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The forecasts-based instrument rule and decision making. How closely interlinked? The case of Sweden

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Abstract

Research background: The Central Bank of Sweden declared in years 1999–2006 the implementation of the Svensson's concept of inflation forecast targeting (IFT). It means that the repo rate decision-making process depends on the inflation fore-casts. The concept evolved from the strict IFT with the decision-making algorithm called 'the rule of thumb' to the flexible IFT.
Purpose of the article: The aim of the article is to: (1) analyze the influence of the inflation rate and GDP growth rate on the repo rate decisions, (2) analyze the influence of the inflation rate and GDP growth rate forecasts (in two year horizon) on the repo rate decisions in Sweden in years 1999–2006.
Methods: The analysis encompasses the repo rates decisions, CPI inflation rate, GDP growth rate, central paths of CPI inflation forecasts and central paths of GDP growth rate forecasts (the mode values) in the two years horizon published by The Central Bank of Sweden in years 1999–2006. The studies are based on the Taylor-type instrument rule and forecast-based Taylor-type instrument rule. The methodology used is multiple linear regression models.
Findings & Value added: The Central Bank of Sweden in years 1999–2006 implemented direct inflation forecast targeting (DIFT) rule. The decision-making algorithm was based on the CPI inflation forecasts and the rule of the thumb algorithm. The exact rule of the thumb was as follow: if the inflation forecast, in the two year forecast's horizon exceeded the inflation target by 1 p.p., then the central bank raised the repo rate by 0.4 p.p; if it was below it,

then the central bank reduced the repo rate by 0.4 p.p. If the inflation forecast was equal to the inflation target, then the repo rate remained unchanged. The historical repo rates differ from the theoretical estimated rule of the thumb's repo rates by +/-0.28 p.p.

Introduction

Inflation targeting (IT) regime is nowadays one of the most common monetary policy strategy (it is used by 27 central banks). There are several central banks which are the pioneers in implementing the new ideas concerning this regime. To such pioneers surely belongs The Central Bank of Sweden (Tura, 2015, pp. 292). In this paper we analyse the repo rate decisions in The Central Bank of Sweden (Sveriges Riksbank, SR) in years 1999–2006. The study refers to the implementation of the decision-making algorithm called the 'rule of the thumb'. The Central Bank of Sweden and the research horizon has been chosen for this analysis due to five reasons:

1) The Central Bank of Sweden has a high level of transparency according to the publication of implemented monetary policy rule, features of IT strategy and features of forecasting model (Tura, 2015, pp. 292);
2) The Central Bank of Sweden is one of several central banks which published the weights put on the inflation rate and GDP growth rate applied in the main forecasting RAMSES model;
3) the author of the concept of inflation forecast targeting, L.E.O. Svensson, was active as advisor to The Central Bank of Sweden during the years 1990-2007;
4) The Central Bank of Sweden officially declared in years 1999-2006 the implementation of inflation forecast targeting rule, the rule of the thumb decision-making algorithm, published the inflation forecasts and their exact data, and made the inflation forecasts based on the assumption of constant instrument rate during the forecast horizon (CIR);
5) central bank's inflation forecasts in Sweden had a large impact on consumers' inflation expectations in Sweden (Szyszko, 2016, p. 9).

The inflation targeting regime may be perceived as a discretionary or based on a rules strategy. In this paper we relate to the L.E.O. Svensson's rules approach (see: Svensson, 1997, pp. 1111–1146, 2005a, pp. 1–54, Svensson & Tetlow, 2005b, pp. 177–207). The researchers still argue whether the IT rule should be modelled as an instrument or targeting rule (see: Svensson, 2002, pp. 771–780, 2003, pp. 426–477, McCallum & Nelson, 2005, pp. 597–611). It is difficult to achieve the consensus. In this paper we lean to the instrument- based IT rules. Such a view comprises the return to Taylor rule and forecast-based Taylor rule.

The main aim of the study is to analyse empirically the application of the rule of the thumb decision-making algorithm and inflation forecast targeting (IFT) rule in The Central Bank of Sweden.

The main research question is as follows: Did the Monetary Policy Committee in Sweden between 1999–2006 make the repo rates decisions on the forecasts-based instrument rule and the rule of the thumb algorithm?

