Experimental study on the effect of nominal price level versus inflation targeting with and without guidance

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Abstract

Since the 2007 crisis, macroeconomists have been interested in monetary policies that could help with stabilizing inflation and output (Honkapohja, 2015). Two ideas gained particular attention: (i) that inflation should be replaced by the nominal price level (PLT) as the target for central bank; and (ii) that the central bank should provide explicit guidance about its interest rate rule. We conduct an experiment to test the of these two hypotheses.

Our experiment is based on a simple DSGE economy with Euler learning (Assenza et al., 2014). Subjects are given only a qualitative description of the economy and are asked to predict inflation and output gap two-periods ahead for 50 periods. There are five treatments with six groups in each. Baseline treatment (1) incorporates a standard inflation targeting rule. The other four treatments utilize a PLT Taylor rule and are based on a two-by-two design: 'weak' rule (2) with guidance and (3) without guidance; and 'strong' rule (4) with guidance and (5) without guidance.

We find that subjects within each treatment coordinate on a similar behavior, but large differences between the treatments prevail. Guidance has a negligible effect, whereas the Taylor rule specification turns out to be crucial. PLT can be a rubust monetary policy, but only if it is sufficiently responsive to the deviations of the output and prices.

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1 Introduction

In this paper we report macroeconomic laboratory experiment, in which we asked subjects to predict inflation and output gap. Subjects played a role of forecasting advisers in a simple economy, which is based on a standard Dynamic Stochastic General Equilibrium model (DSGE) with zero lower bound condition on the interest rate of the central bank. We focus on two alternative monetary policies: Taylor rule with nominal price level target; and guidance. We find that the additional information, which the central bank provides through the guidance, has negligible effect on the market dynamics. On the other hand, price level targeting can be a robust monetary policy, but only if the underlying Taylor rule is sufficiently reactive to the steady states deviations.

Until the mid of the 2000's, most economists and policy makers believed that the monetary policy, with the Taylor rule, reached a mature, satisfying level. This policy advises to smooth the business cycle by changing the nominal interest rate in response to output gap and deviations of inflation from an inflation target set by the central bank. Once the 2007 crisis erupted, central banks accordingly cut their interest rates, but, as quickly became apparent, this response proved to slow too counter the unfolding recession. What made matters worse was that, despite the interest rates of many central banks approaching the zero bound, the recession was still rampart, leaving little space for conventional policies. For example, FED is keeping its interest rate at almost 0% level since 2009. Nevertheless, the GDP growth in the USA through the next years was close to an inspiring level of 2%, and the employment as of 2014 has not recovered to the pre-crisis level. Even more striking example comes with the events in Europe. ECB cut interest rates as FED did (though not as bravely), but after a brief recovery in 2009 and 2010, the Euro Area plummeted into the second wave of recession. In addition, this output contraction hit some countries particularly strong, causing political disturbances, as in the case of Greece or Spain.

The events of the crisis inspired a wave of macroeconomic literature on robust monetary policy. The issue is how to change the behavior of the central banks in order to pull the economies from the recession, but also in order to prevent such big recessions. In particular, two policy alternatives gained a particular attention: guidance and nominal price-level targeting (PLT) (Mitra and Honkapohja, 2014).

The usual definition of PLT is that the central bank uses a Taylor rule, but it tries to steer the inflation such that the actual *price level* follows a preplanned trajectory (such as with a stable, low trend). Guidance in its broadest definition means that the central bank tries to manage inflation expectations by a public commitment to a certain policy. For instance, during a period of recession, the central bank could acknowledge to keep its interest rate at a low value for a longer period; or it could explicate conditions under which it would raise the interest rate again.

The underlying idea of both guidance and PLT policies is that they give economic agents more information about the monetary policy. Under rational expectations (RE), this allows

to curb the business cycle, and speeds up recovery from technology shocks (Evans, 2012). However, much of these results rely on the assumption of RE. The recent crisis shows that the empirical validity of RE is questionable (Cornea et al., 2012), and as a result, these policy measures should be tested in a more realistic environment, which allows the agents to learn and adapt new information with a finite response rate. One such interesting study was conducted by Mitra and Honkapohja (2014), who show that under adaptive (econometric) learning, PLT policy can be stabilizing only if the agents are aware of it, that is only if the bank provides some guidance about its policy. This is an important result, as adaptive learning is still quite 'rational' in terms of the cognitive load, which is required from the agents.

The goal of our paper is to provide an experimental test for the theoretical findings on PLT and guidance. Laboratory experiments are a novel approach in empirical macroeconomics (Assenza et al., 2011). The idea is to take a macroeconomic model, and replace economic agents with real subjects. The subjects then are tasked to decide on consumption, or to forecast aggregate variables as in Learning to Forecast experiments (Hommes, 2011). There are several virtues of this approach. In an experiment, unlike in real economies, the researcher can easily control the setup of the markets and manipulate policy measures. It is possible to directly observe the decisions or expectations of the subjects, and obtain rich samples, in terms of both the number of independent observations from a constant environment (groups within a treatment), as well as time span within each group.

A common, informal argument against market-based experiments is that the laboratory subjects do not possess the experience and skills that the participants of real markets have acquired (such as trading skills in financial markets). It is quite obvious that this argument has a little weight against macro-experiments. Macroeconomic models with micro-foundations aim at describing the 'everyman', normal consumers, many of whom have no economic education – and these are exactly the subjects that were invited to our experiment. This implies that the experiments can be set up to directly test certain theoretical presumptions.

Our experiment is inspired by Mitra and Honkapohja (2014) and based on a simple DSGE model with Euler learning. We emphasize that we use the full nonlinear version of the model, which allows us to study the off-equilibrium behavior of our subjects. We run five treatments in total, which vary in terms of the monetary policy and subject information. First, we look at the baseline case of the inflationary targeting. All other four treatments are based on a PLT Taylor rule: with weak or strong response coefficients; and with or without guidance. The difference between the strong and weak PLT Taylor rules is that the weak one (which is suggested by Mitra and Honkapohja, 2014) is stable under adaptive learning, but not under naive expectations, unlike the strong one.

In our experiment, following the definition of Mitra and Honkapohja (2014), we take guidance in its simplest form. To be specific, in the guidance treatments, the subjects are explicitly informed about the role of the price level deviation in the monetary rule; and during the experiment, this variable belongs to their information set.

The experiment results in two major findings. First one is that the guidance plays no role,

as the difference between guidance and no guidance treatments is negligible. This implies that the subjects either did not consider, or could not properly use the additional information from the central bank. The second result is that the PLT treatments were stable only under the strong rule (with inflation even more stable than under the inflation treatment). Altogether this suggests that central banks should pay less attention to indirect expectations management measures, and instead focus on directly countering the business cycle by a firm response to the deviations from the full employment steady state.

This paper is organized in the following way. Second section discusses the experimental design and some theoretical issues, which underline our experiment. Third section shows the experimental results and quickly discusses the individual behavior. Finally, experimental instructions and details on the econometric analysis can be found in the appendices.

2 Experimental design

In this section we discuss the design of our experiment. We start with a detailed description of the design. Next two subsections discuss the information, which we have provided to the subjects, as well as the specific framing of the guidance. Section 2.4 shows the DSGE model, which was the corner stone of the experimental economy. In section 2.6 we formalize the hypotheses of our experiment.

2.1 Experimental treatments

Our experiment is based on a standard DSGE model with zero-lower bound on the interest rate (see also later part of this section for the details on the model). Central bank follows a Taylor rule with either inflation target or nominal price level target. There are in total three state variables in the model: realized output y_t and inflation π_t, and the interest rate R_t.

Regardless of the treatment, there are $I = 6$ six subjects per one group who participate in a 51 periods long session. Each subject is asked to provide his or her inflation forecast two periods ahead $\pi^e_{i,t+1}$ (the index indicates the period, for which the forecast is formulated), and his or her output gap forecast two periods ahead $o^e_{i,t+1}$. In the instructions and experimental interface, these are framed as percentage points (for example $\pi^e_{i,t+1} = 1$ would correspond to predicting one percentage point of net inflation). These two forecasts are transformed into the average gross inflation forecast $\bar{\pi}^e_{t+1}$ and the average consumption level forecast $\bar{c}^e_{t+1}$, and used to determine the realized contemporary inflation π_t, output level y_t (which equals the realized consumption c_t plus fixed government spending $g_t = g$) and interest rate R_t. One can show that this model has two steady states: full employment with inflation equal to the central bank's target π^* and the corresponding output y^* and interest rate R^*; and zero-lower bound such that $R^Z = 1$, with corresponding net inflation that is negative such that $\pi^Z < 1$, and output, which is below its potential value with $y^Z < y^*$.[1]

[1]Note that the relationship between the output gap and output level is given by $o_t = 100\frac{y_t - y^*}{y^*}$.

The information provided to the subjects is discussed in detail in the next part of this section. In general, subjects are given only a qualitative description of the economy, and can only observe the aggregate variables and their own forecasts and payoffs.

In all the treatments, subjects are paid in the same way. For every inflation and output gap forecast we compute the score with

$$\begin{aligned}\text{Points}^{\pi}_{i,t} =& 100\frac{1}{1+|\pi^{e}_{i,t}-\pi_t|} \in (0,100],\\ \text{Points}^{y}_{i,t} =& 100\frac{1}{1+|o^{e}_{i,t}-o_t|} \in (0,100],\end{aligned}$$

so for example if one subject would predict 1% inflation, whereas the realized inflation would be equal to 4%, in that period the subject would receive 25 points. At the end of each group's session, we add separately inflation and output gap scores for each subject, and pay only for inflation forecasting accuracy, or only for output gap forecasting accuracy (following a roll of dice), with the exchange rate of 0.75 Euro for every 100 points. This means that the subjects could earn anything between 0 and 37.5 Euro. We decided to pay only for inflation or output gap forecasts in order to motivate subjects to pay high attention to both tasks, and to discourage them from hedging.

Our experiment has five treatments in total. There are two differences between them: the specification of the Taylor rule, which is used by the central bank; and in addition, subjects in two treatments receive guidance in the form of additional information about the monetary policy of the central bank. These treatments are:

1. **INF** – Central Bank uses Taylor rule with *inflation target*, given by

$$\text{IFT: } R_t = 1+\max\left\{0, R^*-1+\psi_\pi\left(\pi^{e}_{t+1}-\pi^*\right)+\psi_y\frac{y^{e}_{t+1}-y^*}{y^*}\right\}, \tag{1}$$

   which is bounded from below by unity and where ψ_π and ψ_y are two policy parameters. This is the baseline treatment.

In the other four treatments, Central Bank always uses *nominal price level target* in its Taylor rule, which is given by

$$\text{PLT: } R_t = 1+\max\left\{0, R^*-1+\psi_P\frac{P^{e}_{t+1}-\bar{P}_{t+1}}{\bar{P}_{t+1}}+\psi_y\frac{y^{e}_{t+1}-y^*}{y^*}\right\}, \tag{2}$$

where $\bar{P}_t \equiv \pi^*\bar{P}_{t-1}$ defines trajectory which the central bank takes as the intended price path. The following treatments are based on a 2×2 design, where the two policy measures are the strength of the Taylor rule and guidance:

2. **StrongNo** – Strong PLT rule (2) with *high* policy parameters ψ_P and ψ_y;

3. **WeakNo** – Weak PLT rule (2) with *low* policy parameters ψ_P and ψ_y;

4. **StrongGuid** – Strong PLT rule (2) with *high* policy parameters ψ_P and ψ_y and additional guidance provided by the central bank to the subjects;

5. **WeakGuid** – Weak PLT rule (2) with *low* policy parameters ψ_P and ψ_y and additional guidance provided by the central bank to the subjects.

The difference between weak and strong PLT rules is that only the strong one is stable under homogenous naive expectations. On the other hand, the weak rule turns out to be unstable, but it was suggested in the literature on adaptive learning (Mitra and Honkapohja, 2014). Therefore, differences between treatments 2 and 3; and between 4 and 5 will allow us to test whether subjects are closer to a simple forecasting behavior, or whether they are actually able to use the sophisticated adaptive learning.

As will be explained in the next part of this section, guidance mean that the subjects are given additional information about the behavior of the central bank, namely that the central bank intends to keep prices at a certain trajectory. On the other hand, subjects in the two PLT treatments without guidance 2 and 3 are given the same information as those in the inflation targeting treatment 1. Therefore, with the difference between the two subsets of the treatments we can directly test, whether a simple version of guidance can help the central bank in stabilizing the business cycle.

2.2 Information provided to subjects

In all five treatments, subjects are told that they act as forecasting specialists in statistical bureaus. We provide the subjects with a qualitative description of the economy and the relationship between their forecasts, interest rate and the realized inflation and output gap. However, we never show the subjects the actual laws of motion of the experimental economy. We inform them that they belong to a fixed group and that other subjects have the same task, but we do not specify the exact size or composition of their groups. Finally, we explain the subjects the payment scheme.

Every subject is informed that she or he will observe the past realized inflation, output gap and interest rate, as well as her or his own past inflation and output gap forecasts, and the corresponding earnings. However, no subject is ever shown the forecasts or score of any other subject. Finally, the experimental economy is based on a two-period ahead feedback, we therefore inform the subjects that they will first receive information about their performance and the realized variables only after the first two sets of forecasts. In order to guide them in these 'blind' periods into the vicinity of the steady state of the experimental economy, we mention in the instructions that both the inflation and output gap 'have historically been between -5% and 8%'.

The only difference between treatments 1, 2 and 3 (no guidance) on one hand, and 4 and 5 (guidance) on the other, is that the subjects *in the guidance treatments 4 and 5 receive additional information*. Namely, we explain in detail (using the word 'guide') that the central banks wants the price level to follow a certain trajectory. We inform them that they cannot

directly observe that path, but they will be given the exact value of the deviation of the prices from this path, namely the realized $\frac{P_{t+1}-\bar{P}_{t+1}}{\bar{P}_{t+1}}$ variable.

The instructions cover the above mentioned information. In addition, they contain a table and graph of the payoff function, and explain a screenshot of the subject screen. During the session, subject's screen displays graphs and tables of the realized variables (inflation, output gap, interest rate; and in the guidance treatments the price level deviation), the individual past forecasts and scores (per period and total so far), number of the current period and the remaining number of forecasts that the subjects should submit this period. We use a number of control questions to test whether the subjects understand the instructions. Please refer to Appendix A for the instructions and control questions.

2.3 Guidance specification

In our experiment, guidance implies that (1) the subjects are explicitly told about the fact that the central bank tries to minimize price level deviation, and (2) subjects are informed about the realized values of this variable throughout the session. This version of guidance is the simplest possible. Here, the guidance means that the subjects actually know the target of the central bank, that is they know the specific values of the variable, to which the central bank reacts throughout the session. In addition, the subjects are explicitly told that the central indeed commits to this policy. In contrast, under the non-guidance treatments, subjects can only guess how the central bank will react to a certain level of inflation, and when and which levels of inflation are 'high' enough for the interest rate to increase.[2]

2.4 Experimental economy

The economy in our experiment is based on a standard DSGE model. For derivations, see for example Mitra and Honkapohja (2014).[3] The model is based on a representative Ricardian consumer-firm owner, who maximizes an infinite discounted sum of utility subject to standard production, saving and market clearing condition. Assuming fixed government spending $g_t = g$, non-distortionary lump-sum taxes and an interest rate rule $R_t(\cdot)$, the model can be described as a two dimensional system such that in period t, consumption level c_t and gross inflation π_t are a function of the two-period ahead consumer expectations of these two variables. To be specific, the relationship is given by the following set of equations:

[2]Literature offers many explications of the term 'guidance' in the context of monetary policy. Another popular is one in which the central bank announces (and commits to) that if the inflation or output fall under a specific threshold, the central bank will keep the nominal interest rate at some low level for a predetermined number of periods. This interesting version of guidance requires a number of arbitrary choices (like the threshold conditions, value and duration of the 'low nominal interest rate'), which can be evaluated for example with a laboratory experiment. We leave this for further research.

[3]Remark that Mitra and Honkapohja (2014) further solve the model under the so called steady state learning, instead of leaving it in the Euler learning form. We decided not to follow this approach, as the DSGE model under steady state learning is extremely explosive under naive expectations. As it will be apparent in the next section, naive expectations fit the behavior of our subjects better than the adaptive learning.

1. The aggregate consumption:

$$c_t = c^e_{t+1}\left(\frac{\pi^e_{t+1}}{\beta R_t}\right)^{1/\sigma} + \varepsilon^c_t. \tag{3}$$

2. The Phillips curve:

$$\pi_t = Q^{-1}[K(c_t, \pi^e_{t+1})] + \varepsilon^\pi_t, \tag{4}$$

where

$$Q(\pi_t) = (\pi_t - 1)\pi_t$$

and

$$\kappa(c_t, \pi^e_{t+1}) = \beta\pi^e_{t+1}(\pi^e_{t+1} - 1) + \frac{\nu}{\alpha\gamma}(c_t + \bar{g})^{(1+\varepsilon)/\alpha} + \frac{1-\nu}{\gamma}(c_t + \bar{g})c_t^{-\sigma}, \tag{5}$$

$$K(c_t, \pi^e_{t+1}) = \begin{cases} \kappa(c_t, \pi^e_{t+1}) & \text{if } \kappa(c_t, \pi^e_{t+1}) > -0.25 \\ 0 & \text{else.} \end{cases}$$

The last condition in equation (5) is necessary to avoid complex values of the realized inflation. Notice that the interest rate rule $R_t(\cdot)$ depends on the treatment. It is either based on an inflation target (1) or price level target (2). See Table 1 for the parameters interpretation and values, and the corresponding full employment and ZLB steady states. Finally, the two random errors are uncorrelated IID noise terms to the consumption and inflation, such that $\varepsilon^c_t \sim NID\left(0, (0.0005c^*)^2\right)$, $\varepsilon^\pi_t \sim NID\left(0, 0.0005^2\right)$ and $Cov\left(\varepsilon^c_t, \varepsilon^\pi_t\right) = 0$. The variance of the two noise terms was chosen in such a way, that if the agents would repeatedly forecast the full employment steady state, realized inflation and consumption should both stay within one permil point (!) of the steady state 95% of time.

Under rational expectations, the model is solved to obtain the model consistent expectations such that for every period t it holds that $\pi^e_{t+1} = E(\pi_{t+1})$ and $c^e_{t+1} = E(c_{t+1})$, that is the representative consumer does not make systematic errors. However, in the experiment we take the average net inflation and output gap forecasts of the six subjects, transform them into the consumption level and gross inflation level forecasts and directly input them into the interest rate rule ((1) in treatment **INF**, and (2) in treatments **StrongNo**, **WeakNo**, **StrongGuid** and **WeakGuid**), the consumption rule (3) and hence the Phillips curve (4).

The only constraint on subject behavior (regardless of the treatment) is that both inflation and output gap forecasts have to stay within the $[-5\%, 15\%]$ interval. We disallow more extreme forecasts in order to rule out explosive time paths in the experiment. Notice that the allowed forecasting intervals allow for coordination on the ZLB steady state, as well as on interesting dynamics around that point.

Parameter	Notation	Value
Number of agents/subjects	I	6
Discount factor	β	0.99
Government spending	$\bar{g}$	0.2
Output elasticity	α	0.7
Rotemberg price stickiness	γ	350
Labor supply elasticity	ϵ	1
Demand's elasticity of substitution	ν	21
Consumption elasticity	σ	1
Gross inflation target	π^*	1.05
Steady state gross interest rate	R^*	1.(06)
Steady state consumption	c^*	0.74538
Steady state output	y^*	0.94538
ZLB gross inflation	π^Z	0.99
ZLB gross interest rate	R^Z	1
ZLB consumption	c^Z	0.742765
ZLB output	y^Z	0.942765
ZLB output gap	o^Z	-0.2766%

Table 1: Experimental economy parametrization.

2.5 Experiment

We run 6 groups per each of the 5 treatments, gathering in total 180 subjects. The sessions were run at the CREED laboratory, University of Amsterdam, in November and December 2015, and January 2016. We wrote the experimental software in C++, using standard library and Wt, a C++ Web Toolkit under the standard GNU General Public License.[4] The duration of each session was typically between one and half and two hours. We asked subjects for 51 pairs of forecasts, which results in full 50 periods of data per group.[5]

2.6 Testable hypotheses

Under Rational Expectations, the experimental economy should immediately (in the very first period) converge to either ZLB or full employment steady state. However, previous experimental evidence suggests that the subjects either never truly converge to a steady state, or they do so only after a prolonged spell of a business cycle type of dynamics. Therefore, the design of our experiment can be used to directly test the following hypotheses:

Hypothesis 1 Among the four PLT treatments **StrongNo**, **WeakNo**, **StrongGuid** and **WeakGuid**, only the ones with the strong Taylor rule (treatments **StrongNo** and

[4]The Wt library is available at `http://www.webtoolkit.eu/wt`. The software (compiled for the Windows operating system), as well as the source code can be provided on demand.

