOC rate decisions and improves the model's fit (51 out of 60 decisions are explained correctly).

The results of our study suggest that BOC communication, particularly in its more informal guise, such as speeches by BOC members, contains useful information about future monetary policy. However, agents could explain Canadian rate changes with the same degree of accuracy by monitoring macroeconomic developments in Canada. Furthermore, even though U.S. and Canadian monetary policy are not always synchronised, the much more frequent U.S. communication provides a better indication of upcoming Canadian rate changes than do models relying only on Canadian variables. Therefore, if the BOC is interested in improving the predictability of its policy decisions, it should consider increasing the number of communications to the public.

References

BIS (2007), Foreign Exchange and Derivatives Market Activity in 2007, *Bank for International Settlements Triennial Central Bank Survey*, December.

Castelnuovo, E. (2003), Taylor Rules, Omitted Variables, and Interest Rate Smoothing in the US, *Economics Letters* 81, 55–59.

Curtis, D. (2005), Monetary Policy and Economic Activity in Canada in the 1990s, *Canadian Public Policy* 35, 59–78.

Dickey, D. A. and Fuller, W. A. (1979), Distribution for Autoregressive Time Series with a Unit Root, *Journal of the American Statistical Association* 74, 427–431.

Ehrmann, M. and Fratzscher, M. (2007), Communication by Central Bank Committee Members: Different Strategies, Same Effectiveness? *Journal of Money, Credit and Banking* 39, 509–541.

Fougere, M. (2001), Monetary Policy Reaction Function, Inflation Targeting and Financial Market Disruption: Some Evidence for Canada, *International Review of Economics and Business* 48, 457–473.

Hayo, B. and Neuenkirch, M. (2009a), Domestic or U.S. News: What Drives Canadian Financial Markets? *MAGKS Joint Discussion Paper Series in Economics* 08–2009.

Hayo, B. and Neuenkirch, M. (2009b), Does FOMC Communication Help Predicting Federal Funds Target Rate Changes? *MAGKS Joint Discussion Paper Series in Economics* 25–2009.

Heinemann, F. and Ullrich, K. (2007), Does it Pay to Watch Central Bankers' Lips? The Information Content of ECB Wording, *Swiss Journal of Economics and Statistics* 3, 155–185.

Hodrick, R. J. and Prescott., E. C. (1997), Postwar U.S. Business Cycles—An Empirical Investigation, *Journal of Money, Credit and Banking* 29, 1–16.

Hu, L. and Phillips, P. C. B. (2004), Dynamics of the Federal Funds Target Rate: A Nonstationary Discrete Choice Approach, *Journal of Applied Econometrics* 19, 851–867.

Huber, P. J. (1967), The Behavior of Maximum Likelihood Estimates Under Non-Standard Conditions, *Proceedings of the Fifth Berkeley Symposium on Mathematical Statistics and Probability* 1, 221–233.

Jansen, D. J. and de Haan, J. (2009), Has ECB Communication Been Helpful in Predicting Interest Rate Decisions? An Evaluation of the Early Years of the Economic and Monetary Union, *Applied Economics* 41, 1995-2003.

Kwiatkowski, D., Phillips, P. C. B., Schmidt, P. and Shin, Y. (1992), Testing the Null Hypothesis of Stationarity Against the Alternative of a Unit Root: How Sure Are We that Economic Time Series Have a Unit Root? *Journal of Econometrics* 54, 159–178.

Lapp, J. S. and Pearce, D. K. (2000), Does a Bias in FOMC Policy Directives Help Predict Intermeeting Policy Changes? *Journal of Money, Credit and Banking* 32, 435–441.

Maddala, G. S. (2006), *Limited-Dependent and Qualitative Variables in Econometrics, Cambridge*, Cambridge University Press.

Muscatelli, V. A., Tirelli, P., and Trecoci, C. (1999) Institutional Change, Inflation Targeting and the Stability of Interest Rate Reaction Functions, *University of Milan Working Paper Series* No. 20.

Nikolsko-Rzhevskyy, A. (2008), Monetary Policy Evaluation in Real Time: Forward-Looking Taylor Rules Without Forward-Looking Data, *MPRA Paper* No. 11352.

Orphanides, A. (2001), Monetary Policy Rules Based on Real-time Data, *American Economic Review* 91, 964–985.

Pakko, M. R. (2005), On the Information Content of Asymmetric FOMC Policy Statements: Evidence from a Taylor-Rule Perspective, *Economic Inquiry* 43, 558–569.

Parent, N., Munro, P., and Parker, R. (2003), An Evaluation of Fixed Announcement Dates, *Bank of Canada Review* Autumn 2003, 3–11.

Rudebusch, G. D. (2002), Term Structure Evidence on Interest Rate Smoothing and Monetary Policy Inertia, *Journal of Monetary Economics* 49, 1161–1187.

Rudebusch, G. D. (2006), Monetary Policy Inertia: A Fact or Fiction? *International Journal of Central Banking* 2, 85–135.

Staiger, D. and Stock, J. H. (1997), Instrumental Variables Regression with Weak Instruments, *Econometrica* 65, 557–586.

Taylor, J. (1993), Discretion Versus Policy Rules in Practice, *Carnegie-Rochester Conference Series on Public Policy* 39, 195–214.

White, H. (1980), A Heteroskedasticity-Consistent Covariance Matrix Estimator and a Direct Test for Heteroscedasticity, *Econometrica* 48, 817–830.