This will be achieved in the framework of the hypothesis: If the central bank implement the strict IFT with the algorithm 'the rule of the thumb', the Executive Board's repo rate decisions depend on the inflation forecasts; if flexible IFT with the algorithm 'the rule of the thumb' depend on inflation rate and GDP growth rate forecasts. According to this, the four subquestions have been posed:

1) Did The Central Bank of Sweden apply in years 1999–2006 the rule of the thumb?
2) What were the weights conferred on the inflation rate and GDP growth rate in the Monetary Policy Committee repo rates decisions? How flexible were they?
3) What were the weights conferred on the inflation rate forecasts and GDP growth rate forecasts in the Monetary Policy Committee repo rates decisions? How flexible were they?
4) Were the repo rates decisions easy to predict by economic agents?

The paper is organised as follows. It consists of five parts. The authors begin in section 1 by providing some theoretical background about instrument Taylor rule, Svensson's concept of IFT rule and the Taylor-type forecasts-based instrument rules. The next three sections include the description of the methodology, the data and the results of the research. The conclusions and implications for monetary policy are contained in the fifth section.

Theoretical background

The study relates to the two similar and based on rules concepts on conducting the monetary policy. The first one is the Taylor instrument rule and the second one, the Svensson's rule of the thumb. Both concepts refer to setting the central bank's instrument rate on the basis of the deviations from the target variables. The rule of the thumb comprised, in addition to the Taylor rule, the forward looking approach on monetary policy, which requires the forecast publication.

The original Taylor rule was estimated for US economy for years 1987–1992. It showed the relation between the federal funds rate, inflation and real GDP. The derived policy rule, is as follows (Taylor, 1993, p. 202):

$$i = \pi + 0.5\bar{y} + 0.5(\pi - 2) + 2, \tag{1}$$

where:
i is federal funds rate,
$\hat{\pi}$ is rate of inflation (measured by GDP deflator) over the previous four quarters,
$\bar{y}$ is the percent deviation of real GDP from the target.

The inflation target was set in this example on 2 percent and real GDP target was explained as the real GDP trend. The equation indicates the monetary policy rule: 'the federal funds rate raises if inflation increases above a target of 2 percent or if real GDP raises above trend GDP. If both, the inflation rate and real GDP are on target, then the federal funds rate would equal 4 percent, or 2 in real terms' (Taylor, 1993, p. 202). The Taylor rule was estimated in 1993, since than a lot of new Taylor-type rules have been retrieved and described. The one kind of this evolution is Taylor-type forecast-based instrument rule.

L.E.O. Svensson's concept of inflation forecast targeting was introduced in 1997. The ground of this idea is the forward looking attitude on conducting monetary policy. According to L. E. O. Svensson, the IT regime may be characterised by three specific features: central bank commitment to maintain price stability, explicit inflation target and publication of central banks' inflation forecasts, which play a role of intermediate targets. The rule of the thumb implies that conditional inflation forecast should hit the inflation target in two year horizon. If the inflation forecast, in the chosen horizon, is above the inflation target, then the central bank should raise the repo rate. If the inflation forecast in the chosen horizon is lower than the inflation target, then the central bank should reduce the repo rate. If the inflation forecast is equal to the inflation target, then the repo rate should remain unchanged (Svensson, 1997, pp. 1111–1146). The rule of the thumb implementation indicates the publication of inflation forecasts made for a two year horizon and on the assumption of constant instrument rate during the entire forecast horizon (called CIR). The inflation forecasts may shape the economic agents' inflation expectations and anchor them on the inflation target.

Inflation forecast targeting (IFT) may be divided into two types. The first one, called direct inflation forecast targeting (DIT), assumes setting the central bank's interest rate only on the basis of inflation forecasts. It is im-

possible to implement such an approach exactly in central banking practice. The flexible inflation forecast targeting (or forecasts targeting, Svensson, 2005a, pp.1–54) preconceived that instrument rate decisions depend on two target variables, inflation forecast and output gap forecast, and are made on the basis of its' deviations from the inflation target and potential output gap (respectively). In such a case the inflation target may be achieved in a longer horizon. The weight which is put on the output gap forecast may determine how quickly the inflation forecast is adjusted towards the inflation target (Svensson, 2009, pp. 1–9). The forecasts targeting concept evolved in L.E.O. Svensson's studies into the optimal monetary policy plan. It includes the publication of macroeconomic forecasts which contain the group of target variables (forecasts of inflation and output gap/GDP, etc.) and interest rate path forecasts (called as forward guidance (see: Svensson, 2015, pp. 19–64). The forecasts-based target variables are convergent with the interest rate forecast. The inflation forecast at the end of the longer (usually three years forecast) horizon achieve or is very close to the inflation target. Such an approach includes setting the instrument rate accordingly to the interest rate forecast (Svensson & Tetlow, 2005b, pp. 177–207).