[5]Due to an unexplained software or hardware failure, the last period was not recorded in the case of four groups, leaving only 49 data points. These groups are INF06, PLTStrongGuid01, PLTWeakGuid02 and PLTWeakGuid05. In addition, one subject in group INF03 was extremely slow. Despite the help of the experiment's staff, he was unable to act efficiently throughout the session, which then had to be terminated after period 41. We leave this group out of the following analysis, though the group's results are presented in the Appendix B.

StrongGuid) will exhibit stable dynamics (convergence or mild oscillations).

Hypothesis 2 Guidance can help to stabilize the economy, which implies that treatment **StrongGuid** is more stable than treatment **StrongNo**, and treatment **WeakGuid** is more stable than **WeakNo**.

Hypothesis 3 Subjects will learn simple rules: adaptive or trend chasing expectations.

Hypothesis 1 and **Hypothesis 2** can be directly translated into a statistical test. Following the literature, we will compare the relevant treatments by testing the differences in the distribution of inflation and output gap variability. We will test this variability with Relative and Relative Absolute Deviations (Stöckl et al., 2010). Confirmation of the **Hypothesis 2** would imply that the **Hypothesis 3** is false. On the other hand, should the **Hypothesis 2** turn out false, we will estimate simple behavioral forecasting rules for each subject and investigate the resulting distribution.

3 Experimental results

In this section we discuss the results from our experiment. We will start with a general overview of the dynamics, which was observed in the five treatments. In section 3.2, we will test whether the differences between the stability of the treatments. Section 3.3 will give a brief description of the individual behavior.

3.1 Overview

An important observation is that all the 30 groups in our treatment seem to have started close to each other, with both the initial inflation and the initial output gap in the vicinity of 2.5% level. The experiment resulted in clear differences between the treatments. Figure 3.1.1 shows sample group inflation and output gap results for every treatment (remark that this Figure is spread over two pages). Figure 3.1.2 shows realized inflation and output gap paths separately for each treatment. Full figures for every group can be found in Appendix B.

Under the inflation treatment (**INF**), two types of dynamics are possible. First, some of the groups exhibit mild oscillations, as in the case of group 4 from that treatment (Figures 3.1.1a and 3.1.1b). Despite some instability, subjects are well coordinated and quickly learn to predict well both variables. Second, some of the groups could exhibit convergent dynamics, as in the case of group 5 (Appendix B). Even though the economy does not always converge to the full employment steady state, this treatment seems comparatively stable.

Similar dynamics appear under the stable PLT treatment without guidance (**StrongNo**). Figures 3.1.1c and 3.1.1d present example results for group 4, in which again we observe a high degree of coordination and converging dynamics. The groups under this treatment seem to be more unstable in the initial periods, and they tend to generate faster business cycle than under the inflation treatment **INF**, but they eventually settle down on close to the full

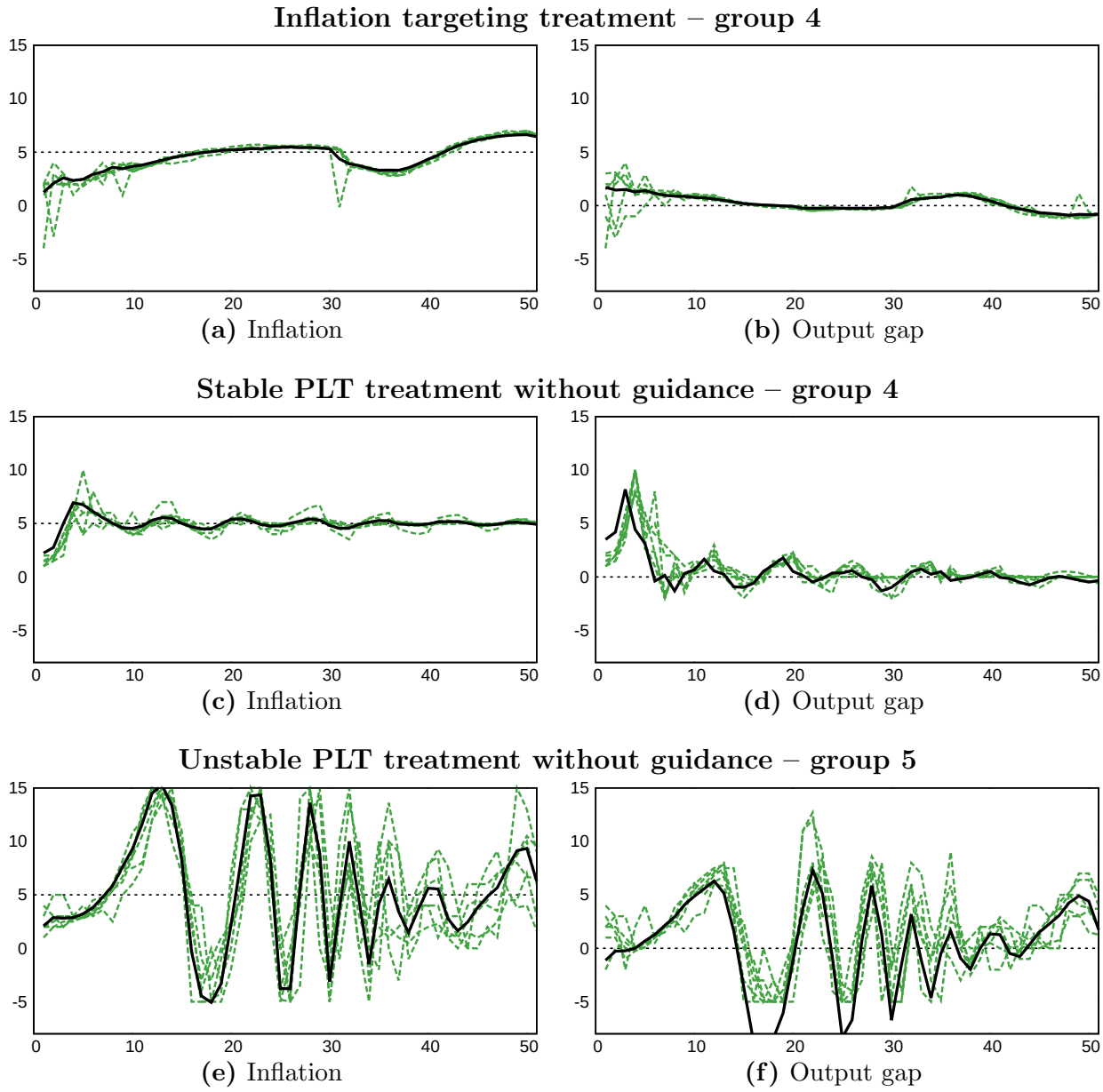
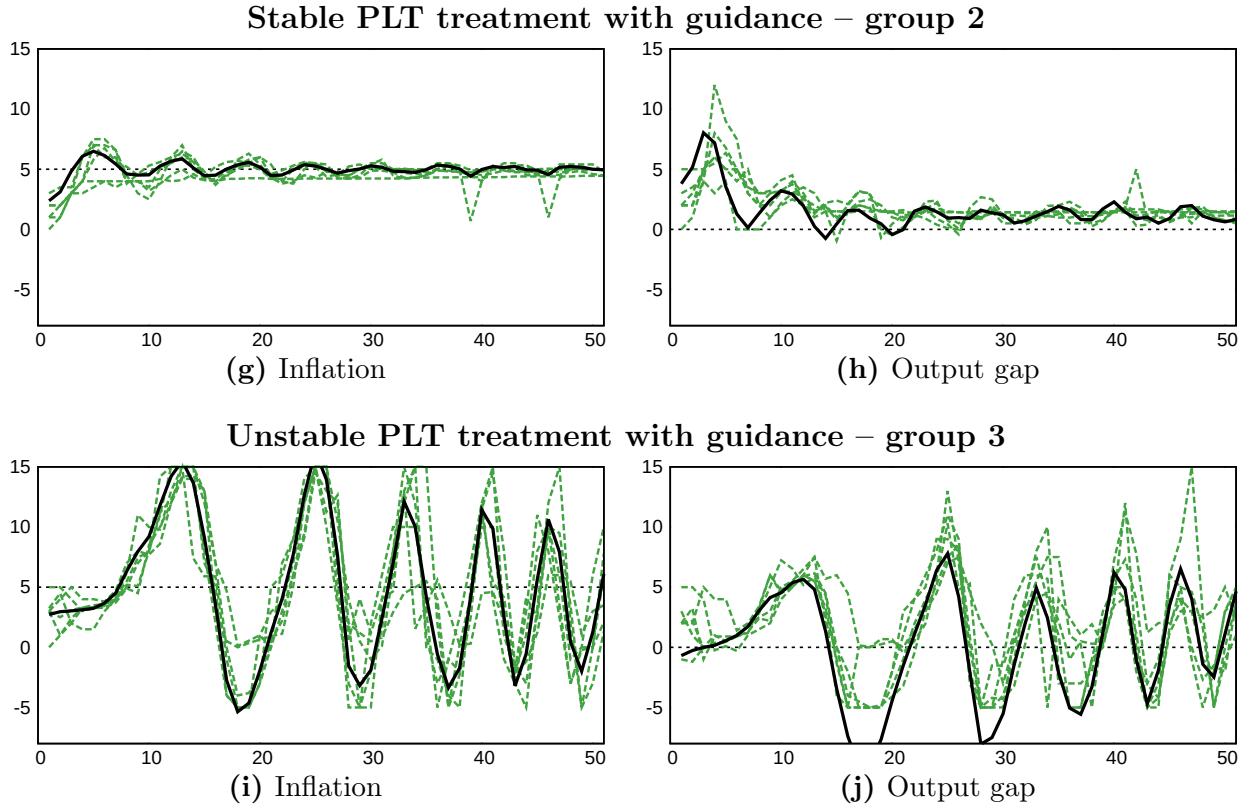


Figure 3.1.1: Example experimental results, with one representative group per treatment. Left panels show the results for the inflation, and right panels for the output gap. In each figure, the realized variable is shown with black line, while the corresponding six subject forecasts are shown with dashed green lines.

employment steady state. On the other hand, under the no guidance treatment with weak Taylor rule (**WeakNo**), all the six groups exhibited explosive dynamics. Subjects repeatedly hit the upper and lower boundaries on their forecasts, which resulted in fast oscillations with high amplitude. If not for the forecasting constraints, these economies would likely collapse to zero output or diverge. In addition, subjects find it much more difficult to coordinate in this unstable environment.

Interestingly, the guidance seems to have little effect on the dynamics under the PLT Taylor rule. Figures 3.1.1g and 3.1.1h show results from group 2 from the stable PLT treatment with guidance (**StrongGuid**), and Figures 3.1.1i and 3.1.1j shows results from group 3 under the unstable PLT treatment without guidance (**WeakGuid**). The realized inflation and output



(g) Inflation **(h)** Output gap

(i) Inflation **(j)** Output gap

Figure 3.1.1: (Cont.) Example experimental results, with one representative group per treatment. Left panels show the results for the inflation, and right panels for the output gap. In each figure, the realized variable is shown with black line, while the corresponding six subject forecasts are shown with dashed green lines.

gap in these two groups look remarkably similar to these from their no guidance counterparts.

3.2 Measuring the stability of the treatments

We use a standard measure of Relative Absolute Deviation (RAD) to quantify the degree, to which the five different monetary policies stabilized the economy (see Stöckl et al., 2010, for a general definition and discussion). RAD measure for variable x and group g is defined as

$$RAD_g = \frac{1}{T-10} \sum_{t=10}^{T} \frac{|x_{g,t} - x_t^f|}{x_t^f}, \tag{6}$$

where T denotes the length of the session of the group g, $x_{g,t}$ denotes the realize value of x in period t in group g and x_t^f denotes the fundamental value of variable x in period t. In our case, the fundamental inflation is $\pi^* = 1.05$, while the RAD for the output by definition coincides with the average absolute output gap (which in the full employment steady state is equal to zero). Remark that we exclude the initial 10 observations, as we interpret these as the initial learning phase.

The results can be found in Tables 2 and 3 for inflation and output gap respectively. The first clear observation is that there is a little variation between the guidance and their respective no guidance treatments (**StrongGuid** versus **StrongNo** and **WeakGuid** versus

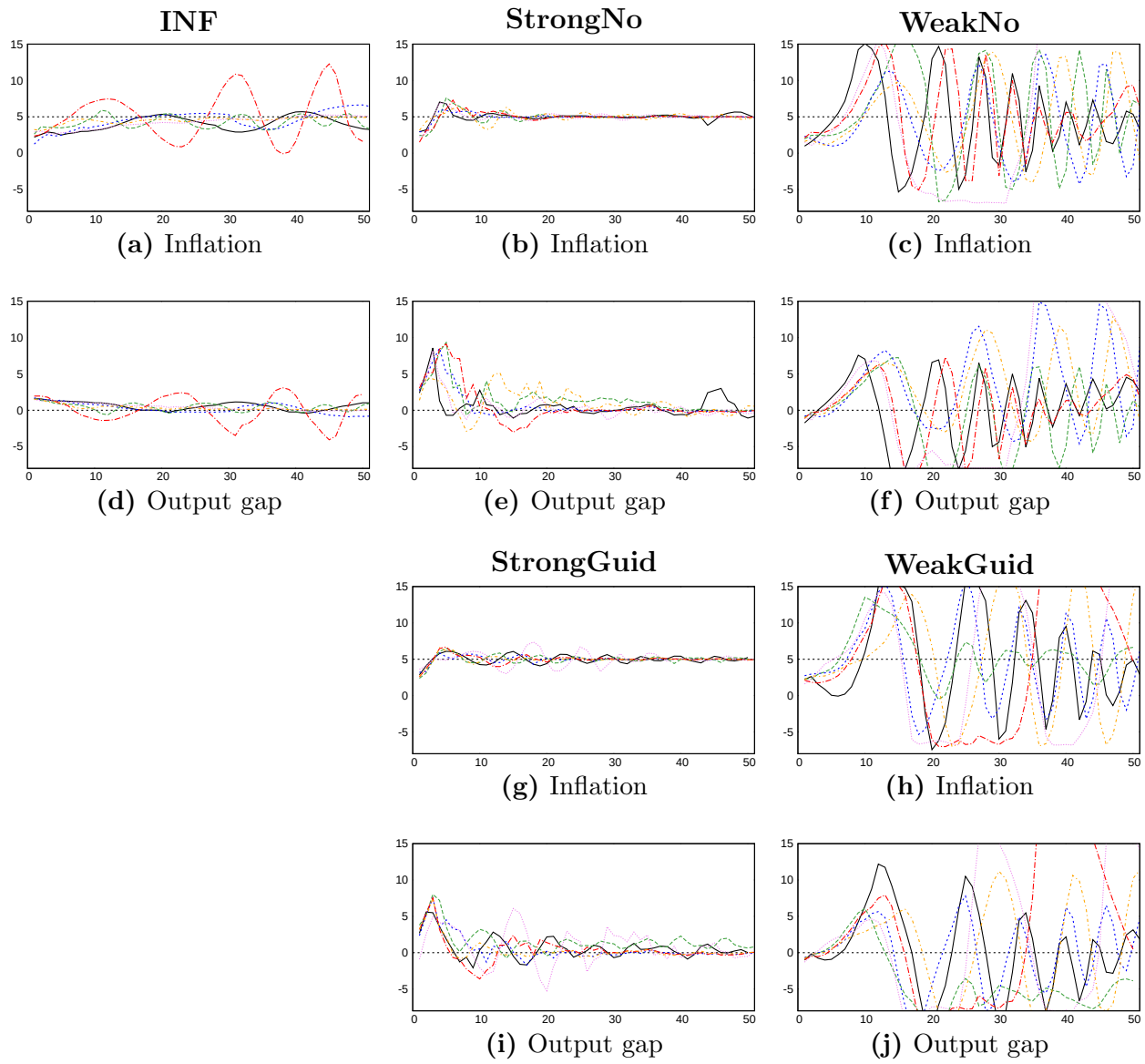


Figure 3.1.2: Realized inflation and output gap for each treatment. Each graph shows either realized inflation, or realized output gap, in six groups from the specified treatment.

Group	INF	StrongGuid	StrongNo	WeakGuid	WeakNo
#1	0.8501	0.3696	0.2073	5.934***	4.31***
#2	0.8047	0.241	0.146	2.308	6.066***
#3	0.7704	0.1325	0.05567	5.275***	4.803***
#4	0.5312	0.6597	0.2055	9.1***	10.13***
#5	2.937***	0.1645	0.1182	8.903***	4.26***
#6	0.3357	0.08466	0.3371	6.858***	4.742***
Average	1.038	0.2753	0.1783	6.396	5.719

Table 2: Relative Absolute Deviation (RAD) of the experimental **inflation** for the five treatments, in percentages. $***$ ($**$) denotes groups for which the average RAD from the last 40 periods is larger than 2% on 1% (5%) significance level.

WeakNo). This is confirmed by Mann-Whitneu U test (MWU test), according to which there is no significant difference between the distribution of inflation and output gap RAD

Group	INF	StrongGuid	StrongNo	WeakGuid	WeakNo
#1	0.5018	0.8222	0.6736	5.058	3.663
#2	0.5098	1.175	0.9529	5.741***	4.992
#3	0.4518	0.3385	0.1941	4.334	5.689***
#4	0.3157	1.745	0.4952	9.126	11.09
#5	1.731	0.5527	0.4899	9.795	3.534
#6	0.221	0.2351	1.28	6.191	5.025
Average	0.6219	0.8113	0.6811	6.708	5.666

Table 3: Relative Absolute Deviation (RAD) of the experimental **output gap** for the five treatments, in percentages. $***$ ($**$) denotes groups for which the average RAD from the last 40 periods is larger than 2% on 1% (5%) significance level.

measures between these two pairs of treatments. From this, we conclude that **Hypothesis 2** is rejected: guidance, as framed in our experiment, does not have a significant effect on the stability of the economy.

Second outcome is that there is a significant difference (confirmed by MWU tests) between the weak Taylor rule treatments and the three other treatments. This implies that the weak Taylor rule is not sufficiently responsive to the business cycle to stabilize it. Instead, central bank can use a PLT rule, but only if it is sufficiently harsh. This confirms **Hypothesis 1**, namely that our subjects were more likely to use simple forecasting rules instead of the sophisticated adaptive learning. In addition, RAD measures imply that the PLT treatments with the strong Taylor rule outperform the inflation target rule in terms of the inflation stability, but on in terms of the output gap stability. We conclude that, in line with the theoretical literature, the price level target indeed can be a promising monetary policy, but only if sufficiently reactive.

3.3 Individual behavior

In our experiment, we organized 6 groups per treatment, which gives us a sample of 180 subjects in total. As the **Hypothesis 1** was rejected, it follows that our subjects used simple forecasting heuristics. Following the previous literature, we assume that the subject forecasting can be explained by the following (two dimensional) first-order rule:

$$\pi^e_{t+1} = c^\pi + \alpha^\pi_1 \pi^e_t + \alpha^\pi_2 \pi_{t-1} + \alpha^\pi_3 o_{t-1} + \beta^\pi(\pi_{t-1} - \pi_{t-2}) \tag{7}$$

$$+ \delta^\pi r_{t-1} + \gamma^\pi D_{t-1} + \varepsilon^\pi_t, \tag{8}$$

$$o^e_{t+1} = c^o + \alpha^o_1 \pi^e_t + \alpha^o_2 o_{t-1} + \alpha^o_3 \pi_{t-1} + \beta^o(o_{t-1} - o_{t-2}) \tag{9}$$

$$+ \delta^o r_{t-1} + \gamma^o D_{t-1} + \varepsilon^o_t,$$

where π denotes the inflation, o denotes the output gap, r denotes the net interest rate and D denotes the price level deviation. Remark that D is used only in the guidance treatments,

otherwise γ's are set to zero. Finally,

$$\begin{pmatrix} \varepsilon_t^{\pi} \\ \varepsilon_t^{o} \end{pmatrix} \equiv \varepsilon_t \sim NID\left(\begin{pmatrix} 0 \\ 0 \end{pmatrix}, \begin{pmatrix} \sigma_{\pi}^2 & \rho_{\pi,o}\sigma_{\pi}\sigma_o \\ \rho_{\pi,o}\sigma_{\pi}\sigma_o & \sigma_o^2 \end{pmatrix} \right) \tag{10}$$

are jointly normally distributed random errors, which are are pairwise independent in the dimensions of time and subjects.

