# Fiscal targets. A guide to forecasters? [§]

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## Abstract

Should rational agents take into consideration government policy announcements? A skilled agent (an econometrician) could set up a model to combine the following two pieces of information in order to anticipate the future course of fiscal policy in real-time: (i) the ex-ante path of policy as published/announced by the government; (ii) incoming, observed data on the actual degree of implementation of ongoing plans. We formulate and estimate empirical models for a number of EU countries (Germany, France, Italy, and Spain) to show that government (consumption) targets convey useful information about ex-post policy developments when policy changes significantly (even if past credibility is low) and when there is limited information about the implementation of plans (e.g. at the beginning of a fiscal year). In addition, our models are instrumental to unveil the current course of policy in real-time. Our approach complements a well-established branch of the literature that finds politically-motivated biases in policy targets.

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## 1. Introduction

Some recent literature convincingly argues that uncertainty about government policies has been detrimental to economic growth over the past few years.[1] In fact, policy-induced uncertainty has increased to record levels since the Great Recession. In addition, uncertainty about the timing and composition of fiscal consolidations may matter for the success of such consolidation (Bi, Leeper and Leith, 2011) and may fundamentally affect medium-term macroeconomic projections and thus policy actions designed in reaction to a given perceived economic situation (Cimadomo, 2012 and Blanchard and Leith, 2013).

The uncertainty about fiscal policies in real-time is closely linked to the issue of the credibility of government plans.[2] These plans determine specific tax changes and spending programmes, and as such shape decisions and actions[3] of economic agents. Nevertheless, the ability of ex-ante budgetary plans to convey information about the ex post course of fiscal policies may be blurred by the presence of political bias and strategic behaviour by governments, as shown by a well-established branch of the literature.[4] Indeed, a large strand of the literature has analyzed from a theoretical and empirical point of view the potential bias that the political and institutional process might have on government fiscal policy plans and the nature and properties of budgetary deviations from targets. For the case of European Union (EU) governments, this literature tends to find empirical evidence in favour of the existence of systematic political and institutional biases in revenue forecasting, while the evidence for the United States is mixed, depending on the institutional coverage of the analysis (Federal government or States).[5]

In this paper we address the issue of the information content of budgetary plans from a real-time perspective. We adopt the point of view of an agent who wishes to obtain an informed and independent estimate about the future course of fiscal policy during the year. To do so, the agent (econometrician) sets out a model at the quarterly frequency in which all the available

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[1] See e.g. Ayhan and Terrones (2012) or Baker and Davis (2012).

[2] Cowan et al. (2000) argue that the credibility of policy is critical to the success of policy in many areas, ranging from monetary policy to patent policy to tax incentives.

[3] Even the late publication of budget laws may impinge on the credibility of plans and penalize the financing costs of the government (Andersen, Lassen, and Westh, 2014).

[4] The theoretical literature on the characterization and determinants of policy credibility is quite large. An early survey is provided by Persson (1988). On the contribution of bureaucratic effects to policy forecasts see, e.g., Mounts and Sowell (1996).

[5] Some empirical papers that look at the properties and determinants government plans (and international organizations' forecasts) are Blackley and DeBoer (1993), Auerbach (1999), Jonung and Larch (2006), Boylan (2008), Dreher et al. (2008), Leal et al. (2008), Beetsma et al. (2009), von Hagen (2010), Holcombe and Ryvkin (2010), Pina and Venes (2011), Frankel (2011), Jong-a-Pin et al. (2012), Frankel and Schreger (2013a, 2013b), Merola and Pérez (2013), Cimadomo (2014), and the references quoted therein.

information is combined: announced (ex-ante) forward-looking government plans, and high frequency fiscal data on the implementation of current (ongoing) government plans.[6] [7] At each point in time, this approach allows the agent to confront what the government says it will do with what the government is actually doing. In this respect we adopt an ex-ante, real-time view, compared to the traditional post-mortem exercise in the related literature that dissects the determinants of ex-post budgetary deviations.

In practical terms, we set out state-of-the-art, mixed-frequencies, time-series factor models, along the lines of Camacho and Perez-Quiros (2010) or Aruoba, Diebold and Scotti (2009, 2010) that provide a natural framework to integrate announced plans, at the annual frequency, with data on the implementation of the plans, at the quarterly frequency. We take government consumption to be the fiscal variable defining policy in our empirical exercises, and focus on euro area economies, namely Germany, France, Italy and Spain, as all these countries have been recently subject to fiscal consolidation processes but with different degrees of intensity.[8]

Following this approach we show that government targets may convey useful information about ex-post policy developments in certain circumstances, in particular when policy changes significantly, even if the track record of government plan's credibility has been poor, and when there is limited information about the implementation of plans (e.g. at the beginning of a fiscal year). This helps qualifying the above-mentioned, well-established results from a related literature that would advise against paying too much attention to policy targets, given that they are found to display politically-motivated biases. In addition, our models are instrumental to unveil the current course of fiscal policy in real-time, which complement a different literature, focused on forecasting, that usually treats government expenses as exogenous in macro scenarios because they are considered erratic and difficult to forecast (see e.g. Grassi et al., 2014).

The rest of the paper is organized as follows. In Section 2, we develop further the main contribution of the paper. In Section 3, we describe the data used. In Section 4, we present the

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[6] A recent literature in the field of short-term forecasting that has shown that the use of high-frequency fiscal data may improve budget forecasting and monitoring. See, e.g. Silvestrini et al. (2008), Pedregal and Pérez (2010), Asimakopoulos et al. (2013), Pedregal et al. (2014, and the references quoted therein.