L.E.O. Svensson persisted on modelling the IT strategy as a kind of targeting rule. It is connected with minimalization of central bank loss function which consists of deviation of the target variables from the target level (deviation of inflation forecast from the inflation target and output gap forecast from the potential output gap). According to Svensson and Rudebush (1999, p. 211) central bank loss function implies an implicit instrument rule. The Taylor rule is a typical explicit instrument rule. The difference concerned the background of target variables. In the original Taylor rule the target variables were exogenous. In the Svensson's rule of the thumb the target variables (forecasts) are endogenous. To simplify, the simple instrument rule and the model are creating the implicit instrument rule (Svensson & Rudebush, 1999, pp. 203–262).

There are plenty of studies which concerned the estimation of simple Taylor rule for specific economies. In our paper we refer to the concept, which posed the consensus between the simple original Taylor rule and L.E.O. Svensson's forecasts targeting rule. In this point we refer to the Taylor-type forecasts-based instrument rules, which are the simple central bank implicit reaction functions, where the forecasts of inflation rate and output gap play a role of intermediate target variables. These forecasts are model consistent.

The general specification of forecast based instrument rules is as follows (Levin et al, 2003, p. 625):

$$i_t = \alpha_i i_{t-1} + (1-\alpha_i)(i^* + E_t\hat{\pi}_{t+\theta}) + \alpha_\pi(E_t\hat{\pi}_{t+\theta} - \pi^*) + \alpha_y E_t y_{t+\kappa}, \qquad (2)$$

where:

i_t is short-term nominal interest rate,

$\hat{\pi}$ is four quarter –average inflation rate,

y is output gap (the deviation of output gap from potential),

i^* is unconditional mean of the short-term interest rate,

E_t is operator of the forecast of inflation or output gap using information available in period *t*, *t*-years,

π^* is inflation target,

θ is forecast horizon for inflation forecast,

κ is forecast horizon for output gap forecast.

The Taylor-type forecasts-based instrument rules estimated and derived by the researchers differ in four main assumptions: the use of interest rate smoothing, the chosen forecasts horizon, output gap forecasts encompassing and assumed potential output. Most of the rules include the interest rate smoothing. The chosen forecast horizons oscillate between two and fifteen quarters. The potential output gap may be derived from the model, as an output trend or be explicitly arranged. The features of the chosen Taylor-type forecasts-based instrument rules are shown in Table 1.

In our studies we are referring to the rules with the two year forecast horizon. Our choice was caused by three reasons. Firstly, the original L.E.O. Svensson's rule of the thumb assumed the two year inflation forecast horizon (see: Svensson, 1997, pp. 1111–1146). Secondly, Batini & Nelson (2001, p. 910) were analysing the optimal policy horizon for a set of forecast-based target variables as a part of flexible inflation targeting framework. They found that 'it is optimal to remove the effects of the various shock considered over a period of 8 to 19 quarters'(Batini & Nelson, 2001, p. 910). Finally, The Central Bank of Sweden officially declared the use of the rule of the thumb within two year time lags (see: Rosenberg, 2006, pp. 1–8). According to this, the similar rules were analysed by Rudebush & Svensson (1999, pp. 203–262).

Data

The Central Bank of Sweden (Sveriges Riskbank, SR) has been implemented IT strategy since 1993 and has determined the inflation target as 2% measured by CPI index. During the years 1993–2016 it declared two types of IT rules: the rule of the thumb and optimal monetary policy algorithm. In this connection, the central bank published the inflation forecasts conditioned by the constant instrument rate during the entire forecast horizon (called CIR) and the set of macroeconomic forecasts conditioned by the interest rate path forecast. The forecast horizon depends on the chosen rule type. The data are analysed quarterly. The potential GDP growth rate was estimated and declared to be as a desirable value in a range 2–2.5% in Sweden (Heikensten, 2000; 2003). At the end of 1999 The Central Bank of Sweden has started to publish the forecasts' data. The analysis of the rule of the thumb includes the years 1999–2006. The main information on the forecast-based monetary policy in Sweden is presented in the Table 2.