For each subject, we estimate the two forecasting rules (7) *jointly* with a simple Maximum Likelihood estimator, which allows us to use the Likelihood Ratio test for all the following tests, for the two rules jointly. We add lags of the two forecasts until there is no evidence of auto-correlation, and hence eliminate the insignificant variables until the two rules contain only significant ones (if any). For the details on the estimation algorithm, and the full results, see Appendix C.

We were able to estimate a two-dimensional rule for all the subjects, and most of these rules are non-trivial (that is they contain significant variables). Average estimated coefficients, as well as number of significant coefficients per treatment, are provided in Table 4. See also Appendix C for the full estimation results. From these 180 two-dimensional rules, some stylized fact emerge:

1. Subjects remained largely heterogeneous within groups, within treatments and between treatments. This means that they both used different values and different subsets of coefficients, even if they belonged to the same group.

2. In general the inflation rules are simpler: they contain fewer significant coefficients.

3. A clear between-treatments pattern is that the subjects used simpler rules under the inflation targeting **INF** and strong Taylor rule PLT treatments **StrongNo** and **StrongGuid**. We interpret this as a sign that in more difficult, unstable environment, subjects try to use more information.

4. Subjects learn to incorporate guidance information and the interest rate mostly under the unstable treatment **WeakGuid**. For example, δ^{π} is significant for 13 subjects under **StrongGuid** and for 23 subjects under **WeakGuid** treatment. This leads to an interesting result that people seek the monetary authority's guidance if times are unstable, but this does not counter the effect of a relatively weak response of the central bank.

5. A typical result is that subjects used 'close to' adaptive rules (with significant weights on past forecasts and/or past observations, not necessarily adding up to unity). In addition, trend chasing is popular, with both β 's often significant and then positive.

6. In general, subject rules are far from a fundamentalist rule (forecasting only the full employment steady states values of inflation and output gap), but constants equal to the these fundamental values values do appear. This implies that some of the subjects learned the steady state, but they would still consider the business cycle.

	Inflation forecasting rule							Output gap forecasting rule						
	c^{π}	π_t^e	π_{t-1}	o_t	$\Delta\pi_{t-1}$	r_{t-1}	D_{t-1}	c^{o}	o_t^e	o_{t-1}	π_{t-1}	Δo_{t-1}	r_{t-1}	D_{t-1}
INF	0.568	0.373	0.431	0	0.586	0.0528	n/a	0.512	0.176	0.539	−0.0638	0.413	−0.022	n/a
(SD)	(1.3)	(0.443)	(0.528)	(0)	(0.645)	(0.279)		(1.44)	(0.3)	(0.558)	(0.263)	(0.609)	(0.174)	
Sign.	11	16	18	0	18	3		18	17	27	2	15	14	
SNo	1.72	0.193	0.484	0	0.397	−0.0229	n/a	0.633	0.178	0.653	−0.105	0.17	0.00328	n/a
(SD)	(1.94)	(0.303)	(0.517)	(0)	(0.763)	(0.097)		(2.89)	(0.249)	(0.437)	(0.524)	(0.408)	(0.351)	
Sign.	19	16	18	0	13	9		23	22	32	6	10	18	
WNo	1.88	0.131	0.0522	0.327	0.496	0.276	n/a	1.17	0.101	0.801	−0.478	0.436	0.293	n/a
(SD)	(1.92)	(0.303)	(0.742)	(0.535)	(0.312)	(0.369)		(1.44)	(0.292)	(0.47)	(0.473)	(0.277)	(0.389)	
Sign.	26	22	25	13	29	21		32	35	36	31	36	36	
SGu	1.42	0.212	0.507	−0.0967	0.299	−0.0249	−0.394	1.17	0.206	0.455	−0.193	0.216	0.00106	−0.276
(SD)	(2.7)	(0.344)	(0.665)	(0.572)	(0.542)	(0.189)	(1.01)	(3.88)	(0.305)	(1.39)	(0.998)	(0.496)	(0.486)	(2.31)
Sign.	19	16	18	1	13	9	13	23	27	31	9	18	22	22
WGu	0.616	0.15	0.632	−0.112	0.513	0.106	−0.0313	−0.32	0.127	0.467	−0.118	0.428	0.277	−0.0455
(SD)	(3.66)	(0.286)	(0.801)	(0.99)	(0.354)	(0.319)	(0.212)	(4.23)	(0.271)	(1.16)	(0.865)	(0.302)	(0.553)	(0.236)
Sign.	19	22	32	10	34	23	23	24	28	32	29	32	33	28

Table 4: Average estimated forecasting rules. SNo, WNo, SGu and WGu denote **StrongNo**, **WeakNo**, **StrongGuid** and **WeakGuid** treatments respectively. SD denotes standard deviation *across the subjects from the treatment* and Sign. denotes number of subjects, for which the coefficient was significant on 5% significance level.

Altogether, these results confirm **Hypothesis 3**.

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Appendices

A Experimental instructions and control questions

The first set of instructions was given to the subjects from the treatments **INF**, **StrongNo** and **WeakNo** (treatment without guidance). The second set of instructions was given to subjects from the treatments **StrongGuid** and **WeakGuid** (treatments with guidance).

All subjects had to answer control questions 1, 2 and 3. In addition, subjects from the treatments **StrongGuid** and **WeakGuid** (treatments with guidance) had to answer control question 4 in order to start the experiment.

Experimental instructions

Welcome to this experiment! The experiment is anonymous, the data from your choices will only be linked to your station ID, not to your name. You will be paid privately at the end, after all participants have finished the experiment. After the main part of the experiment and before the payment you will be asked to fill out a short questionnaire. On your desk you will find a calculator and scratch paper, which you can use during the experiment.

During the experiment you are not allowed to use your mobile phone. You are also not allowed to communicate with other participants. If you have a question at any time, please raise your hand and someone will come to your desk.

General information and experimental economy

All participants will be randomly divided into groups of a fixed size. The group composition will not change during the experiment. You and all other participants will take the roles of statistical research bureaus making predictions of inflation and the so-called "output gap". The experiment consists of 50 periods in total. In each period you will be asked to predict inflation and output gap for the next period.

The economy you are participating in is described by three variables: inflation π_t, output gap y_t and interest rate R_t. The subscript t indicates the period the experiment is in. In total there are 50 periods, so t increases during the experiment from 1 to 50.

Inflation (π_t) measures the percentage change in the price level of the economy. In each period, inflation depends on inflation predictions of the statistical research bureaus in the economy (that is on your own forecast as well as on the forecasts of the other bureaus in the experiment), on output gap, on interest rate and on a small random term. There is a **positive** relation between the actual inflation and (i) the inflation predictions and (ii) the actual output gap. This means that if the inflation predictions of the research bureaus or the actual output gap increase, then actual inflation will also increase (everything else equal). In economies similar to this one, inflation has historically been between -5% and 8%.

Output gap (y_t) represents the amount of goods produced by firms and consumed by households in the economy. In each period, output gap depends on inflation predictions and output gap predictions of the statistical research bureaus in the economy (that is on your own forecast as well as on the forecasts of the other bureaus in the experiment), on the interest rate and on a small random term. There is a **positive** relation between the actual output gap and both the inflation predictions and output gap predictions. This means that if the inflation predictions or output gap predictions of the research bureaus increase, then actual output gap will also increase (everything else equal). There is a **negative** relation between output gap and the interest rate. This means that if the interest rate increases, then actual output gap

will instead decrease (everything else equal). In economies similar to this one, output gap has historically been between -5% and 8%.

Interest rate (R_t) measures the cost of borrowing money and is determined by the central bank. The central bank sets the interest rate in response to the inflation and the output gap. In each period, if inflation and output gap forecasts are considered too high, the central bank increases the interest rate. If inflation and output gap forecasts are considered too low, the central bank decreases the interest rate. The interest rate cannot take negative values.

Prediction task

Your task in each period of the experiment is to predict inflation and output gap in the next period. For example, in period 21 you have to predict inflation and output gap in period 22. When the experiment starts, you have to predict inflation and output gap for the first two periods, i.e. π_1^f and y_1^f and then π_2^f and y_2^f. The superscript f indicates that these are forecasts. When all participants have made their predictions for the second period, the actual inflation (π_1), the interest rate (R_1) and the actual output gap (y_1) for period 1 are announced. Then period 2 of the experiment begins. In period 2 you make inflation and output gap predictions for period 3 (π_3^f and y_3^f). When all participants have made their predictions for period 3, actual inflation (π_2), interest rate (R_2) and output gap (y_2) for period 2 are announced. This process repeats itself for 50 periods.

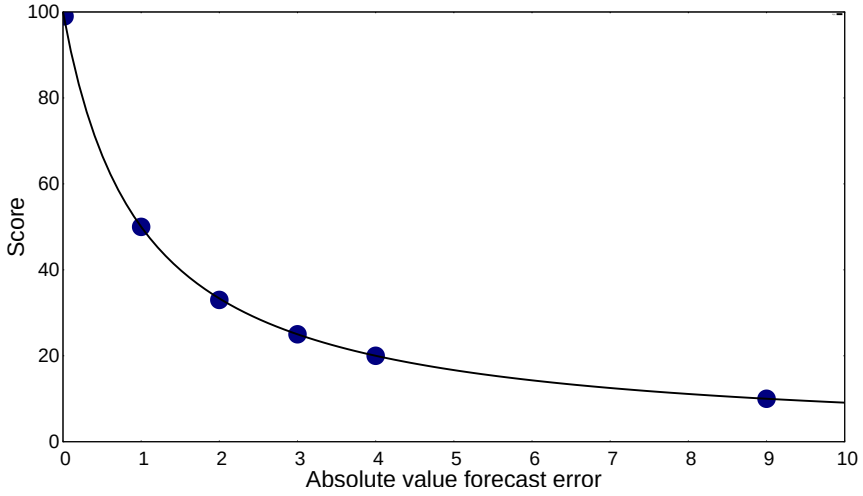
Thus, in a certain period t when you make predictions of inflation and output gap for the next period $t+1$, the following information is available to you:

- realized values of inflation, interest rate and output gap, up to and including period $t-1$;
- Your predictions up to and including your prediction for period t;
- Your prediction scores up to and including period $t-1$ (see below).

Payments

Your payment will depend on the accuracy of your predictions. You will be paid either for predicting inflation or for predicting output gap. The accuracy of your predictions is measured by the absolute distance between your prediction and the actual values (this distance is the prediction error). For each period the prediction error is calculated as soon as the actual values are known; you subsequently get a prediction score that decreases as the prediction error increases. The table below gives the relation between the prediction error and the prediction score. The prediction error is calculated in the same way for inflation and output gap.

Prediction error	0	1	2	3	4	9
Score	100	50	33.33	25	20	10



Example: If (for a certain period) you predict an inflation of 2%, and the actual inflation turns out to be 3%, then you make an absolute error of $3\% - 2\% = 1\%$. Therefore you get a prediction score of 50. If you predict an inflation of 1%, and the actual inflation turns out to be negative, for example -2%, you make a prediction error of $1\% - (-2\%) = 3\%$. Then you get a prediction score of 25. For a perfect prediction, with a prediction error of zero, you get a prediction score of 100.

The figure above shows the relation between your prediction score (vertical axis) and your prediction error (horizontal axis). Points in the graph correspond to the prediction scores in the previous table. At the end of the experiment, you will have two total scores, one for inflation predictions and one for output gap predictions. These total scores simply consist of the sum of all prediction scores you got during the experiment, separately for inflation and output gap predictions. **When the experiment has ended, one of the two total scores will be randomly selected for payment.**

Your final payment will consist of 0.75 **euro for each** 100 **points in the selected total score (**200 **points therefore equals** 1.50 **euro). This will be the only payment from this experiment, i.e. you will not receive a show-up fee on top of it.**

Computer interface

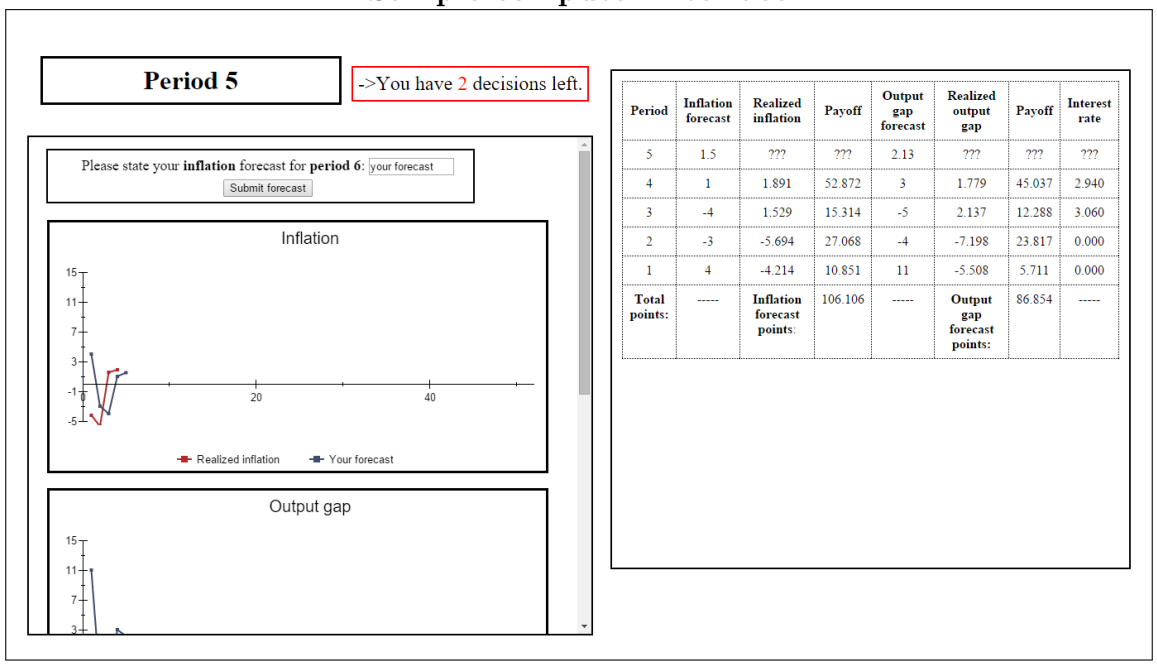
The computer interface will be mainly self-explanatory and example screenshot is presented below. The top part of the screen will tell you the current period, and how many decisions (forecasts) you still have to make in the current period (if you made all the forecasts, you will be asked to wait for other subjects). The right part of the screen will show you a table with all of the information available up to the period that you are in. That is, in period t, i.e. when you are asked to make your prediction for period $t+1$, this will be actual inflation, interest rate and output gap until period $t-1$, your predictions until period t, and the prediction scores arising from your predictions until period $t-1$ for both inflation and output gap. The

sum of the prediction scores over the different periods are shown in the bottom right of the screen, separately for your inflation and output gap predictions. Once the current period will become large, you may need to scroll down the table to see the early periods.

The left part of the screen will show you the information on inflation, interest rate and output gap in graphs. The axis of the inflation graph shows values in percentage points (i.e. 3 corresponds to 3%). Please note that maybe you need to scroll the graph box down to see bottom figures and the decision box for the output gap forecast (compare the last two figures).

In this panel you will also be asked to enter your predictions. When submitting your prediction, use a decimal point if necessary (not a comma). For example, if you want to submit a prediction of 2.5% type "2.5"; for a prediction of -1.75% type "-1.75". The order of the boxes in the panel is: box for inflation forecast, three graphs with inflation, output and interest rate information and box for output gap forecast.

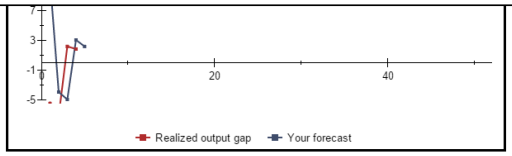
Sample computer interface

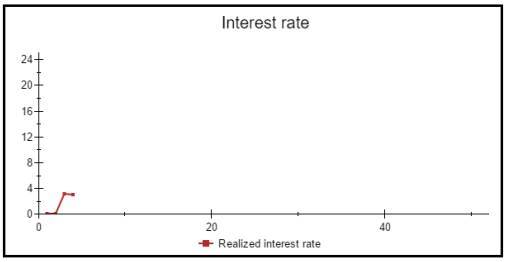


Period	Inflation forecast	Realized inflation	Payoff	Output gap forecast	Realized output gap	Payoff	Interest rate
5	1.5	???	???	2.13	???	???	???
4	1	1.891	52.872	3	1.779	45.037	2.940
3	-4	1.529	15.314	-5	2.137	12.288	3.060
2	-3	-5.694	27.068	-4	-7.198	23.817	0.000
1	4	-4.214	10.851	11	-5.508	5.711	0.000
Total points:	-----	**Inflation forecast points:**	106.106	-----	**Output gap forecast points:**	86.854	-----

Period 5

->You have 2 decisions left.





Please state your **output gap** forecast for **period 6**: your forecast

Submit forecast

Period	Inflation forecast	Realized inflation	Payoff	Output gap forecast	Realized output gap	Payoff	Interest rate
5	1.5	???	???	2.13	???	???	???
4	1	1.891	52.872	3	1.779	45.037	2.940
3	-4	1.529	15.314	-5	2.137	12.288	3.060
2	-3	-5.694	27.068	-4	-7.198	23.817	0.000
1	4	-4.214	10.851	11	-5.508	5.711	0.000
Total points:	-----	**Inflation forecast points:**	106.106	-----	**Output gap forecast points:**	86.854	-----

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General information and experimental economy

All participants will be randomly divided into groups of a fixed size. The group composition will not change during the experiment. You and all other participants will take the roles of statistical research bureaus making predictions of inflation and the so-called "output gap". The experiment consists of 50 periods in total. In each period you will be asked to predict inflation and output gap for the next period.

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decrease (everything else equal). In economies similar to this one, output gap has historically been between -5% and 8%.

Interest rate (R_t) measures the cost of borrowing money and is determined by the central bank. The central bank sets the interest rate in response to the output gap and the relative deviation of the price level from its intended level (see below). In each period, if output gap forecasts are considered too high, the central bank increases the interest rate. If output gap forecasts are considered too low, the central bank decreases the interest rate. The interest rate cannot take negative values. Furthermore, throughout all 50 periods the central banks commits to the following inflation stabilizing policy.

The central banks wants to guide the actual inflation (price growth) in such a way that the actual **price level** P_t will not deviate from its intended path P_t^{int}, in which price growth (actual inflation) is neither too large nor too low. The intended price level, which the central bank desires for a specific period, can vary between periods. This intended price level is not known, but what is known is the *relative* deviation of the price level from this intended level. In each period, if price level forecasts are considered too high relative to the intended level, the central bank increases the interest rate. If price forecasts are considered too low relative to the intended level, the central bank decreases the interest rate. The interest rate cannot take negative values.

Prediction task

Your task in each period of the experiment is to predict inflation and output gap in the next period. For example, in period 21 you have to predict inflation and output gap in period 22. When the experiment starts, you have to predict inflation and output gap for the first two periods, i.e. π_1^f and y_1^f and then π_2^f and y_2^f. The superscript f indicates that these are forecasts. When all participants have made their predictions for the second period, the actual inflation (π_1), the interest rate (R_1), the actual output gap (y_1) and the relative deviation of the price level $(\frac{P_1-P_1^{int}}{P_1^{int}})$ for period 1 are announced. Then period 2 of the experiment begins. In period 2 you make inflation and output gap predictions for period 3 (π_3^f and y_3^f). When all participants have made their predictions for period 3, inflation (π_2), interest rate (R_2), output gap (y_2) and $\frac{P_2-P_2^{int}}{P_2^{int}}$ relative deviation of the price level for period 2 are announced. This process repeats itself for 50 periods.

Thus, in a certain period t when you make predictions of inflation and output gap for the next period $t+1$, the following information is available to you:

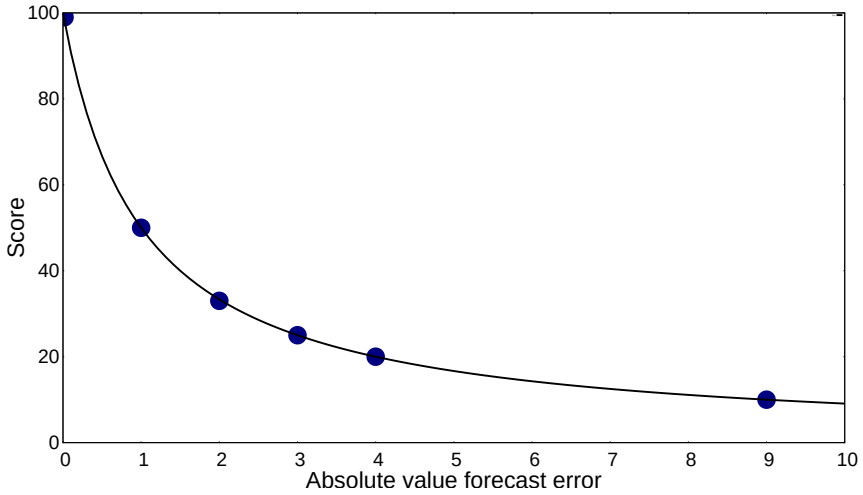
- realized values of inflation, output gap and deviations of the price level from the one intended by the central bank, up to and including period $t-1$;
- Your predictions up to and including your prediction for period t;
- Your prediction scores up to and including period $t-1$ (see below).