Appendix

Table A1: Unit Root Tests

	ADF	ADF w/ Trend	KPSS	KPSS w/ Trend
Unemployment Rate	–1.72	–2.1	0.57**	0.15**
Δ(Unemployment Rate)	–7.59***	–7.52***	0.12	0.12
Core CPI Inflation Rate	–2.47	–2.44	0.17	0.17**
Δ(Core CPI Inflation Rate)	–8.69***	–8.62***	0.08	0.08
CAD/USD Gap	–3.51**	–3.49*	0.13	0.07

Notes: The ADF test assumes a unit root under the null hypothesis. The KPSS test assumes that the series is stationary under the null hypothesis. The number of lags (0 in all cases) for the ADF test is selected on the basis of the Schwartz criterion. All test equations contain a constant. */**/*** denotes significance at the 10/5/1% level.

Table A2: Descriptive Statistics

	Mean	Median	Max.	Min.	Std. Dev.	–1	0	1
Canadian Rate Decisions	–0.017	---	---	---	0.813	20	21	19
U.S. Rate Decisions	–0.017	0	3	–4	1.19	---	---	---
Δ(Core CPI Inflation Rate)	0.014	0.06	0.61	–0.64	0.254	---	---	---
Δ(Unemployment Rate)	–0.039	–0.04	0.55	–0.92	0.217	---	---	---
CAD/USD Gap	0.387	0.5	7.66	–6.75	3.01	---	---	---
Statements	0.167	---	---	---	0.847	17	16	27
Monetary Policy Reports	0.2	---	---	---	0.632	7	34	19
Speeches & Testimonies	0.183	---	---	---	0.725	11	27	22
Δ(U.S. Inflation Expectations)	0.012	0	1.4	–2.4	0.5	---	---	---
U.S. ISM Gap	–1.43	–0.87	10.04	–19.23	7.07	---	---	---
U.S. Comm. Indicator	0.567	---	---	---	0.789	15	13	32
U.S. Statements	0.283	---	---	---	0.846	11	4	45

Figure A1: Bank of Canada Target Rate vs. Federal Funds Target Rate

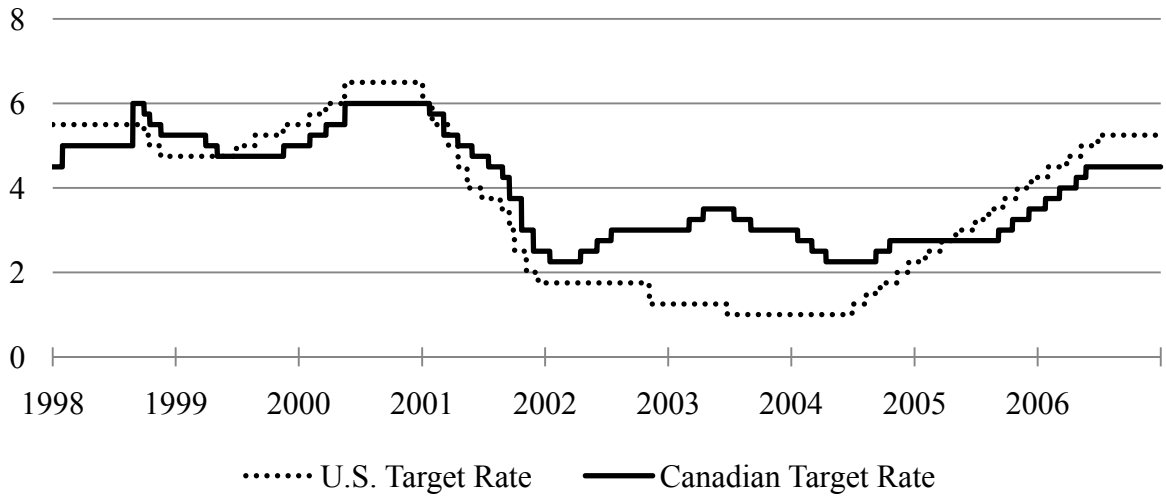
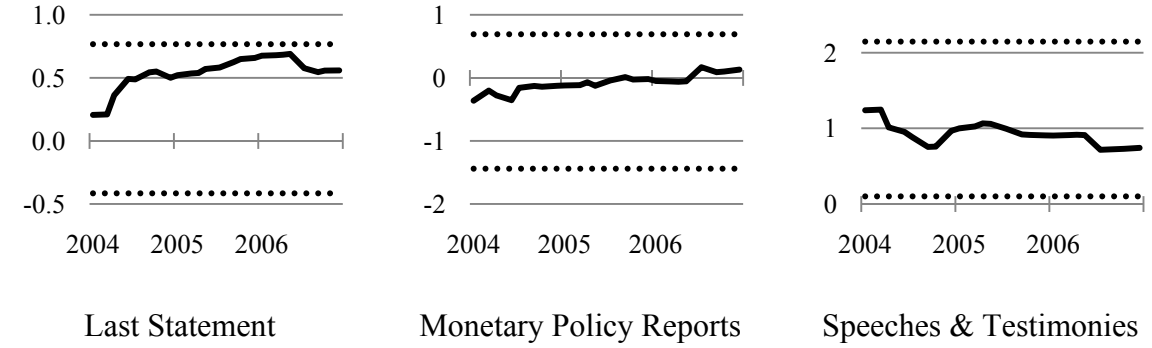


Figure A2: Parameter Stability of Models (1) and (2)

(1) Taylor Rule Model

(2) Communication Model



Notes: Parameter estimates based on one-step updating over the period 2004–2006 and 95 percent confidence bands based on coefficient estimates from the subsample 1998–2003.