In this paper, the central paths of the central bank's forecasts are analysed at the two year prognostic moment of the forecasts' horizon. This is due to the rule of the thumb assumption: the central bank should be forward-looking and react to on the deviations of the forecasts from the target in two year forecasts horizon. The forecasts' central paths have been downloaded from the swedish central bank website (inflation reports boxes) and Inflation/Monetary Policy Reports. The repo rates data were collected from The Central Bank of Sweden website. Inflation forecasts' central paths published in years 1999–2006 by The Central Bank of Sweden are presented in Figure 1. The repo rate in Sweden in years 1999-2006 is shown in Figure 2. The CPI inflation rate and GDP growth rate data were collected from the Eurostat database.

During the years 1999–2006 the forecasts were made on the basis of the DSGE RAMSES model. The model application assumed setting the instrument rate on the rule of the thumb algorithm. The enforced in the model instrument rule has the following form (Adolfson *et al*., *2*007b, p. 21):

$$i_t = f(\pi_t - \pi^*; \Delta\pi_t; y_t; \Delta y_t; i_{t-1}; x_t) + \varepsilon_{i,t}, \tag{3}$$

where:

i_t is policy rate;

π_t is underlying inflation rate;

$\Delta\pi_t$ is change in the rate of underlying inflation;

π^* is inflation target;

y_t is GDP gap;

Δy_t is change in the GDP gap;

x_t is exchange rate gap;

$\varepsilon_{i,t}$ is called as a as a measure of the element of monetary policy surprises;

t means years, $t \in \{1,2,...\}$.

According to the model of Adolfson *et al.* (2007a, pp. 481–511) the real exchange rate gap is measured as the percentage deviation of the actual real exchange rate from an assumed equilibrium level that is constant. The model implemented also the interest rate smoothing.

Research methodology

The research includes the estimations of different type-Taylor instrument rules for the Sweden economy based on historical data. The estimations differ in the chosen targets variables and assumptions. The main method used is multiple linear regression models. The studies conducted have been divided into two parts.

The first part of the study consists of two stages. At the first stage, we assume that the monetary policy reaction function is linear function of the target variables and lagged instrument rate. To the target variables belong the CPI inflation rate and GDP growth rate gap. According to this, the simple Taylor-type instrument rate rule has a form (Svensson, 2003, p. 426, Taylor, 1999, p. 5) :

$$i_t = \alpha_0 + \alpha_\pi(\pi_t - \pi^*) + \alpha_y(y_t - y^*) + \alpha_i i_{t-1} + \varepsilon, \tag{4}$$

where:

i_t is policy rate;

π_t is CPI inflation rate;

π^* is CPI inflation target settled at 2%;

y_t is GDP growth rate,

y_t^* is potential GDP growth rate;

t means years, $t \in \{1,2,...\}$.

GDP growth rate gap is calculated as the difference between real GDP growth rate and the potential GDP growth rate (which was settled by the authors at 2.25% (as the midpoint of the range 2–2.5%)). The second stage is similar to the previous one, but assumed the linear Taylor-type reaction function in the form which was applied in the RAMSES model (see: Adolfson *et al*., 2007, pp. 481–511). In the estimation we assumed the constant exchange rate gap. In this step we estimated the equation for the target variables: deviations of CPI inflation rate from the inflation target, change in the CPI inflation rate, change in the GDP growth rate and GDP growth rate gap, following the form (Adolfson *et al*., 2007, pp. 5–40):

$$i_t = \alpha_0 + \alpha_\pi(\pi_t - \pi^*) + \alpha_{\Delta\pi}\Delta\pi_t + \alpha_y(y_t - y^*) + \alpha_{\Delta y}\Delta y_t + \alpha_i i_{t-1} + \varepsilon, \quad (5)$$

where:
$\Delta\pi_t$ is change in the rate of underlying inflation;
Δy_t is change in the rate of GDP growth rate;
t means years, $t \in \{1,2,...\}$.

The purpose of these two stages is to calculate the empirical weights which are put on the deviations of CPI inflation rate from the inflation target and GDP growth rate output gap in setting the instrument rate in simple instrument Taylor rule and Taylor-type instrument rule derived from RAMSES model. At the end of this part we compare the regression results with the proposed exact values of coefficients for target variables in the main forecasting RAMSES model.