Payments

Your payment will depend on the accuracy of your predictions. You will be paid either for predicting inflation or for predicting output gap. The accuracy of your predictions is measured by the absolute distance between your prediction and the actual values (this distance is the prediction error). For each period the prediction error is calculated as soon as the actual values are known; you subsequently get a prediction score that decreases as the prediction error increases. The table below gives the relation between the prediction error and the prediction score. The prediction error is calculated in the same way for inflation and output gap.

Example: If (for a certain period) you predict an inflation of 2%, and the actual inflation turns out to be 3%, then you make an absolute error of $3\% - 2\% = 1\%$. Therefore you get a prediction score of 50. If you predict an inflation of 1%, and the actual inflation turns out to be negative, for example -2%, you make a prediction error of $1\% - (-2\%) = 3\%$. Then you get a prediction score of 25. For a perfect prediction, with a prediction error of zero, you get a prediction score of 100.

Prediction error	0	1	2	3	4	9
Score	100	50	33.33	25	20	10



The figure above shows the relation between your prediction score (vertical axis) and your prediction error (horizontal axis). Points in the graph correspond to the prediction scores in the previous table. At the end of the experiment, you will have two total scores, one for inflation predictions and one for output gap predictions. These total scores simply consist of the sum of all prediction scores you got during the experiment, separately for inflation and output gap predictions. **When the experiment has ended, one of the two total scores will be randomly selected for payment.**

Your final payment will consist of 0.75 **euro for each** 100 **points in the selected total score (**200 **points therefore equals** 1.50 **euro). This will be the only payment from this experiment, i.e. you will not receive a show-up fee on top of it.**

Computer interface

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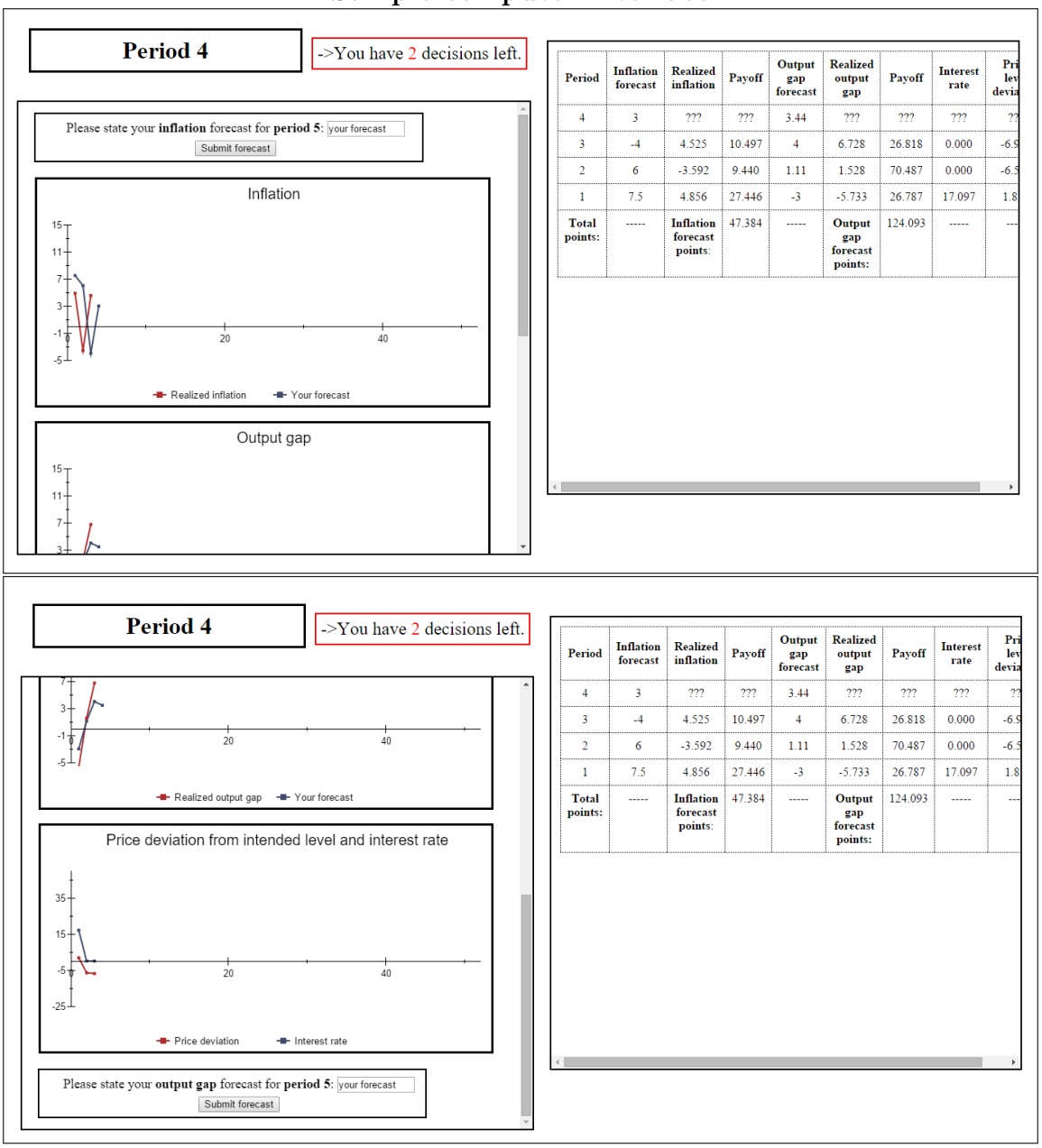
The left part of the screen will show you the information in graphs on inflation, output gap, interest rate and the relative deviation of the price level from its intended value. The vertical axis of the graph shows values in percentage points (i.e. 3 corresponds to 3%). Please note that maybe you need to scroll the graph box down to see bottom figures and the decision box for the output gap forecast (compare the last two figures).

In this panel you will also be asked to enter your predictions. When submitting your prediction, use a decimal point if necessary (not a comma). For example, if you want to submit a prediction of 2.5% type "2.5"; for a prediction of -1.75% type "-1.75". The order of the boxes in the panel is: box for inflation forecast, three graphs with inflation, output gap and interest rate/price deviation from the level intended by the central bank information;; and box for output forecast.

Sample computer interface



Period	Inflation forecast	Realized inflation	Payoff	Output gap forecast	Realized output gap	Payoff	Interest rate	Pri lev devia
4	3	???	???	3.44	???	???	???	??
3	-4	4.525	10.497	4	6.728	26.818	0.000	-6.9
2	6	-3.592	9.440	1.11	1.528	70.487	0.000	-6.5
1	7.5	4.856	27.446	-3	-5.733	26.787	17.097	1.8
Total points:	-----	Inflation forecast points:	47.384	-----	Output gap forecast points:	124.093	-----	---

Period	Inflation forecast	Realized inflation	Payoff	Output gap forecast	Realized output gap	Payoff	Interest rate	Pri lev devia
4	3	???	???	3.44	???	???	???	??
3	-4	4.525	10.497	4	6.728	26.818	0.000	-6.9
2	6	-3.592	9.440	1.11	1.528	70.487	0.000	-6.5
1	7.5	4.856	27.446	-3	-5.733	26.787	17.097	1.8
Total points:	-----	Inflation forecast points:	47.384	-----	Output gap forecast points:	124.093	-----	---

Control questions

Question 1

Suppose that the statistical bureaus predict that inflation will increase. Holding all other factors equal, including the interest rate, this means that:

(a) the output gap will be **increase**;

(b) the output gap will be **stay on the same level**;

(c) the output gap will be **decrease**;

Question 2

Suppose that the statistical bureaus predict that output gap in period decrease. Holding all other factors equal, this means that:

(a) the central bank will **increase** the interest rate, which in turn has a **positive** impact on the output gap;

(b) the central bank will **decrease** the interest rate, which in turn has a **negative** impact on the output gap;

(c) the central bank will **increase** the interest rate, which in turn has a **negative** impact on the output gap.

(d) the central bank will **decrease** the interest rate, which in turn has a **positive** impact on the output gap;

Question 3

Suppose that your inflation prediction for period 9 is -1%, and the realized inflation in that period is 3%. For this forecast you will receive score of

(a) 10 points;

(b) 100 points;

(c) 20 points;

(d) 33.33 points.

Question 4 – only for guidance treatment

Suppose that the prices fall below the intended level of the central bank. Holding all other factors equal, this means that:

(a) the central bank will **increase** the interest rate.

(b) the central bank will **decrease** the interest rate.

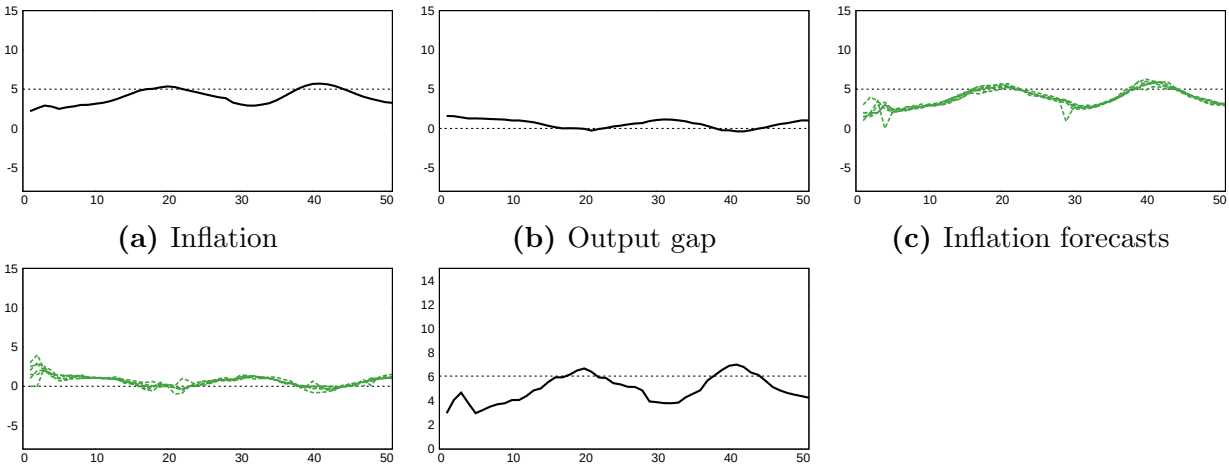
(c) the central bank will **not change** the interest rate.

(d) it is not possible to say what the central bank will do.

Solution:
1a, 2d, 3c, 4b

B Experimental results (graphical representation)

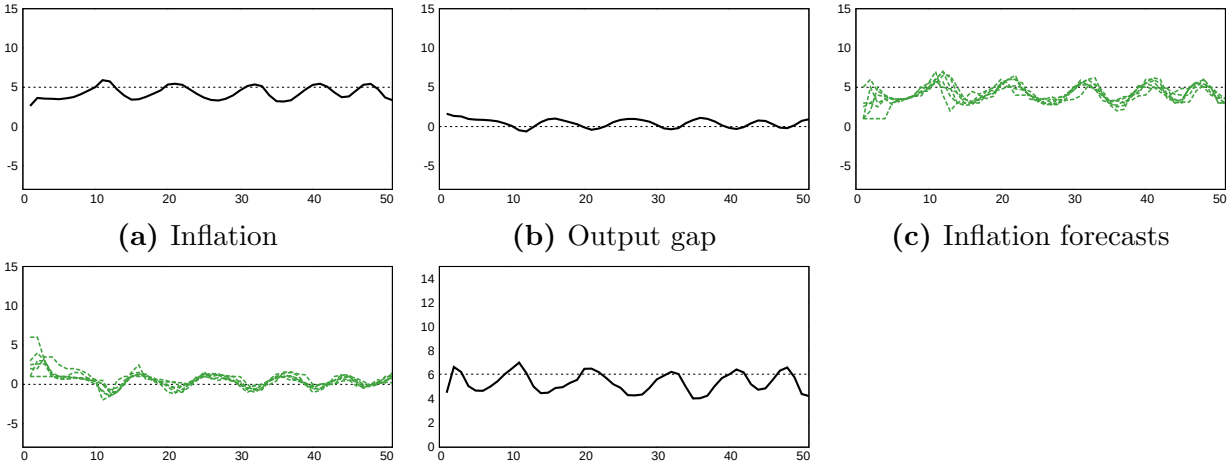
B.1 Inflation targeting



(a) Inflation **(b)** Output gap **(c)** Inflation forecasts

(d) Output gap forecasts **(e)** Interest rate

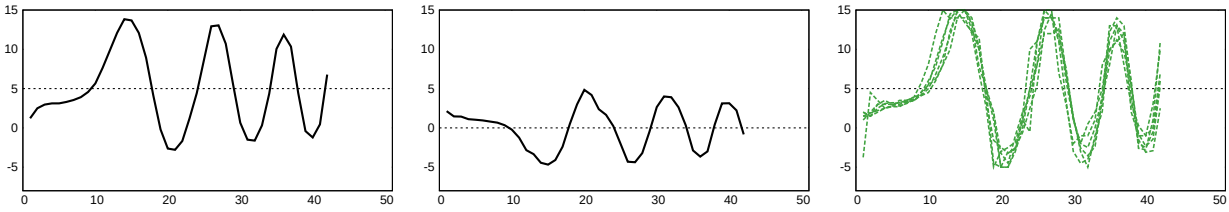
Figure B.1.1: Group number 1 (Inflation Targeting).



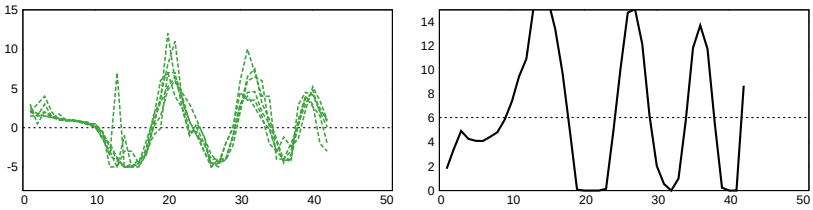
(a) Inflation **(b)** Output gap **(c)** Inflation forecasts

(d) Output gap forecasts **(e)** Interest rate

Figure B.1.2: Group number 2 (Inflation Targeting).

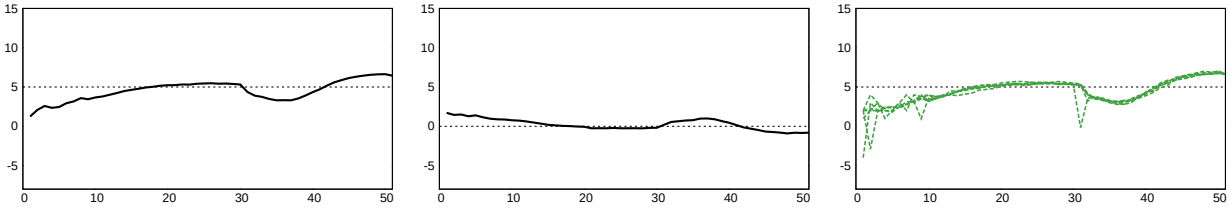


(a) Inflation **(b)** Output gap **(c)** Inflation forecasts

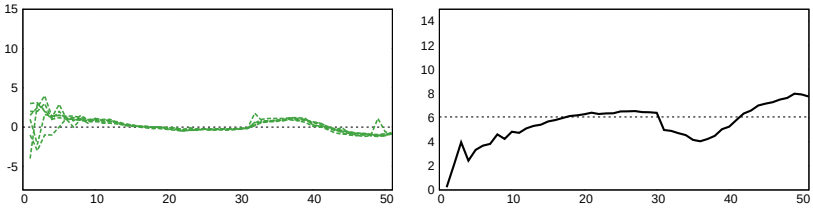


(d) Output gap forecasts **(e)** Interest rate

Figure B.1.3: Group number 3 (Inflation Targeting). The group in which one of the subjects was extremely slow. The group was terminated after period 41 and not used in the econometric analysis.

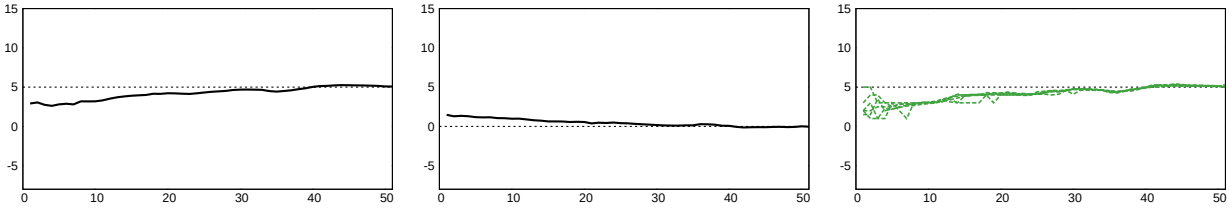


(a) Inflation **(b)** Output gap **(c)** Inflation forecasts

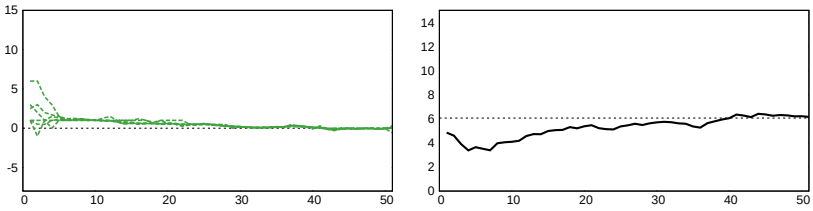


(d) Output gap forecasts **(e)** Interest rate

Figure B.1.4: Group number 4 (Inflation Targeting).

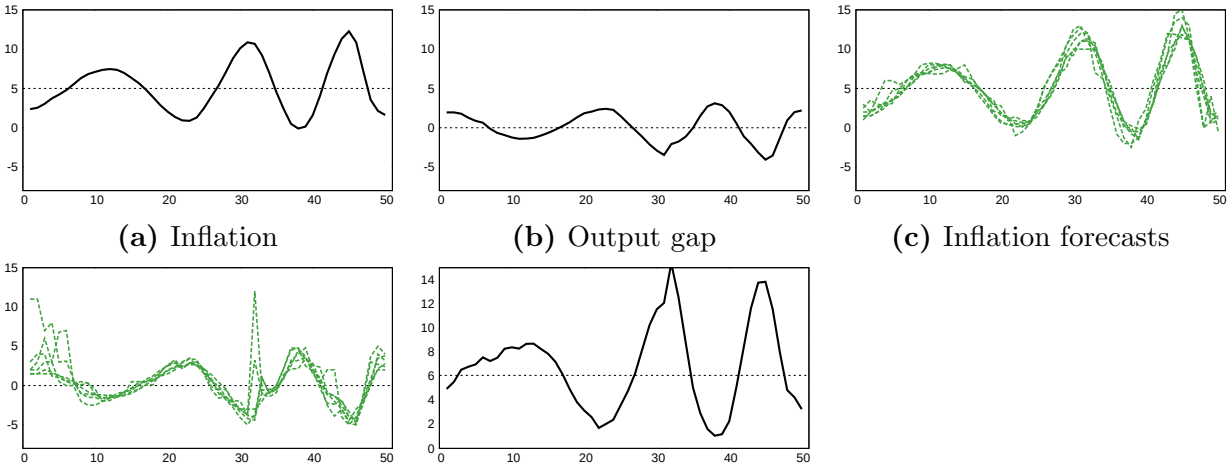


(a) Inflation **(b)** Output gap **(c)** Inflation forecasts



(d) Output gap forecasts **(e)** Interest rate

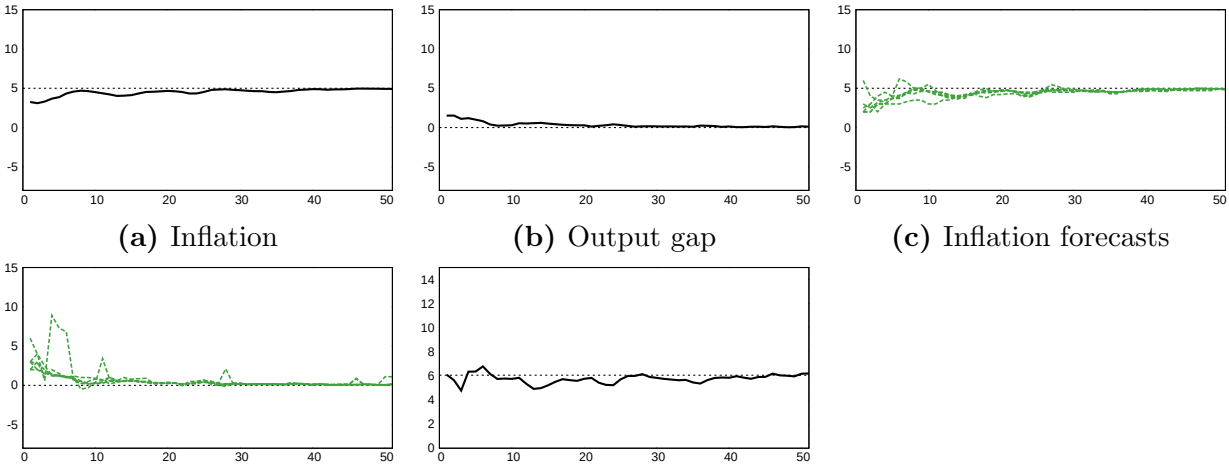
Figure B.1.5: Group number 5 (Inflation Targeting).



(a) Inflation **(b)** Output gap **(c)** Inflation forecasts

(d) Output gap forecasts **(e)** Interest rate

Figure B.1.6: Group number 6 (Inflation Targeting).

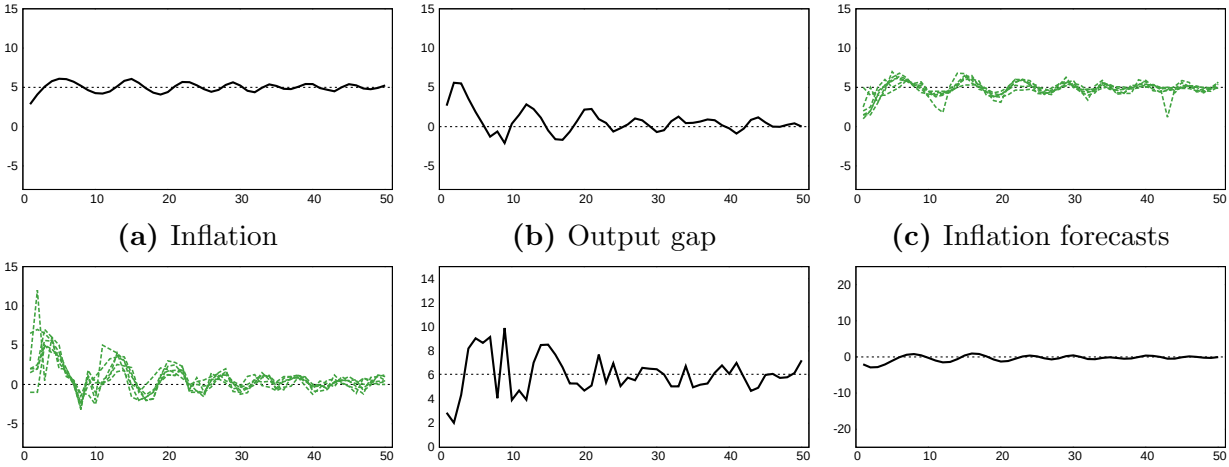


(a) Inflation **(b)** Output gap **(c)** Inflation forecasts

(d) Output gap forecasts **(e)** Interest rate

Figure B.1.7: Group number 7 (Inflation Targeting).

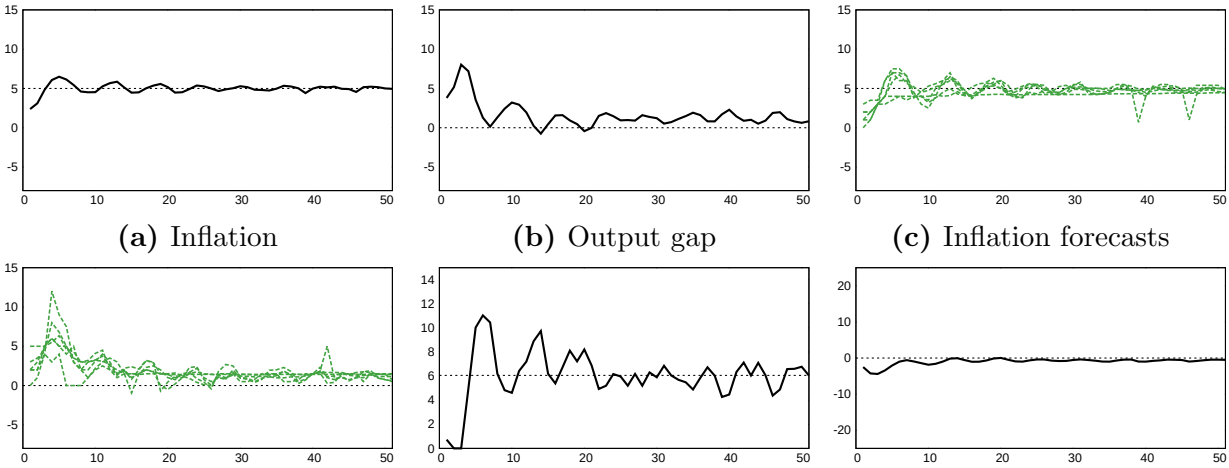
B.2 PLT: Stable with Guidance



(a) Inflation **(b)** Output gap **(c)** Inflation forecasts

(d) Output gap forecasts **(e)** Interest rate **(f)** Price Deviation

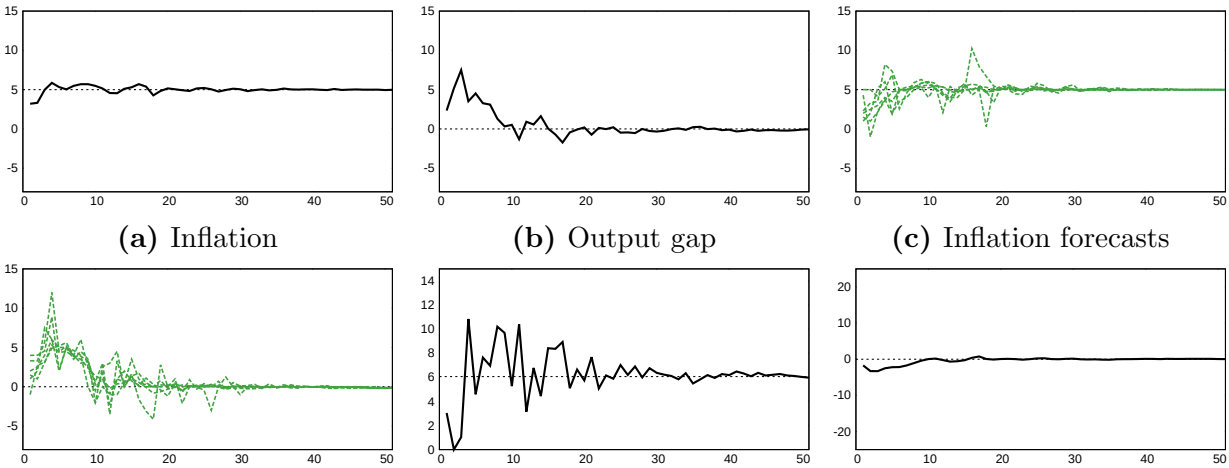
Figure B.2.1: Group number 1 (PLT: Stable with Guidance).



(a) Inflation **(b)** Output gap **(c)** Inflation forecasts

(d) Output gap forecasts **(e)** Interest rate **(f)** Price Deviation

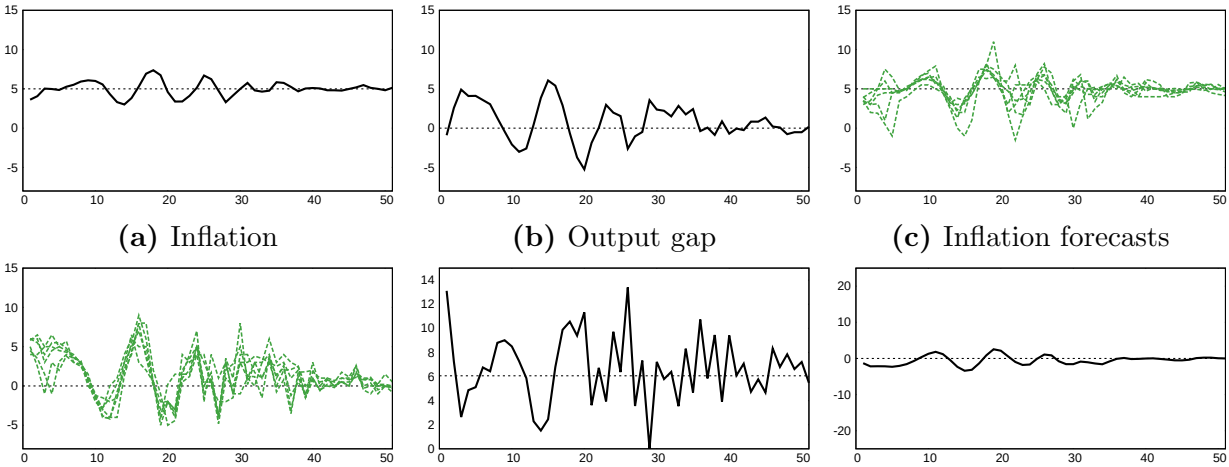
Figure B.2.2: Group number 2 (PLT: Stable with Guidance).



(a) Inflation **(b)** Output gap **(c)** Inflation forecasts

(d) Output gap forecasts **(e)** Interest rate **(f)** Price Deviation

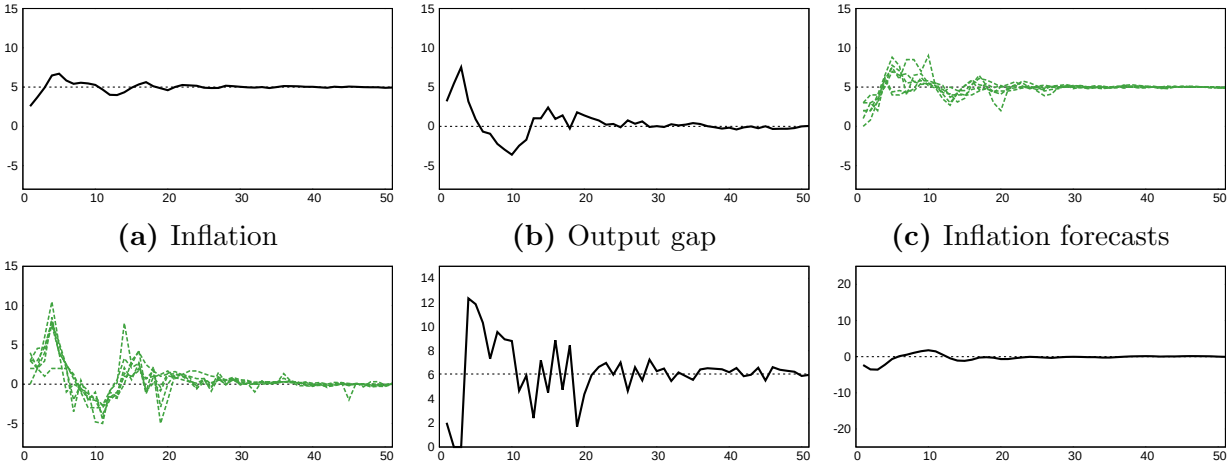
Figure B.2.3: Group number 3 (PLT: Stable with Guidance).



(a) Inflation **(b)** Output gap **(c)** Inflation forecasts

(d) Output gap forecasts **(e)** Interest rate **(f)** Price Deviation

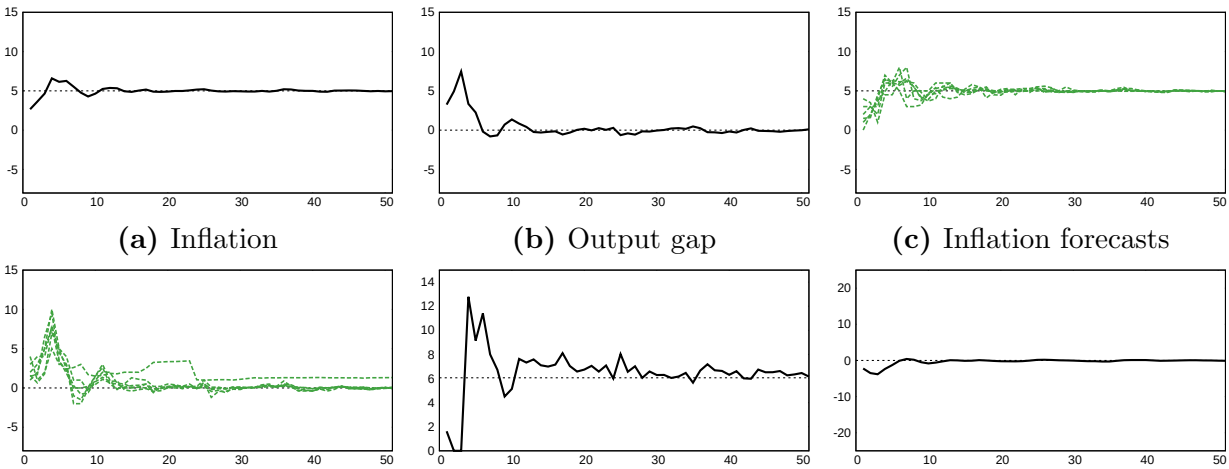
Figure B.2.4: Group number 4 (PLT: Stable with Guidance).



(a) Inflation **(b)** Output gap **(c)** Inflation forecasts

(d) Output gap forecasts **(e)** Interest rate **(f)** Price Deviation

Figure B.2.5: Group number 5 (PLT: Stable with Guidance).

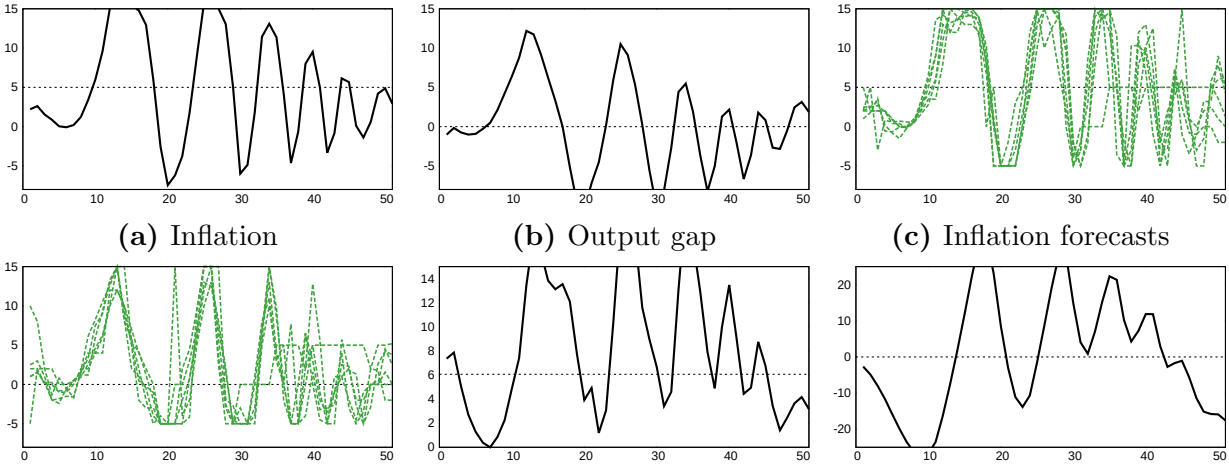


(a) Inflation **(b)** Output gap **(c)** Inflation forecasts

(d) Output gap forecasts **(e)** Interest rate **(f)** Price Deviation

Figure B.2.6: Group number 6 (PLT: Stable with Guidance).

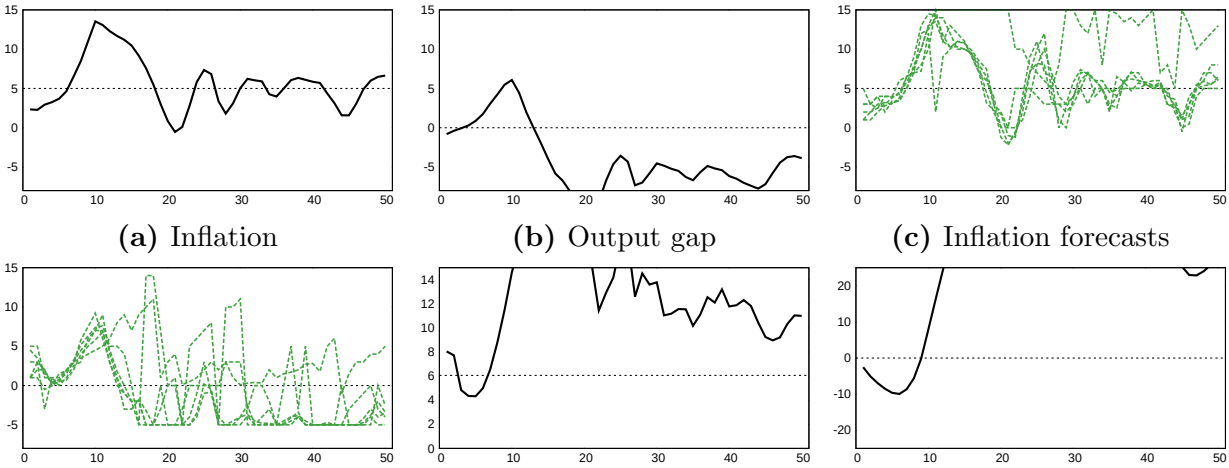
B.3 PLT: Unstable with Guidance



(a) Inflation **(b)** Output gap **(c)** Inflation forecasts

(d) Output gap forecasts **(e)** Interest rate **(f)** Price Deviation

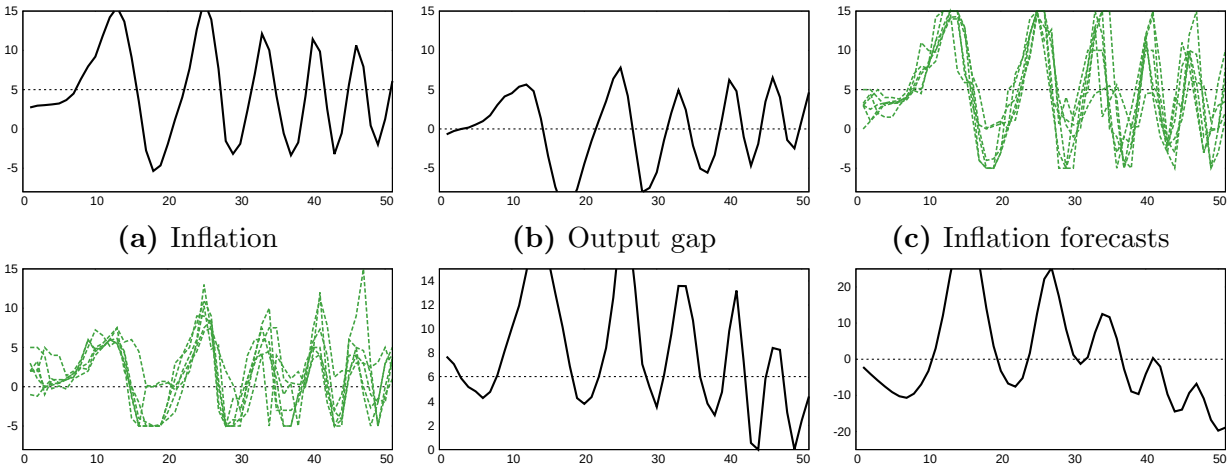
Figure B.3.1: Group number 1 (PLT: Unstable with Guidance).



(a) Inflation **(b)** Output gap **(c)** Inflation forecasts

(d) Output gap forecasts **(e)** Interest rate **(f)** Price Deviation

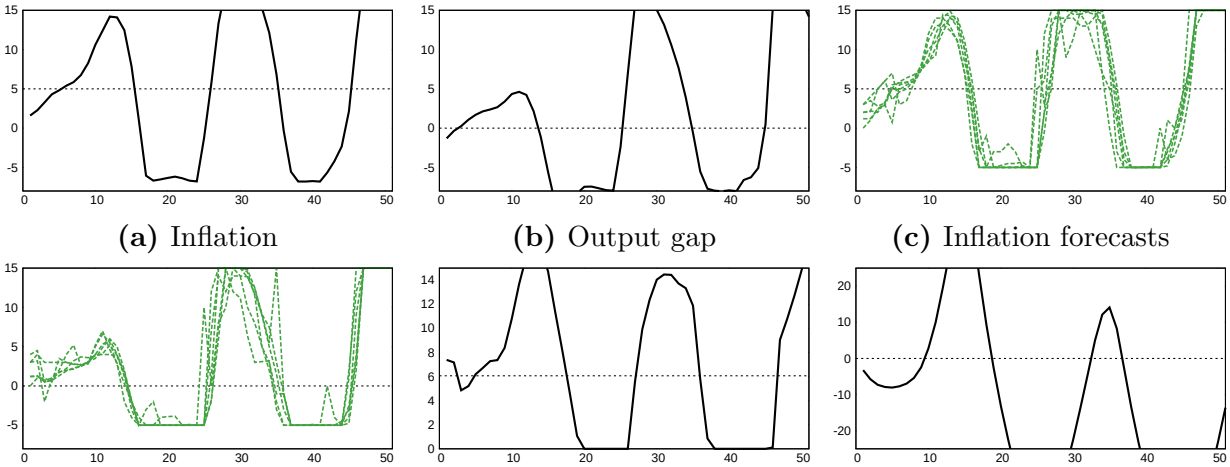
Figure B.3.2: Group number 2 (PLT: Unstable with Guidance).