The second part of the study is similar to the previous one. We also assumed that reaction function is linear function of the target variables, but instead of the inflation rate and GDP growth rate we placed the intermediates targets: inflation forecast and GDP growth rate forecasts two years ahead. Such a view is coincident with the forecast-based instrument targeting rule proposed by Svensson (1997, pp. 1111–1146). According to this, the simplified version of Taylor- type forecast- based instrument rate rule may have a form:

$$i_t = \alpha_0 + \alpha_{\pi|t+2}(\pi_{t+2|i_{t-1}} - \pi^*) + \alpha_{y|t+2}(y_{t+2|i_{t-1}} - y^*) + \alpha_i i_{t-1} + \varepsilon. \qquad (6)$$

where:

$\pi_{t+2|i_{t-1}}$ is CPI inflation forecast in eight quarter horizon made on the assumption of constant instrument rate i_{t-1} over the forecast horizon,

$y_{t+2|i_{t-1}}$ is GDP growth rate forecast in eight quarter horizon made on the assumption of constant instrument rate i_{t-1} over the forecast horizon.

At the next stage we also assumed that reaction function is linear function of the target variables and we placed the intermediates targets: inflation forecast and GDP growth rate forecasts two years ahead. The Taylor- type forecast- based instrument rule has a form retrieved from RAMSES model:

$$\begin{aligned} i_t = {} & \alpha_0 + \alpha_\pi(\pi_{t+2|i_{t-1}} - \pi^*) + \alpha_{\Delta\pi}\Delta\pi_t + \alpha_y(y_{t+2|i_{t-1}} - y^*) + \\ & + \alpha_{\Delta y}\Delta y_t + \alpha_i i_{t-1} + \varepsilon. \end{aligned} \qquad (7)$$

The purpose of this part is to calculate the empirical weights which are put on the deviations of the CPI inflation forecasts from the inflation target and deviations of GDP growth rate forecasts from the previously assumed potential GDP growth rate in setting the instrument rate. This step may show whether SR implemented the rule of the thumb and what was the degree of its' flexibility. At the end of this part we compare the results with the weights suggested in the RAMSES model. The RAMSES model assumed the following weights: 1.7 for the inflation deviations from the inflation target, 0.3 for inflation changes, 0.04 for GDP gap and 0.1 for GDP changes (Adolfson *et al*., 2007b, p. 21).

The whole research plan is presented in Table 3.

Results

Inflation forecasts' central paths at the two year prognostic moment of the forecasts' horizon and the repo rates changes in Sweden in years 1999–2006 are shown in Figure 3.

Firstly we estimated the simple linear Taylor-type instrument rule with target variables: deviations from the CPI inflation rate and inflation target, ad GDP growth rate gap. After that we estimated the Taylor-type instrument rule with the form downloaded from the RAMSES model. In both

cases, the derived target variables coefficients have significant, positive and similar influence on instrument rate (α_π =.14 and, α_y =0.1; α_π =0.14 and α_y =0.11) and indicate the flexible type of implemented IT regime. In Figure 4 there are the variations of these formulations with differential responses to inflation and output, following the forms (Orphanides, 2003, p. 985; Adolfson *et al*., 2007b, p. 21):

$$i_t - i_{t-1} = \alpha_\pi(\pi_t - \pi^*) + \alpha_y(y_t - y^*), \tag{8}$$

$$i_t - i_{t-1} = \alpha_\pi(\pi_t - \pi^*) + \alpha_{\Delta\pi}\Delta\pi + \alpha_y(y_t - y^*) + \alpha_{\Delta y}\Delta y. \tag{9}$$

On the graph we compare three the repo rate paths: theoretical paths derived from the simple Taylor rule, the form from RAMSES and the theoretical path calculated from the declared in RAMSES coefficients. The accomplished repo rates from the RAMSES model(with the declared weights coefficient) differ from the historical repo rates by +/- 1.65. It means that the repo rates decisions may not be predicted on the basis of this equation.

Secondly we estimated the simple linear Taylor-type forecast-based instrument rule with target variables: deviations from the inflation forecast and inflation target, and deviations from GDP growth rate forecast and potential GDP growth rate. After that we estimated the Taylor-type instrument rule form from the RAMSES model. The results are similar in both cases. Only the deviations of inflation forecast from the inflation target have significant, positive influence on instrument rate (0.4). It indicates the implementation of strict inflation forecast targeting and the original rule of the thumb. The repo rates from the model estimated differ from the historical by +/- 0.29. In Figure 5 there are the variations of these formulations with differential responses to inflation forecast and output forecast, following the form:

$$i_t - i_{t-1} = \alpha_\pi(\pi_{t+2|i_{t-1}} - \pi^*) + \alpha_{\Delta\pi}\Delta\pi + \alpha_y(y_{t+2|i_{t-1}} - y^*) + \alpha_{\Delta y}\Delta y. \tag{10}$$

The exact theoretical repo rates derived from the original model's RAMSES forecast-based Taylor rule differ (absolute average) from the exact repo rates by +/-0.4 p.p. It also means that the repo rates decisions may not be predicted on the basis of this equation. In Table 4 there are the differences between the exact historical repo rates and the theoretical repo rates derived from the calculation of weights from the RAMSES instrument

equation put on the target variables. The whole research estimation results are shown in Table 5.