(a) Inflation **(b)** Output gap **(c)** Inflation forecasts

(d) Output gap forecasts **(e)** Interest rate **(f)** Price Deviation

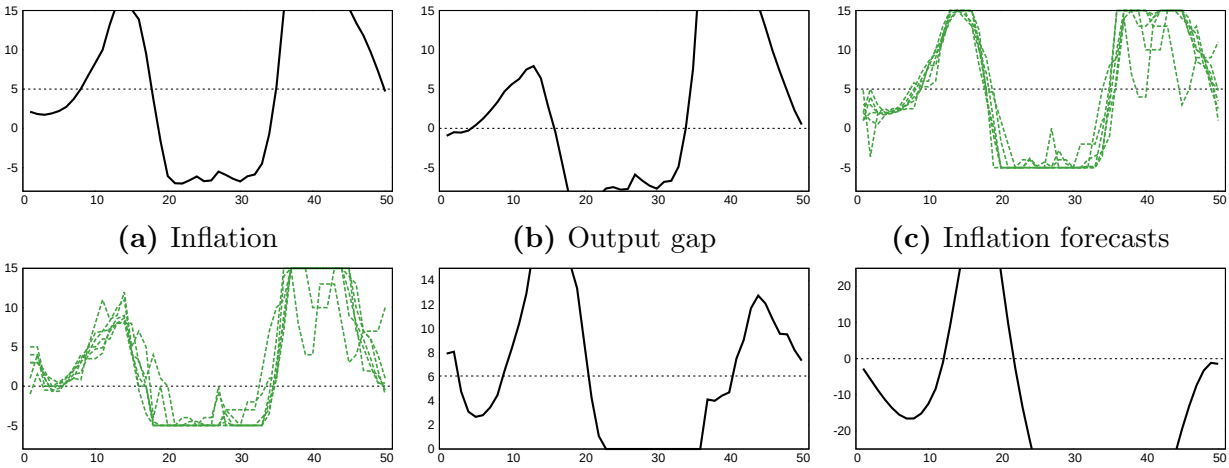
Figure B.3.3: Group number 3 (PLT: Unstable with Guidance).



(a) Inflation **(b)** Output gap **(c)** Inflation forecasts

(d) Output gap forecasts **(e)** Interest rate **(f)** Price Deviation

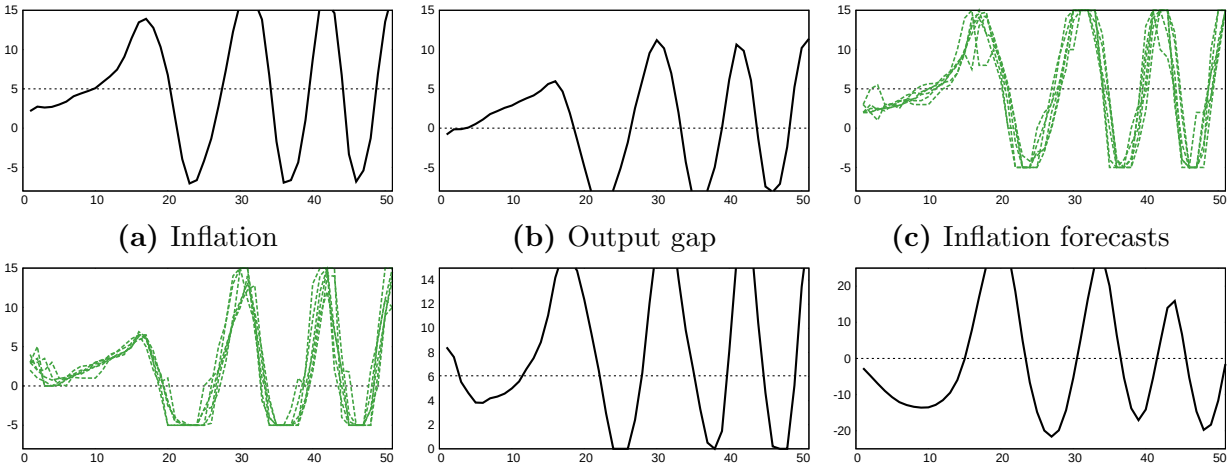
Figure B.3.4: Group number 4 (PLT: Unstable with Guidance).



(a) Inflation **(b)** Output gap **(c)** Inflation forecasts

(d) Output gap forecasts **(e)** Interest rate **(f)** Price Deviation

Figure B.3.5: Group number 5 (PLT: Unstable with Guidance).

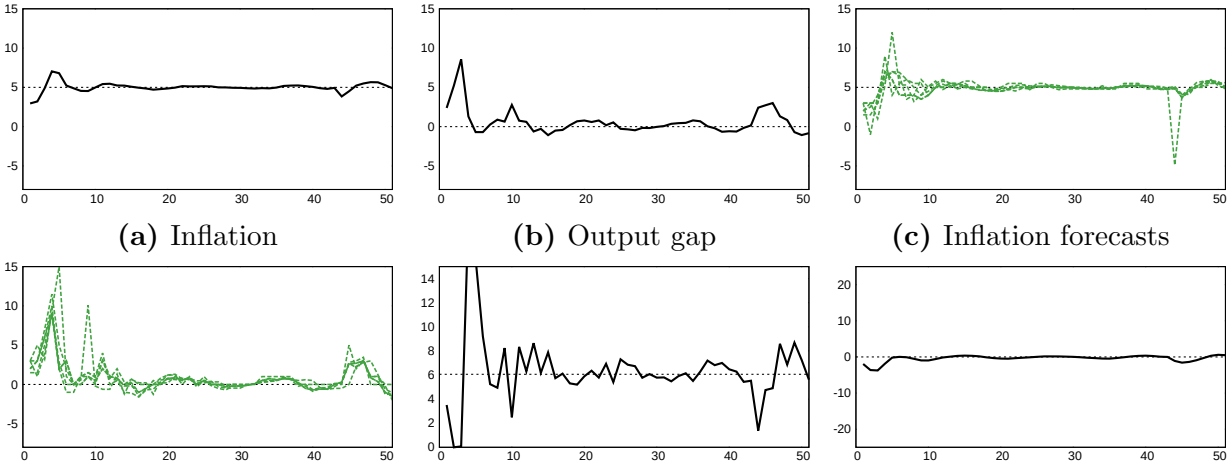


(a) Inflation **(b)** Output gap **(c)** Inflation forecasts

(d) Output gap forecasts **(e)** Interest rate **(f)** Price Deviation

Figure B.3.6: Group number 6 (PLT: Unstable with Guidance).

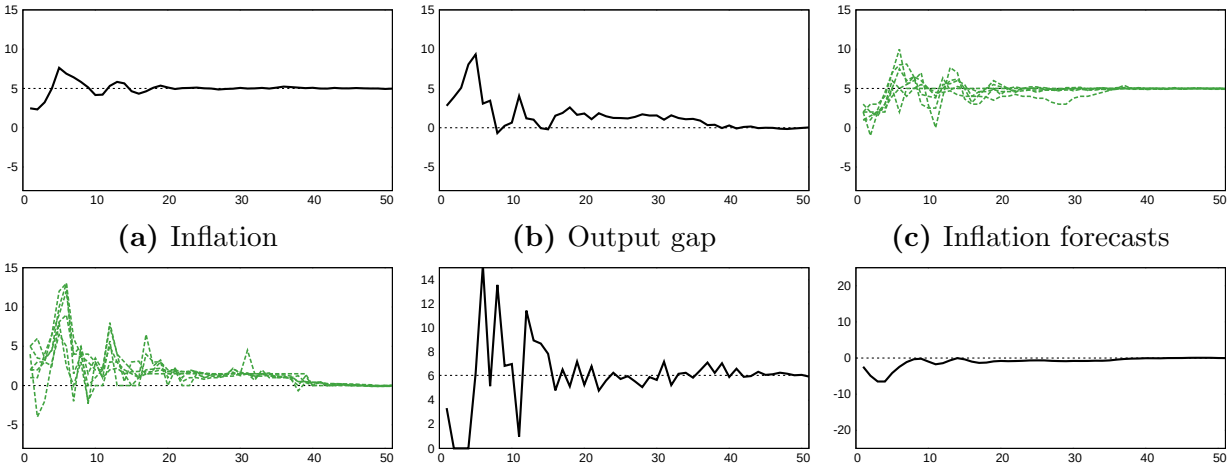
B.4 PLT: Stable with No Guidance



(a) Inflation **(b)** Output gap **(c)** Inflation forecasts

(d) Output gap forecasts **(e)** Interest rate **(f)** Price Deviation

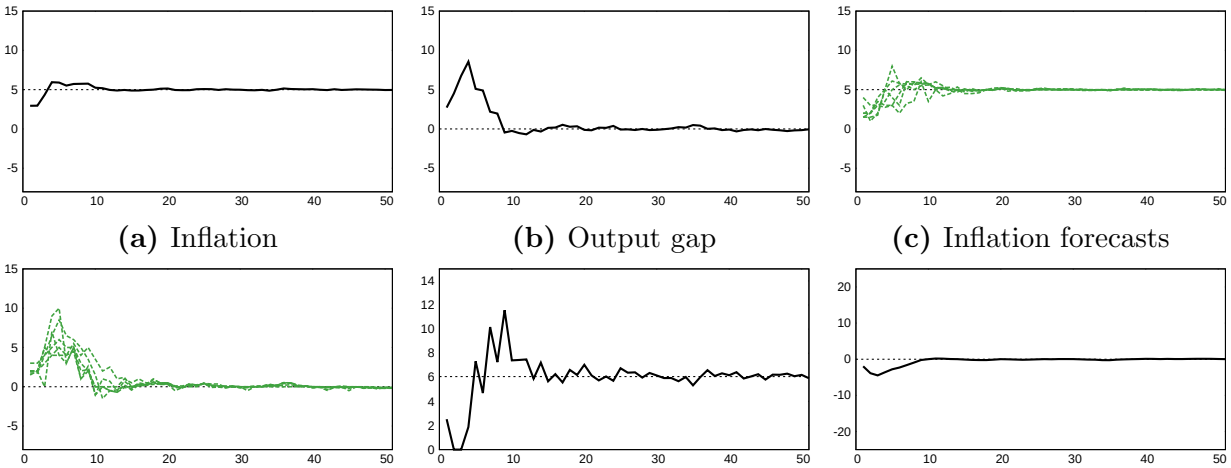
Figure B.4.1: Group number 1 (PLT: Stable with No Guidance).



(a) Inflation **(b)** Output gap **(c)** Inflation forecasts

(d) Output gap forecasts **(e)** Interest rate **(f)** Price Deviation

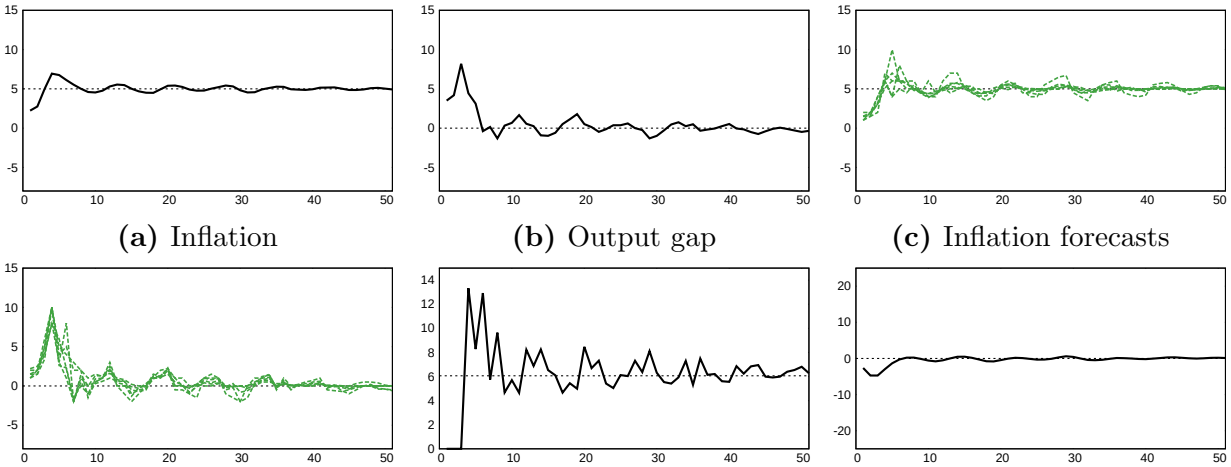
Figure B.4.2: Group number 2 (PLT: Stable with No Guidance).



(a) Inflation **(b)** Output gap **(c)** Inflation forecasts

(d) Output gap forecasts **(e)** Interest rate **(f)** Price Deviation

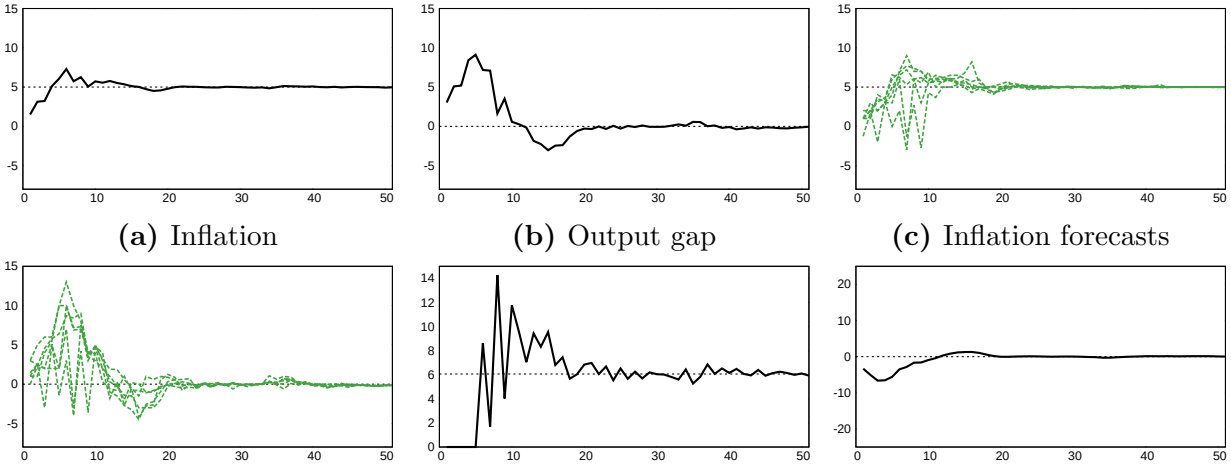
Figure B.4.3: Group number 3 (PLT: Stable with No Guidance).



(a) Inflation **(b)** Output gap **(c)** Inflation forecasts

(d) Output gap forecasts **(e)** Interest rate **(f)** Price Deviation

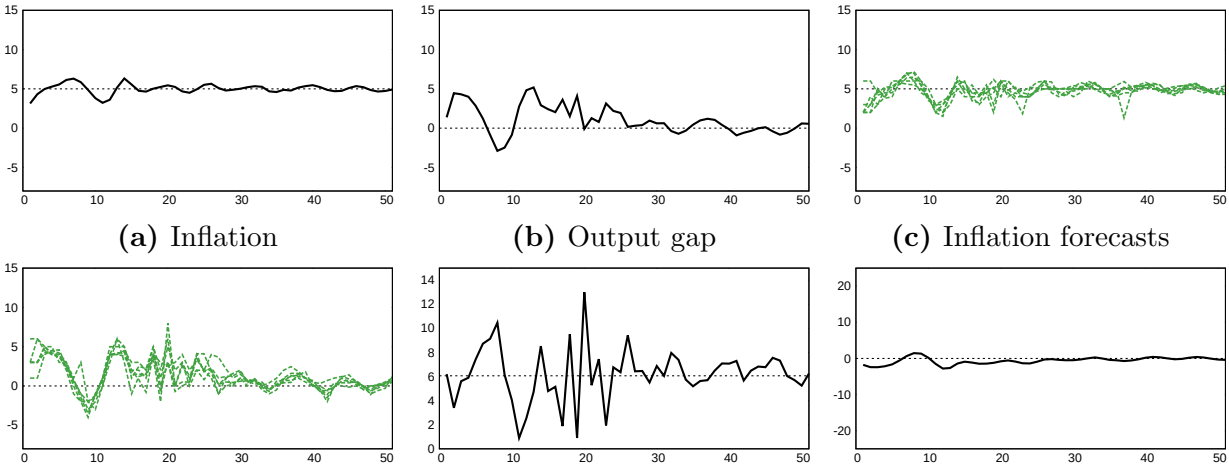
Figure B.4.4: Group number 4 (PLT: Stable with No Guidance).



(a) Inflation **(b)** Output gap **(c)** Inflation forecasts

(d) Output gap forecasts **(e)** Interest rate **(f)** Price Deviation

Figure B.4.5: Group number 5 (PLT: Stable with No Guidance).

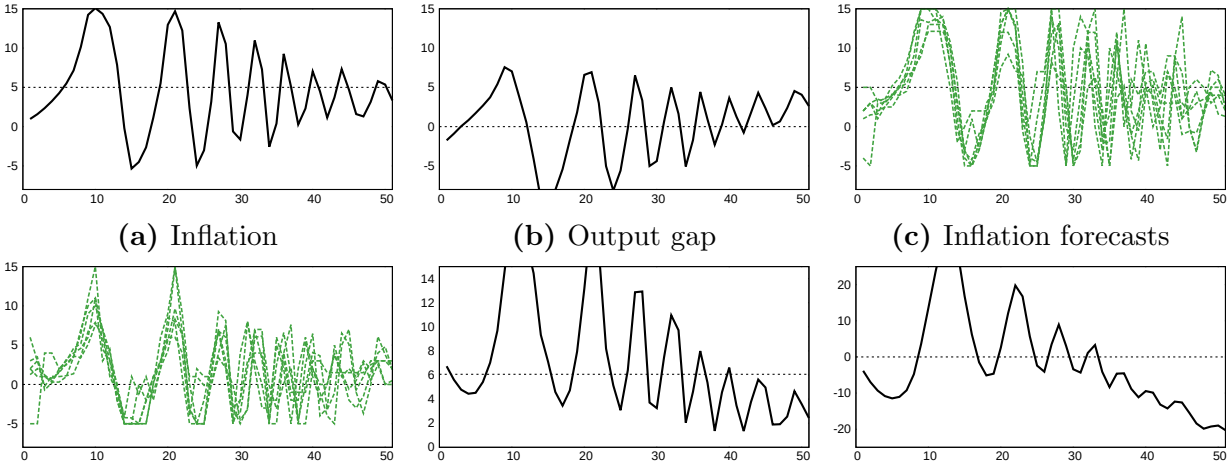


(a) Inflation **(b)** Output gap **(c)** Inflation forecasts

(d) Output gap forecasts **(e)** Interest rate **(f)** Price Deviation

Figure B.4.6: Group number 6 (PLT: Stable with No Guidance).

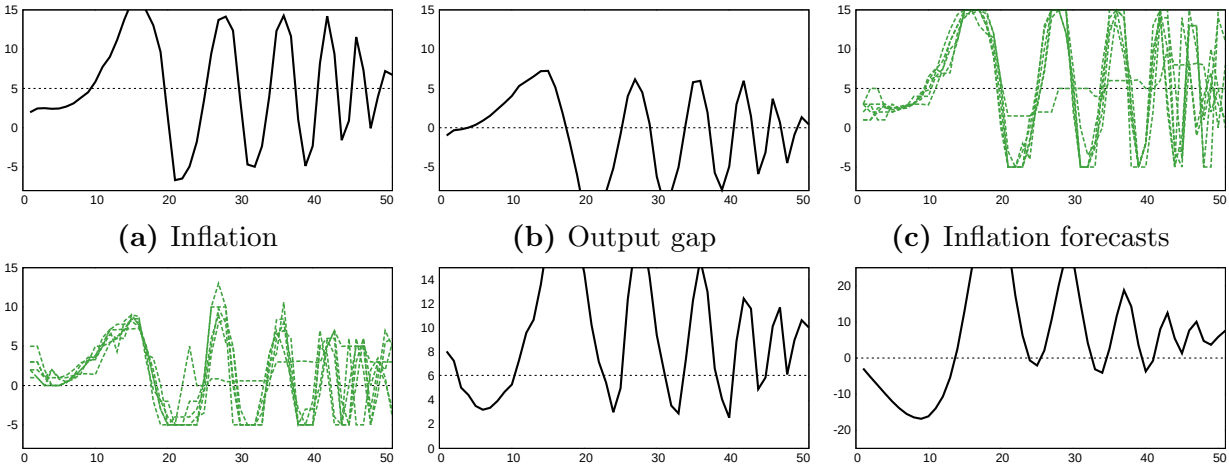
B.5 PLT: Unstable with No Guidance



(a) Inflation **(b)** Output gap **(c)** Inflation forecasts

(d) Output gap forecasts **(e)** Interest rate **(f)** Price Deviation

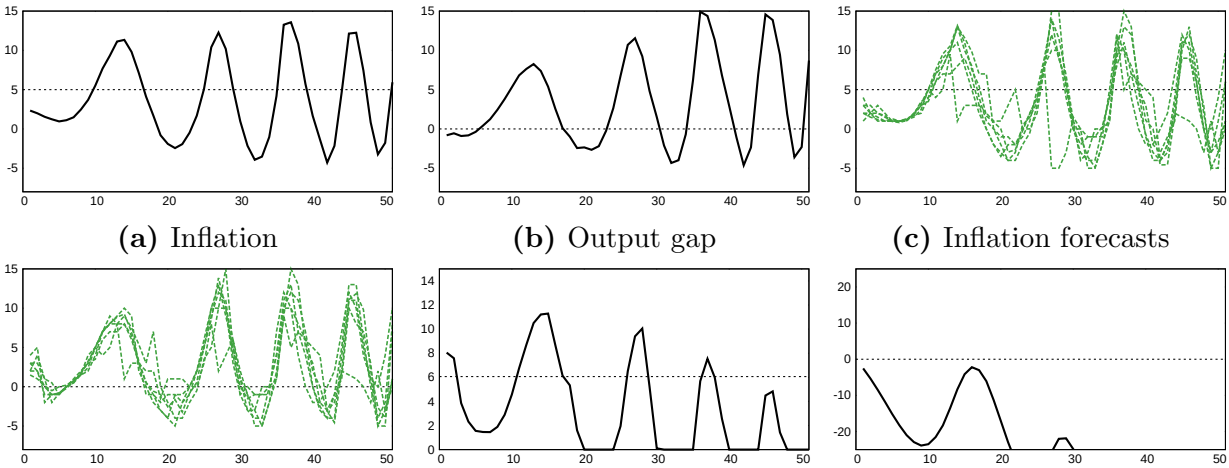
Figure B.5.1: Group number 1 (PLT: Unstable with No Guidance).



(a) Inflation **(b)** Output gap **(c)** Inflation forecasts

(d) Output gap forecasts **(e)** Interest rate **(f)** Price Deviation

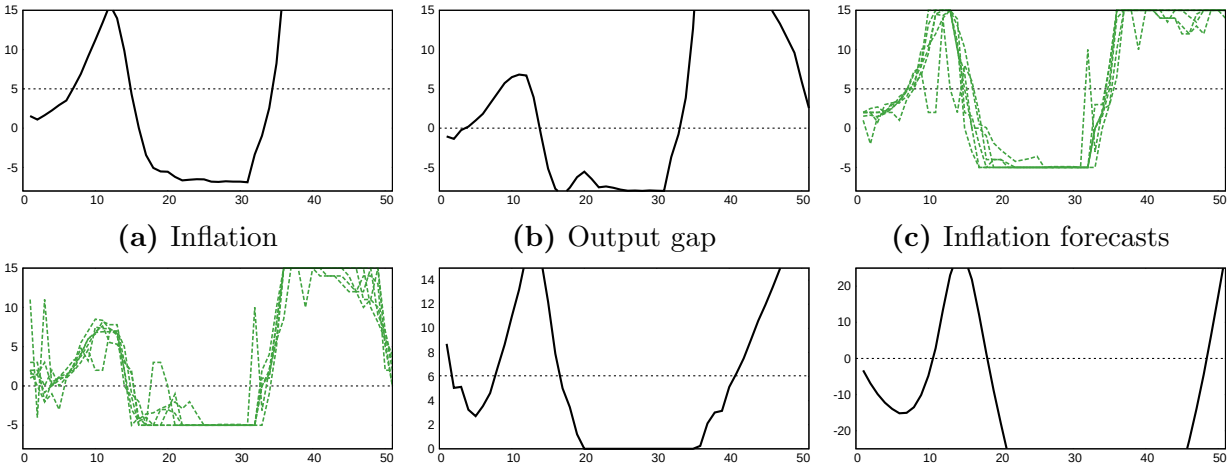
Figure B.5.2: Group number 2 (PLT: Unstable with No Guidance).



(a) Inflation **(b)** Output gap **(c)** Inflation forecasts

(d) Output gap forecasts **(e)** Interest rate **(f)** Price Deviation

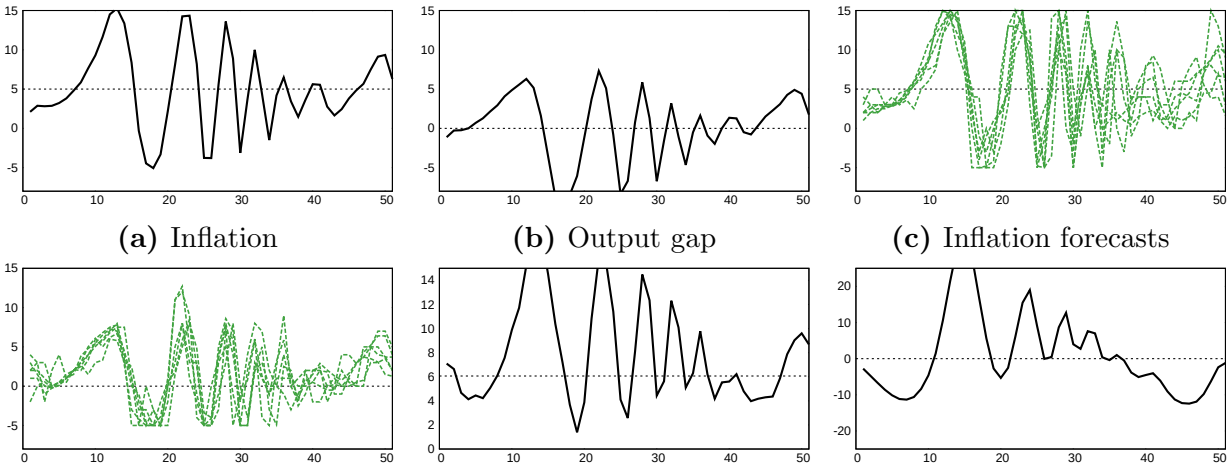
Figure B.5.3: Group number 3 (PLT: Unstable with No Guidance).



(a) Inflation **(b)** Output gap **(c)** Inflation forecasts

(d) Output gap forecasts **(e)** Interest rate **(f)** Price Deviation

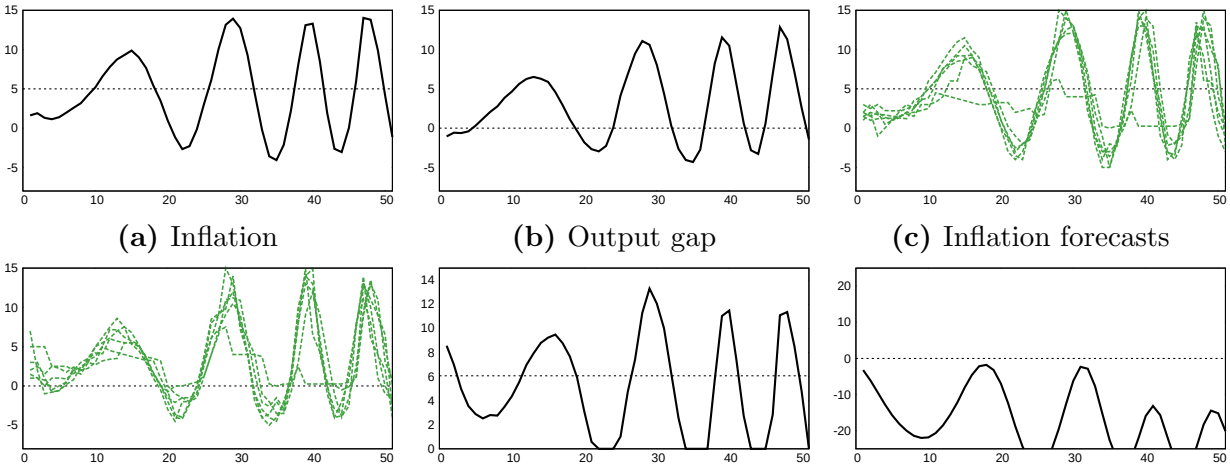
Figure B.5.4: Group number 4 (PLT: Unstable with No Guidance).



(a) Inflation **(b)** Output gap **(c)** Inflation forecasts

(d) Output gap forecasts **(e)** Interest rate **(f)** Price Deviation

Figure B.5.5: Group number 5 (PLT: Unstable with No Guidance).



(a) Inflation **(b)** Output gap **(c)** Inflation forecasts

(d) Output gap forecasts **(e)** Interest rate **(f)** Price Deviation

Figure B.5.6: Group number 6 (PLT: Unstable with No Guidance).

C Estimated individual behavior

For every subject, we independently estimate the two-dimensional forecasting rule (7) with the algorithm discussed below. All the estimations are base on a straightforward two-dimensional ML approach (with BFGS maximization algorithm), while test are performed with LR test on 5% significance level. We wrote the econometrics code in matrix algebra language Ox. The code is available on request.

Variable selection algorithm **Start** with all coefficients in the coefficient pool.

1. Test significance of each individual coefficient, which was not yet thrown out of the coefficient pool. If all are significant, **stop**. Otherwise, go to the next point.

2. Test the joined significance of all coefficients, which were found insignificant in the previous step. If test rejects their joint significance, throw them all out of the pool and repeat the previous point. Otherwise go to the next point.

3. From the coefficients, which were found insignificant in point 1, select exactly one to be thrown out of the pool according to this criterion:

   - If no coefficient was so far thrown out from the pool at point 3; or if the last coefficient that was thrown out of the pool at point 3 was a coefficient from the output gap rule, select a coefficient from the inflation rule;
   - Otherwise, select a coefficient from the output gap rule;
   - For the relevant rule, throw one coefficient out of the pool which was deemed insiginificant in point 1, and which appears as first in the following enumeration (superscripts have been suppressed for the sake of brevity): α_3, β, γ (only if one of the two guidance treatments), δ, α_2, α_1, constant.

   Afterward, go back to point 1.

Remark that at no stage one throws out higher lags of the explained variables, as to make sure that there is no autocorrelation in the data. See also Table 4 for the average coefficients.

C.1 Treatment INF

Subject	Inflation forecasting rule						Output gap forecasting rule					
	c^π	α_1^π	α_2^π	α_3^π	β^π	δ^π	c^v	α_1^v	α_2^v	α_3^v	β^v	δ^v
Group 1												
11		0.553	0.43		0.995		2.41	0.305				−0.403
12		0.292				0.551	1.94	0.28			−0.601	−0.286
13			0.972		1.38				1.01		1.16	
14	0.528	0.874			1.24		1.06	−0.0197	0.693			−0.163
15	0.465	0.888			1.16		1.02	0.241	0.403			−0.159
16			0.994						1.02			
Mean	0.165	0.434	0.399	0	0.796	0.0918	1.07	0.134	0.521	0	0.0932	−0.168
(SD)	(0.235)	(0.368)	(0.44)	(0)	(0.575)	(0.205)	(0.9)	(0.142)	(0.423)	(0)	(0.525)	(0.145)
Group 2												
21	4.44				1.04		−0.958	0.201	0.528		1.23	0.205
22			1.01		1.01		−2.12		1.36		1.08	0.365
23	2.25	0.478			1.37		−0.098	0.264	0.532		1.29	0.0238
24	4.24				1.4		0.777	0.0913	0.00873		1.53	−0.102
25			0.997		0.642				0.964		0.742	
26	−0.898		−0.837			1.59	0.0146	0.00215	1.15		0.783	0.0255
Mean	1.67	0.0797	0.195	0	0.91	0.265	−0.397	0.0931	0.757	0	1.11	0.0863
(SD)	(2.11)	(0.178)	(0.644)	(0)	(0.479)	(0.594)	(0.92)	(0.105)	(0.451)	(0)	(0.278)	(0.154)
Group 3												

Table 5: Estimated individual rules for Treatment 1 (Inflation forecasting).

Subject	c^{π}	α_1^{π}	α_2^{π}	α_3^{π}	β^{π}	δ^{π}	c^{υ}	α_1^{υ}	α_2^{υ}	α_3^{υ}	β^{υ}	δ^{υ}
31			1.01						1.04			
32	0.335	0.929			1.26		1.24	0.182	0.486			−0.219
33			0.976				−0.113		0.99		1.03	
34			1.01				3.37					−0.558
35		0.995			1.18				1.11			
36			1						1.02			
Mean	0.0559	0.321	0.667	0	0.408	0	0.75	0.0304	0.774	0	0.172	−0.13
(SD)	(0.125)	(0.454)	(0.472)	(0)	(0.577)	(0)	(1.26)	(0.068)	(0.402)	(0)	(0.384)	(0.208)
Group 4												
41		1.01							0.95			
42		1.01						0.932				
43		1.01							0.907			
44		1.01						0.947				
45		1						0.977				
46		1.01						0.941				
Mean	0	1.01	0	0	0	0	0	0.633	0.309	0	0	0
(SD)	(0)	(0.00242)	(0)	(0)	(0)	(0)	(0)	(0.448)	(0.438)	(0)	(0)	(0)
Group 5												
51			1.03		1.08		6.29		−1.24	−1.08	0.814	
52			0.94		0.688			0.283	0.612		0.788	
53			0.992		1.63				0.849		2.01	
54			0.974		0.649		1.27		0.526		0.565	−0.159
55	1.59		0.998		1.63	−0.243	3.37	−0.0395	−0.422	−1.21	1.57	0.459

Table 5: Estimated individual rules for Treatment 1 (Inflation forecasting).

Subject	c^π	α_1^π	α_2^π	α_3^π	β^π	δ^π	c^υ	α_1^υ	α_2^υ	α_3^υ	β^υ	δ^υ
56			1		0.607				1.02		0.868	
Mean	0.265	0	0.989	0	1.05	−0.0405	1.82	0.0405	0.223	−0.383	1.1	0.05
(SD)	(0.592)	(0)	(0.0277)	(0)	(0.44)	(0.0905)	(2.33)	(0.109)	(0.798)	(0.543)	(0.511)	(0.192)
Group 6												
61		1.01							1.25			
62			0.997									
63	1.5	0.675			2.11		−1.06	0.417	0.899			0.179
64			0.998									
65	4.64						0.031		0.85			
66	1.37	0.701					−0.0455	0.349	0.9			
Mean	1.25	0.397	0.333	0	0.352	0	−0.178	0.128	0.65	0	0	0.0298
(SD)	(1.64)	(0.411)	(0.47)	(0)	(0.787)	(0)	(0.393)	(0.182)	(0.478)	(0)	(0)	(0.0667)

Table 5: (Cont.) Estimated individual rules for Treatment 1 (Inflation forecasting).

C.2 Treatment StrongNo

	Inflation forecasting rule						Output gap forecasting rule					
Subject	c^π	α_1^π	α_2^π	α_3^π	β^π	δ^π	c^υ	α_1^υ	α_2^υ	α_3^υ	β^υ	δ^υ
Group 1												
11			1.11			−0.0882	2.2		0.735			−0.286
12			1.18			−0.15			0.719			
13			0.992						0.944			

Table 6: Estimated individual rules for Treatment 2 (Stable price level targeting (no guidance)).

Subject	c^{π}	α_1^{π}	α_2^{π}	α_3^{π}	β^{π}	δ^{π}	c^{υ}	α_1^{υ}	α_2^{υ}	α_3^{υ}	β^{υ}	δ^{υ}
14			0.993						0.941			
15	1.03	0.796			1.17		1.58	0.209	0.736			−0.259
16			0.953				−8.72		1.28	0.699	1.02	0.847
Mean	0.171	0.133	0.87	0	0.195	−0.0397	−0.823	0.0349	0.892	0.117	0.17	0.0503
(SD)	(0.382)	(0.296)	(0.397)	(0)	(0.436)	(0.0589)	(3.64)	(0.0781)	(0.197)	(0.261)	(0.38)	(0.377)
Group 2												
21	3.35	0.308			2.5		0.0945	0.215	0.646		0.856	
22	4.96				0.89		7.62	0.136	1.08	−1.63	−0.0981	0.0959
23	6.06				1.03	−0.174	−3.53	−0.129	1.62	−0.84	1.76	1.26
24	2.43	0.818			1.2	−0.237	0.486	0.584	0.479		0.134	−0.0675
25		0.997						0.511	0.489			
26	5						0.452	0.569				
Mean	3.63	0.354	0	0	0.936	−0.0686	0.854	0.314	0.719	−0.411	0.443	0.214
(SD)	(2.01)	(0.41)	(0)	(0)	(0.844)	(0.0987)	(3.33)	(0.263)	(0.513)	(0.624)	(0.67)	(0.468)
Group 3												
31	5							−0.106	1.13			
32	5						0.105		1.05			
33			1									
34	1.72	0.171	0.473				3.49	0.812	0.0597			−0.562
35			0.999									
36	5.01						0.0569	0.541	0.234			
Mean	2.79	0.0285	0.412	0	0	0	0.608	0.208	0.413	0	0	−0.0937
(SD)	(2.29)	(0.0638)	(0.448)	(0)	(0)	(0)	(1.29)	(0.343)	(0.486)	(0)	(0)	(0.21)

Table 6: Estimated individual rules for Treatment 2 (Stable price level targeting (no guidance)).

Subject	c^{π}	α_1^{π}	α_2^{π}	α_3^{π}	β^{π}	δ^{π}	c^{υ}	α_1^{υ}	α_2^{υ}	α_3^{υ}	β^{υ}	δ^{υ}
						Group 4						
41	2.16		0.565				2.25	0.223	0.534			−0.333
42			0.992						1.19			
43			1.01				0.411		0.66			
44	3.38	0.32			1.3		2.39	0.437	0.24			−0.343
45	3.11	0.383			2.72		4.44	0.37	0.307			−0.702
46	2.83	0.431					0.136	−0.0313	0.72			
Mean	1.91	0.189	0.428	0	0.671	0	1.61	0.167	0.608	0	0	−0.23
(SD)	(1.4)	(0.192)	(0.452)	(0)	(1.03)	(0)	(1.59)	(0.188)	(0.311)	(0)	(0)	(0.26)
						Group 5						
51	1.48	0.347				0.293	−0.547	0.259	0.308			0.0807
52		0.63	0.382						0.267			
53	2.11	0.579			1.34		−0.104	−0.231	1.28			0.0364
54			1.01					0.357	0.71			
55			1.25		−1.21	−0.206	9.42		1.64	−2.52		0.53
56		−0.462	1.47					0.589				
Mean	0.599	0.182	0.685	0	0.021	0.0144	1.46	0.162	0.702	−0.419	0	0.108
(SD)	(0.867)	(0.38)	(0.587)	(0)	(0.736)	(0.145)	(3.57)	(0.27)	(0.585)	(0.937)	(0)	(0.191)
						Group 6						
61	3.27	0.318			1.38		−3.24	0.0223	0.55	0.255	1.14	0.427
62	2.23	0.344			0.698	0.155	3	0.271	0.348		−0.0979	−0.435
63	1.8	0.612			0.908		−1.8	0.394	0.592		0.593	0.355
64			1.16		0.372	−0.176		0.398	0.401	0.253	0.662	−0.136

Table 6: Estimated individual rules for Treatment 2 (Stable price level targeting (no guidance)).

Subject	c^π	α_1^π	α_2^π	α_3^π	β^π	δ^π	c^υ	α_1^υ	α_2^υ	α_3^υ	β^υ	δ^υ
65			0.964						0.971		0.151	
66		0.359	0.923			−0.239	2.61		0.657			−0.386
Mean	1.22	0.272	0.507	0	0.559	−0.0433	0.0955	0.181	0.586	0.0847	0.408	−0.0291
(SD)	(1.29)	(0.215)	(0.513)	(0)	(0.495)	(0.13)	(2.22)	(0.179)	(0.202)	(0.12)	(0.432)	(0.332)

Table 6: (Cont.) Estimated individual rules for Treatment 2 (Stable price level targeting (no guidance)).