Conclusions

In the years 1999–2006 the Swedish Central Bank declared the implementation of inflation targeting strategy. According to the estimated simple Taylor-type rule, we may state that the central bank applied inflation targeting flexible type, with the weights put on the CPI inflation rate and GDP growth rate. The estimations results for the simple Taylor-type rule and the form of this rule from the RAMSES model did not differ significantly.

The Central Bank of Sweden in years 1999–2006 also declared the use of the concept of inflation forecast targeting and the rule of the thumb decision-making algorithm. In this case the deviations of CPI inflation forecasts from the inflation target and the deviations of GDP growth rate forecasts from the potential GDP growth rate were our target variables in Taylor-type forecast-based instrument rules. The estimation results describe the implemented strategy as a direct inflation forecast targeting (DIFT), with the weight put on the CPI inflation forecast. The GDP growth rate forecasts transpired to be not significant in setting the repo rates. The weight put on the inflation forecasts is positive, consistent with the rule of the thumb. The exact rule of the thumb for Sweden in years 1999–2006 was as follows: if the inflation forecast, in the two year horizon exceeded the inflation target by 1 p.p., then the central bank raised the repo rate by 0.4 p.p. If the inflation forecast in the two year forecast horizon was lower by 1 p.p. than the inflation target , then the central bank reduced the repo rate by 0.4 p.p. If the inflation forecast was equal to the inflation target, then the repo rate remained unchanged. The historical repo rates differ from the theoretical rule of the thumb repo rates by +/-0.28 p.p.

What is more, there were large differences between the exact historical repo rates and the theoretical repo rates calculated from the exact instrument equation from forecasting RAMSES model. It means that the economic agents might not predict the repo rates changes on the basis of declared weights put on target variables from the model.

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Annex

Table 1. The overview of the chosen Taylor-type forecasts-based instrument rules

Studies	Interest rate smoothing	Inflation forecast	Inflation forecast horizon (quarters)	Output gap forecast	Output gap forecasts horizon (quarters)
Clarida et al. (2000, pp. 147–180)	Yes	Yes	4	Yes	0
Orphanides (2001, pp. 964–985)	Yes	Yes	4	Yes	4
De Brouwer & Ellis (1998)	No	Yes	4	Yes	4
Batini & Nelson (2001, pp. 891–910)	Yes	Yes	2 and 15	No	-
Rudebush & Svensson (1999, pp. 203–262)	Yes	Yes	8 and 12	No	-

Source: Levin *et al.* (2003, p. 625).

Table 2. The main information on the forecast based monetary policy in Sweden

Year	The forecast based rule	The instrument rate assumption in the forecast	Published forecasts	Forecasts published per year	Forecasts horizon	Forward Guidance	Monetary Policy Committees Meetings	Monetary Policy Trade of Description
1999	Rule of the thumb	CIR	Inflation forecasts, GDP forecasts*	4	8 Q	No	Each month	No
2000								
2001								
2002								
2003								
2004								
2005		CIR and ME						
2006								
2007	Optimal monetary policy	E	Inflation forecasts, GDP forecasts, Instrument rate forecasts	3	12 Q			
2008								
2009								
2010								
2011								
2012								
2013								
2014								
2015								
2016								

CIR-Constant instrument rate during the forecast horizon
ME- Market expectations instrument rate during the forecast horizon
E- Endogenous instrument rate dovetailed with instrument rate forecast path
*In these years GDP growth forecasts were not published in the form of charts but were described in the inflation reports with all necessary central paths data

Source: own elaboration based on the Inflation Reports published by The Central Bank of Sweden between 1999–2016.