C.3 Treatment WeakNo

	Inflation forecasting rule						Output gap forecasting rule					
Subject	c^π	α_1^π	α_2^π	α_3^π	β^π	δ^π	c^υ	α_1^υ	α_2^υ	α_3^υ	β^υ	δ^υ
Group 1												
11			0.361		0.855	0.427	−0.958	−0.109	0.993	−0.585	0.683	0.614
12			0.284		0.445	0.256		−0.0777	0.748	−0.647	0.359	0.591
13	2.37			0.315	0.648	0.262	1.93	0.25	0.394	−0.183	0.515	−0.0118
14			−0.695	0.747	0.5	0.907		−0.255	0.898	−0.715	0.647	0.585
15	5.75		−2	1.76		1.14	3.08	−0.103	1.38	−1.43	−0.0866	0.634
16	4.95	0.181	−0.247	0.471			3.11	0.0278	0.414	−0.186	0.0468	−0.203
Mean	2.18	0.0301	−0.383	0.549	0.408	0.498	1.19	−0.0446	0.804	−0.624	0.361	0.368
(SD)	(2.41)	(0.0674)	(0.805)	(0.602)	(0.316)	(0.396)	(1.59)	(0.155)	(0.341)	(0.417)	(0.291)	(0.341)
Group 2												
21	2.14	−0.295	0.172	0.855		0.513	1.53	−0.355	1.65	−0.927	0.204	0.66
22	4.81	−0.372		0.859	0.65	0.437	3.37	0.292	0.544	−0.264	0.461	−0.0281

Table 7: Estimated individual rules for Treatment 3 (Unstable price level targeting (no guidance)).

Subject	c^{π}	α_1^{π}	α_2^{π}	α_3^{π}	β^{π}	δ^{π}	c^{υ}	α_1^{υ}	α_2^{υ}	α_3^{υ}	β^{υ}	δ^{υ}
23	2.24			0.645	0.348	0.623	2.01	0.0601	1.3	−0.825	0.289	0.466
24	4.69	0.544	−1.26	1.4		0.612	2.11	−0.0336	1.96	−1.95	−0.00253	1.17
25	2.16	0.694		0.226			3.57	0.627	0.291	−0.0239	−0.0589	−0.224
26	2.67	−0.368		0.615	1.09	0.611	2.43	−0.231	1.24	−0.62	0.675	0.368
Mean	3.12	0.0339	−0.181	0.767	0.348	0.466	2.5	0.06	1.16	−0.769	0.261	0.402
(SD)	(1.17)	(0.434)	(0.485)	(0.354)	(0.41)	(0.219)	(0.737)	(0.327)	(0.584)	(0.614)	(0.254)	(0.455)
Group 3												
31	2.12	0.532			0.564		2.1	0.604	0.2	−0.276	0.503	−0.0353
32	0.592	−0.4	1.03		0.56	0.251	−0.314	−0.374	1.57	−0.911	0.483	0.779
33	1.15	0.165	0.18		0.776	0.241	1.21	0.169	0.18	0.0631	0.856	0.182
34	0.745	0.473					0.103	0.341	0.618	−0.716	0.0799	0.486
35	1.32	0.586			0.728		1.12	0.361	0.53	−0.459	0.712	0.218
36		−0.179	0.687		0.683	0.559	−0.474		0.698	−0.396	0.553	0.78
Mean	0.987	0.196	0.316	0	0.552	0.175	0.623	0.184	0.633	−0.449	0.531	0.402
(SD)	(0.658)	(0.374)	(0.401)	(0)	(0.259)	(0.204)	(0.923)	(0.31)	(0.464)	(0.311)	(0.24)	(0.307)
Group 4												
41		0.32	0.47		0.587	0.118	−1.27	0.214	1.14	−0.953	0.367	0.761
42	0.66		0.589		0.268	0.258	−0.542	0.0292	1.46	−1.34	0.109	0.971
43		0.223	0.607				−0.419	0.334	0.801	−0.586	0.272	0.508
44			0.724		0.747	0.163	−1.3	−0.376	1.55	−1.05	0.418	1.02
45		0.26	0.522		0.748	0.142	0.57	0.793	0.134		0.317	−0.101
46		0.511	0.361		0.782			0.3	0.435		0.399	0.0399
Mean	0.11	0.219	0.546	0	0.522	0.114	−0.493	0.216	0.922	−0.655	0.314	0.534

Table 7: Estimated individual rules for Treatment 3 (Unstable price level targeting (no guidance)).

Subject	c^{π}	α_1^{π}	α_2^{π}	α_3^{π}	β^{π}	δ^{π}	c^{υ}	α_1^{υ}	α_2^{υ}	α_3^{υ}	β^{υ}	δ^{υ}
(SD)	(0.246)	(0.179)	(0.114)	(0)	(0.292)	(0.0912)	(0.662)	(0.351)	(0.518)	(0.513)	(0.104)	(0.434)
						Group 5						
51	5.5	0.352	−1.82	1.61	0.476	0.85	2.3	0.268	0.779	−0.578	0.6	0.159
52			−0.584	0.522	0.524	0.79		−0.141	0.371		0.417	0.088
53	6.69	−0.301	0.887		0.575	−0.459	4.45	−0.128	0.513	−0.0205	0.737	−0.247
54	3.58	0.229	−1.81	1.73	0.253	1.23	2.39	0.31	0.607	−0.531	0.37	0.198
55	1.31		0.759		0.347		0.605	0.0133	0.765	−0.137	0.3	0.177
56	4.55	0.251			0.45		2.78	−0.0786	0.595	−0.321	0.312	0.098
Mean	3.6	0.0884	−0.428	0.645	0.437	0.401	2.09	0.0405	0.605	−0.265	0.456	0.0789
(SD)	(2.32)	(0.217)	(1.1)	(0.752)	(0.108)	(0.591)	(1.46)	(0.183)	(0.141)	(0.23)	(0.16)	(0.151)
						Group 6						
61	1.76	0.586			0.892		1.53	0.278	0.519	−0.0833	0.854	−0.135
62	0.58		0.802		0.414		−0.00439	0.0818	0.624		0.486	0.18
63	1.54		0.575		0.905		0.949	−0.224	1.19	−0.543	1.08	0.338
64	1.34		0.741		0.738		1.75	−0.086	1.15	−0.225	0.541	−0.0832
65	0.811	0.731			0.31		1.14	0.659	0.218		0.228	−0.184
66	1.66		0.543		1.01		1.4	0.201	0.383	0.215	0.977	−0.266
Mean	1.28	0.219	0.443	0	0.711	0	1.13	0.152	0.68	−0.106	0.694	−0.0252
(SD)	(0.44)	(0.313)	(0.326)	(0)	(0.261)	(0)	(0.568)	(0.282)	(0.367)	(0.235)	(0.299)	(0.213)

Table 7: (Cont.) Estimated individual rules for Treatment 3 (Unstable price level targeting (no guidance)).

C.4 Treatment StrongGuid

	Inflation forecasting rule							Output gap forecasting rule						
Subject	c^{π}	α_1^{π}	α_2^{π}	α_3^{π}	β^{π}	δ^{π}	γ^{π}	c^{υ}	α_1^{υ}	α_2^{υ}	α_3^{υ}	β^{υ}	δ^{υ}	γ^{υ}
Group 1														
11	−1.61		1.3				−0.44	4.53	0.5	−1.36		−0.618	−0.704	−2.63
12	0.973		0.798					−1.17	0.399	0.236		1.26	0.247	
13	4.93				0.936			8.71	0.119	0.933	−1.77	−0.179	0.032	0.497
14	−4.14		1.76				−1	5.23	0.475	−1.65		−0.365	−0.84	−2.89
15			0.977					2.26		−0.728			−0.377	−2.17
16		0.626	0.355				−0.365		−0.268					−2.06
Mean	0.0255	0.104	0.865	0	0.156	0	−0.301	3.26	0.204	−0.428	−0.294	0.0158	−0.274	−1.54
(SD)	(2.74)	(0.233)	(0.58)	(0)	(0.349)	(0)	(0.361)	(3.33)	(0.28)	(0.906)	(0.658)	(0.595)	(0.399)	(1.3)
Group 2														
21	2.07	0.507					−0.632	2.41	0.329	−0.665		0.041	−0.268	−1.4
22	4.28							0.609	0.577					
23		0.917					−0.684		0.901					
24			0.876				−0.574		0.467	0.276		0.61	0.0544	
25		0.314	0.663		0.874			−0.765		0.265			0.126	−1.61
26		0.833					−1.24		0.626					−0.821
Mean	1.06	0.429	0.257	0	0.146	0	−0.521	0.376	0.483	−0.0207	0	0.109	−0.0147	−0.638
(SD)	(1.63)	(0.363)	(0.368)	(0)	(0.326)	(0)	(0.427)	(0.994)	(0.277)	(0.312)	(0)	(0.225)	(0.122)	(0.68)
Group 3														
31			1.01					0.568	0.229	0.48			−0.0745	0.379
32	6.89	−0.213			1.08	−0.138	−0.986	1.35	−0.105	1.12		−0.446	−0.18	1.25
33	6.83				1.28	−0.29		−12.4	−0.293	2.39	1.41	1.05	0.909	0.387
34	2.63	0.499						0.0161	0.491	0.477				
35		0.995			0.573			−2.51		1.12			0.426	

Table 8: Estimated individual rules for Treatment 4 (Stable price level targeting with guidance).

Subject	c^{π}	α_1^{π}	α_2^{π}	α_3^{π}	β^{π}	δ^{π}	γ^{π}	c^{υ}	α_1^{υ}	α_2^{υ}	α_3^{υ}	β^{υ}	δ^{υ}	γ^{υ}
36[!]	4.95				1.08				0.0954	−0.769		1.36	0.00826	−2.78
Mean	3.55	0.214	0.168	0	0.669	−0.0715	−0.164	−2.16	0.0695	0.802	0.235	0.328	0.181	−0.126
(SD)	(2.88)	(0.411)	(0.375)	(0)	(0.519)	(0.11)	(0.367)	(4.71)	(0.249)	(0.947)	(0.526)	(0.648)	(0.376)	(1.26)
Group 4														
41		0.241	0.644		0.767	0.0835				0.551				−1.2
42	2.88	0.358			1.43			9.54		3.84	−3.13	0.886	1.07	5.35
43[*]		0.477				0.358	−0.332		−0.271	−2.25	1.57		−1.1	−5.12
44	−5		3.13	−3.48	0.603	−0.904	−5.99	13	0.244	5.35	−4.19	0.628	1.44	8.94
45	4.08				1.18	0.137		2.77	0.429	−0.546	0.426	−0.0214	−0.677	−1.27
46	1.43	−0.381	0.977		0.47	0.0886		3.88	0.0909	1.73	−0.796	0.507	0.0931	2.01
Mean	0.565	0.116	0.792	−0.58	0.74	−0.0395	−1.05	4.86	0.082	1.45	−1.02	0.333	0.138	1.45
(SD)	(2.89)	(0.282)	(1.11)	(1.3)	(0.466)	(0.402)	(2.21)	(4.83)	(0.218)	(2.56)	(2.01)	(0.358)	(0.893)	(4.64)
Group 5														
51		0.629	0.365							0.828				
52			0.976							0.844				
53	4.94				1.5			−0.802	0.251	−0.923	0.592	1.63	−0.355	−2.83
54			1.01							0.828		0.25		
55[!]	3.66					0.195			−0.267	1.91	−1.07	0.534	0.855	0.961
56	1.27	0.303	0.429				−0.479	0.293	0.212	−0.0945		0.665		−1.12
Mean	1.64	0.155	0.464	0	0.251	0.0325	−0.0798	−0.0849	0.0325	0.565	−0.0797	0.514	0.0834	−0.498
(SD)	(1.97)	(0.239)	(0.409)	(0)	(0.561)	(0.0727)	(0.178)	(0.338)	(0.17)	(0.882)	(0.493)	(0.559)	(0.369)	(1.2)
Group 6														
61	5							0.0388	0.0711	0.692				
62			0.996							1				
63			0.994						0.969					
64		0.986					−0.815	0.147	0.402	0.755				

Table 8: Estimated individual rules for Treatment 4 (Stable price level targeting with guidance).

Subject	c^π	α_1^π	α_2^π	α_3^π	β^π	δ^π	γ^π	c^υ	α_1^υ	α_2^υ	α_3^υ	β^υ	δ^υ	γ^υ
65			0.989				−0.65	1.9	0.35	0.406			−0.277	
66	5.12	0.547			−0.998	−0.427		2.48	0.379	−0.648		−0.00864	−0.37	−1.82
Mean	1.69	0.256	0.496	0	−0.166	−0.0712	−0.244	0.762	0.362	0.368	0	−0.00144	−0.108	−0.304
(SD)	(2.39)	(0.383)	(0.496)	(0)	(0.372)	(0.159)	(0.349)	(1.03)	(0.313)	(0.552)	(0)	(0.00322)	(0.155)	(0.68)

Table 8: (Cont.) Estimated individual rules for Treatment 4 (Stable price level targeting with guidance).

C.5 Treatment WeakGuid

	Inflation forecasting rule							Output gap forecasting rule						
Subject	c^π	α_1^π	α_2^π	α_3^π	β^π	δ^π	γ^π	c^υ	α_1^υ	α_2^υ	α_3^υ	β^υ	δ^υ	γ^υ
Group 1														
11*		0.487	0.457			0.589	−0.0781	−5.73				0.554	0.937	−0.258
12*!		0.491	0.384	−0.308	0.258	0.39	−0.203		0.405			0.493	0.214	−0.158
13*!		−0.478	1.31	−0.28	0.592	0.181				0.517		1.02	0.232	
14!	13.7	0.258	−1.95	3.09	0.456		0.674		−0.000506	1.19	−0.81	0.56	0.716	0.000803
15!		−0.186	0.698		0.313	0.196	−0.0579		−0.213	0.937	−0.565	0.549	0.535	
16		0.501	0.189		−0.109	0.266	−0.19	−0.852	0.444	−0.156			0.404	−0.234
Mean	2.28	0.179	0.182	0.417	0.252	0.27	0.0243	−1.1	0.106	0.415	−0.229	0.529	0.506	−0.108
(SD)	(5.11)	(0.38)	(1.02)	(1.2)	(0.243)	(0.184)	(0.299)	(2.09)	(0.238)	(0.509)	(0.332)	(0.295)	(0.259)	(0.113)
Group 2														
21*!		0.106	0.906	−0.2	1.15	−0.0797			0.448	0.432	−0.157	0.356	0.0823	
22	2.56	0.639	0.205				−0.0583	−11.1	0.102	−2.21	1.31	−0.144	1.19	−0.75
23*!		−0.368	1.59		0.758	−0.696	0.337		0.462	2.28	−1.09			0.486
24	1.3		0.765		1.07			7.72	0.374	2.21	−1.28	0.441	−0.364	0.402

Table 9: Estimated individual rules for Treatment 5 (Unstable price level targeting with guidance).

Subject	c^π	α_1^π	α_2^π	α_3^π	β^π	δ^π	γ^π	c^υ	α_1^υ	α_2^υ	α_3^υ	β^υ	δ^υ	γ^υ
25$^!$	1.65		0.919		0.461		−0.0334		0.183	−0.329	−0.526	−0.0641	1.2	−0.474
26*		0.544	0.876	−1.28	−0.794	0.551	−0.401	2.83	0.373	0.801			−0.403	0.264
Mean	0.917	0.154	0.877	−0.246	0.441	−0.0374	−0.026	−0.089	0.323	0.53	−0.291	0.0982	0.285	−0.0121
(SD)	(0.99)	(0.344)	(0.402)	(0.466)	(0.673)	(0.362)	(0.214)	(5.63)	(0.135)	(1.54)	(0.852)	(0.219)	(0.668)	(0.457)
Group 3														
31$^{*!}$			1.45	−0.969	1.08	−0.276	−0.0893				0.67	0.961	−0.193	−0.0591
32		−0.197	0.497		0.644	0.546		−14	−0.179	−2.83	2.3	0.524	0.835	−0.586
33$^!$	7.48	0.484	0.721		0.564	−0.872	0.114		0.09	−0.981	1.05	0.96	−0.474	−0.137
34$^{*!}$		0.324			0.362	0.447	−0.0799		0.166	0.71	−0.743	0.347	0.66	−0.0511
35	0.863	0.514	0.254		0.398			3.94	0.525	0.499		0.353	−0.435	0.102
36	−13.9	0.29	3.92	−4.69	0.723		−0.862	−1.51	0.491	−1.52	1.56	0.647	−0.595	−0.198
Mean	−0.929	0.236	1.14	−0.944	0.628	−0.0257	−0.153	−1.92	0.182	−0.687	0.805	0.632	−0.0338	−0.155
(SD)	(6.39)	(0.256)	(1.32)	(1.71)	(0.238)	(0.471)	(0.324)	(5.63)	(0.254)	(1.24)	(0.993)	(0.254)	(0.567)	(0.214)
Group 4														
41	−1.26		0.522		0.299	0.478	−0.0491	−2.24	−0.119	1.32	−1.07	0.217	1.12	−0.0599
42			0.671		0.556	0.223		−0.488		1.15	−0.727	0.37	0.663	
43		0.647	0.192		0.462		−0.0378	−1.4	0.451		0.331	0.411		−0.0669
44	−2.3	0.577			0.659	0.417	−0.0788	−0.286	0.64	−0.3	0.632	0.266	−0.378	−0.0637
45	1.07		0.76		0.412			1.15	−0.184	1.13	−0.346		0.275	0.011
46	0.675		0.784		0.64				−0.301	1.47	−0.819	0.482	0.636	
Mean	−0.303	0.204	0.488	0	0.505	0.186	−0.0276	−0.542	0.0812	0.797	−0.333	0.291	0.386	−0.0299
(SD)	(1.15)	(0.289)	(0.295)	(0)	(0.127)	(0.202)	(0.0302)	(1.07)	(0.344)	(0.685)	(0.62)	(0.157)	(0.487)	(0.0338)
Group 5														
51	−0.679	0.275		0.391	0.598	0.437		−0.81	0.118	1.22	−0.885	0.3	0.71	
52	−1.35		0.728		0.706	0.222	−0.0283	−1.85	−0.164	1.55	−1.11	0.233	0.91	−0.00805
53			0.589		0.469	0.315	−0.0107	−1.61		0.73	−0.358	0.288	0.651	−0.0293

Table 9: Estimated individual rules for Treatment 5 (Unstable price level targeting with guidance).

Subject	c^π	α_1^π	α_2^π	α_3^π	β^π	δ^π	γ^π	c^υ	α_1^υ	α_2^υ	α_3^υ	β^υ	δ^υ	γ^υ
54	1.07	0.241	1.25	−0.653	0.69	−0.424		0.956	0.182	−0.796	1.46	0.463	−0.658	−0.0348
55		−0.285	1.01		0.326	0.156				0.651		0.312	0.102	
56		0.263	0.531		0.676	0.0858	−0.0126	−0.51		1.16	−0.732	0.53	0.574	
Mean	−0.16	0.0822	0.684	−0.0437	0.577	0.132	−0.0086	−0.638	0.0227	0.753	−0.27	0.354	0.382	−0.012
(SD)	(0.738)	(0.202)	(0.393)	(0.307)	(0.138)	(0.273)	(0.0102)	(0.951)	(0.109)	(0.756)	(0.853)	(0.105)	(0.525)	(0.0145)
Group 6														
61	1.55		0.517		0.862	0.151	−0.0771	4.23	−0.0461	1.44	−0.696	1.05	0.173	0.0849
62			0.213		0.804	0.524	−0.0684	5.36		1.61	−0.873	0.742		0.202
63	1.32		0.639		0.651			−6.28	0.0755	−0.745	0.777	0.877	0.563	−0.3
64	2.3	0.287	0.327		0.826		−0.0372	6.91	0.744	0.436	0.181	0.656	−0.895	0.149
65	4.96			0.878	0.552		0.2	7.15	−0.222	2.52	−1.42	0.26	0.132	0.272
66	1.19		0.834		0.351			−3.17	−0.255	0.708	−0.322	0.388	0.85	−0.141
Mean	1.89	0.0478	0.422	0.146	0.674	0.112	0.00291	2.37	0.0494	0.994	−0.392	0.661	0.137	0.0442
(SD)	(1.53)	(0.107)	(0.276)	(0.327)	(0.18)	(0.192)	(0.0931)	(5.18)	(0.332)	(1.03)	(0.717)	(0.27)	(0.544)	(0.201)

Table 9: (Cont.) Estimated individual rules for Treatment 5 (Unstable price level targeting with guidance).