Table 3. Research plan

Part	Stage	Research question?	Description
Part I	Stage I	How flexible is SR in his interest rate decisions?	Calculation of weights imposed on the deviations of inflation rate from the inflation target and GDP growth gap in simple Taylor-type instrument rule
	Stage II		Calculation of weights imposed on the deviations of inflation rate from the inflation target, GDP growth gap, change in inflation and change in GDP gap in Taylor-type instrument rule prosposed in RAMSES
Part I	Stage I	How flexible is SR in his forecast-based interest rate decisions?	Calculation of weights imposed on the deviations of inflation forecasts from the inflation target and GDP growth forecast from potential GDP growth
	Stage II		Calculation of weights imposed on the deviations of inflation forecasts from the inflation target and GDP growth forecast from potential GDP growth, change in inflation and change in GDP gap

Table 4. Differences between the exact historical repo rates and the theoretical repo rates derived from the exact RAMSES equation

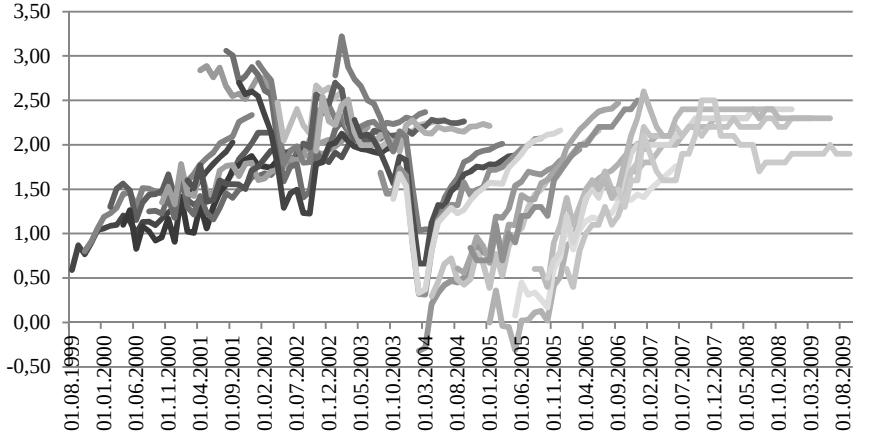
Rule	Target variables	Diference (absolute average)
Simple Taylor-type instrument rule	CPI inflation, GDP growth rate	+/-1.65
Forecast-based Taylor-type instrument rule	CPI inflation, GDP growth rate forecasts	+/-0.4

Table 5. Instrument rules' estimation results

		α_0	α_i	α_π	α_y	$\alpha_{\Delta\pi}$	$\alpha_{\Delta y}$	$\alpha_{\pi\, t+2\mid i_{t-1}}$	$\alpha_{y\, t+2\mid i_{t-1}}$
Simple Taylor-Type Instrument Rule	Coefficient	0.25 [0.15]	0.91*** [0.04]	0.14*** [0.04]	0.1*** [0.04]	-	-	-	-
	R square	0.91							
	ε	0.27							
Taylor-Type Instrument Rule form from RAMSES model	Coefficient	0.22 [0.16]	0.92*** [0.04]	0.14** [0.05]	0.11*** [0.03]	-0.1 [0.09]	-0.1* [0.05]	-	-
	R square	0.92							
	ε	0.27							
Weights declared in RAMSES (Adolfson et al., 2007b, p.21)	Coefficient	-	-	1.7	0.004	0.3	0.1	-	-
Forecast-Based Simple Instrument Taylor Rule	Coefficient	0.07 [0.12]	0.96*** [0.03]	-	-	-	-	0.4* [0.17]	-0.01 [0.09]
	R square	0.91							
	ε	0.29							
Direct Inflation Forecast-Based Instrument Taylor Rule	Coefficient	0.07 [0.11]	0.91*** [0.03]	-	-	-	-	0.4* [0.16]	-
	R square	0.9							
	ε	0.29							
Forecast-Based Instrument Taylor-type Rule form from RAMSES model	Coefficient	0.08 [0.12]	0.96*** [0.04]	-	-	0.004 [0.09]	-0.04 [0.05]	0.4* [0.17]	-0.01 [0.09]
	R square	0.9							
	ε	0.29							
Weights declared in RAMSES model- forecasts based target variables (Adolfson et al., 2007b, p.21)	-	-	-	-	-	0.3	0.1	1.7	0.004

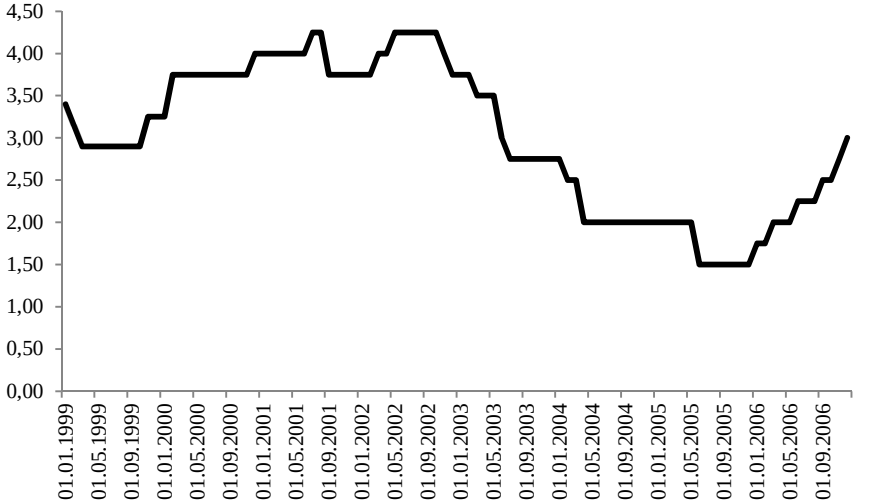
***Significant at 0.001**Significant at 0.01*Significant at 0.05. Robust standard errors in parentheses

Figure 1. Inflation forecasts' central paths published in years 1999-2006 by The Central Bank of Sweden



Source: own elaboration based on the Inflation Reports published by The Central Bank of Sweden between 1999–2006.

Figure 2. The repo rate in Sweden in years 1999–2006



Source: own elaboration based on the Inflation Reports published by The Central Bank of Sweden between 1999–2006.

Figure 3. Inflation forecasts' central paths at the two year prognostic moment

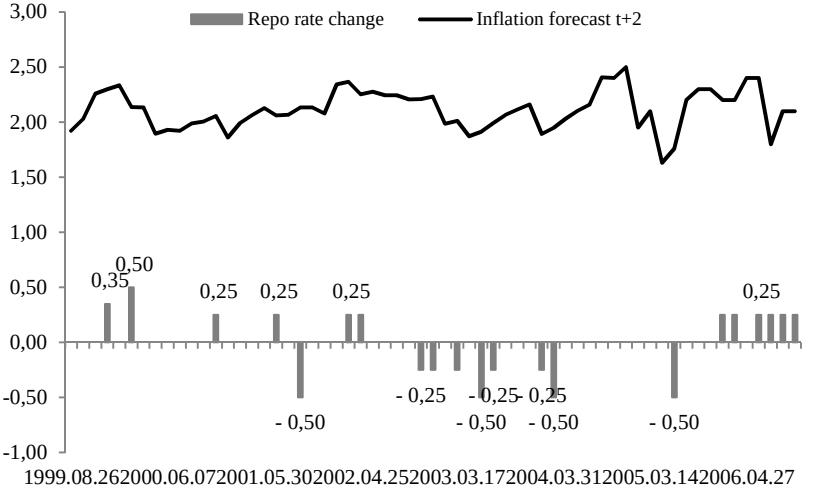


Figure 4. The variations of formulations with differential responses to inflation and output

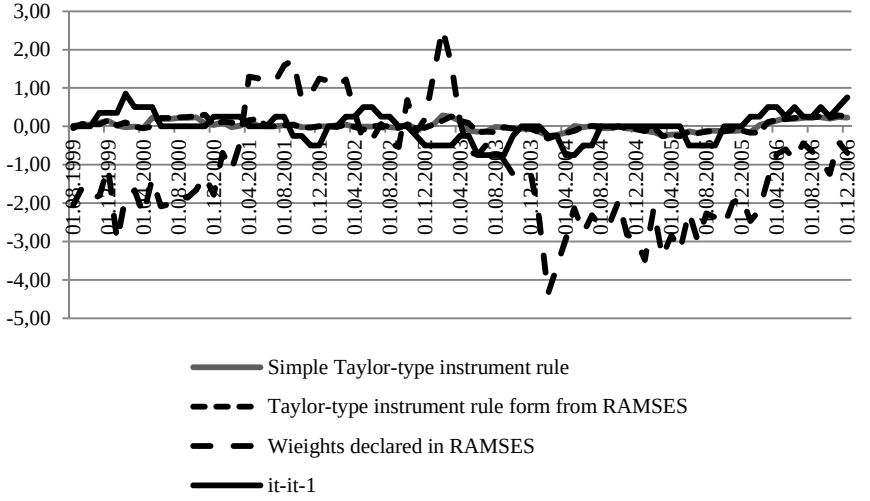


Figure 5. The variations of formulations with differential responses to inflation and output forecasts