[7] Lundtofte and Leoni (2014) argue that governments are in most cases better informed about the future of the macroeconomy than the vast majority of private investors. In the framework of monetary policy, Andersen (1989) considers policy announcements from a forward-looking perspective, rather than relying on learning from experience, and states conditions under which policy announcements are credible or non-credible.

[8] In addition, focusing on EU countries has the advantage that EU fiscal rules prescribe the publication of multi-annual fiscal plans (that encompass the most recent budget) at the same date, and according to comparable statistical standards.

models, and in Section 5 the empirical experiments carried out and the main results. Section 6 provides some conclusions and policy implications.

## 2. Learning about the government plan

At each quarter $t$ of a given year $T$ economic agents observe the government plan $\Delta_T \bar{g}$ for that very year for a given fiscal variable $\Delta_T g$, which denotes the annual rate of growth of government consumption. They can also find from official publications the track record of the government in living up to its past years' plans, i.e they can compute the sequence of budgetary deviations given by

$$\Psi_T = \left\{ \Delta_{T-j} g - \Delta_{T-j} \bar{g} \right\}_{j=T-1}^{1} \tag{1}$$

where the index for years is arbitrarily set to run from year *1* (first year for which a fiscal plan is available) to *T-1*. In a stochastic world, a government that has met its commitments in the past would present a sequence $\Psi_T$ with zero mean, no autocorrelation and low variance. It would also be expected that fiscal plans of a government with a poor track record (i.e. $\Psi_T$ being a sequence with a non-zero mean/biased, or in general not efficient) would be assigned a very low weight (historical credibility) by agents when trying to predict the future course of policy.

At the same time, in each quarter $t$ of year $T$ the agent observes the actual historical quarterly time series of government consumption, $\Phi_{t,T} = \left\{ \Delta g_t \right\}_{t \in I}$ (where $I$ runs at the quarterly frequency over the yearly support *1* to *T*) and may assess how likely is the annual target for the current year $\Delta_T \bar{g}$ conditional on that quarterly information. To compute an optimal projection of $\Delta_T g$ at each quarter $t$ of year $T$, one can optimally combine observed data, $\Phi_{t,T}$, with forward-looking information (target), $\Delta_T \bar{g}$, conditional on $\Psi_T$, and all other relevant available information (indicators), in a general model of the form $F\left( \Phi_{t,T}; \Delta_T \bar{g} / \Psi_T \right)$. The need to combine these two sources of information arises from the fact that the ability of the government to force $\Delta_T g$ to be equal to $\Delta_T \bar{g}$ decreases as the quarters within the year go by, in particular if the cumulated sequence of quarterly data $\Phi_{t,T}$ drifts away from the annual target. At the same time, if the cumulated sequence of data is assessed to be consistent with reaching the target, this would make the agent more confident on $\Delta_T \bar{g}$ irrespective of the track record of $\Psi_T$ being good or bad.

Thus, $F\left(\Phi_{t,T};\Delta_T\overline{g}/\Psi_T\right)$ can be deemed as a learning device to help based behavioural decisions. Economic agents can update their whole-year projection every quarter to take into account newly revealed data on the actual implementation of the plan. Given the standard delays in data publication by most national statistical institutes worldwide, updating this learning process might be useful for an analyst even after the calendar year is over, given that the final quarterly and annual figures for macro and fiscal aggregates for a given calendar year are typically published with a delay of two to three months.

With this basic framework in mind, we are interested in three baseline cases. First, a case in which the economic agent estimates the weighting function/"policy rule" $F\left(\Phi_{t,T};\Delta_T\overline{g}/\Psi_T\right)$, to projects $\Delta_T g$. Second, a case in which $\Psi_T = 0_{1\times T}$ in equation (1); this case could be relevant from a real-time point of view not to penalize a newly appointed government that aims at *starting from scratch* with past policy practices, and pursues a given policy, credibly committing to it. Finally, a case in which the agent totally disregards the target $\Delta_T\overline{g}$ and projects $\Delta_T g$ only on the basis of observed data on the implementation of the plans.

In the following sections we will be more specific about all aspects of this general setup.

## 3. Some definitions and data issues

### 3.1. Government consumption

In the paper *g* is quarterly government consumption, as defined by the European System of Accounts (ESA 1995). Compared to the prior literature looking at government targets that typically edges on annual fiscal deficits this allows us to integrate a macroeconomic perspective together with the public finance one. Indeed, *g* is a direct demand component of GDP, which represents about 15%-20% of GDP in advanced economies, and as such tends to receive specific and detailed attention when governments prepare their macroeconomic projections. At the same time, given the core role of GDP in national statistical systems, the availability of quarterly data is much richer than for standard public finance variables, in particular as regards the decomposition of nominal values between volumes and prices, as well as the availability of seasonally-adjusted data. Due to the latter, most studies looking at the macroeconomic effects of "government spending shocks" have mainly paid attention to government consumption.[9] In addition, *g* is the only fiscal variable for which EU governments are obliged to publish their

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[9] See e.g. Ramey (2011) and the references quoted therein.

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yearly target in both real (value) and nominal (volume) terms, in the framework of the publication of annual Stability and Convergence Programme (SP).

*3.2. Data issues*

The real-time dimension of our study and the quarterly frequency adopted, introduce the need to fine-tune the information set that would have been available to an analysts at each quarter. Available high frequency variables, notwithstanding, are heterogeneous in our case of interest, and tend to be related either to the real part of $g$, to the price part, or to the interaction of both (nominal terms). This is due to the fact that $g$ covers, among others, spending in goods and services that are provided, broadly speaking, at no cost for the user: defense, judicial system, education, health, etc. In order to find suitable indicators of these activities, it is important to acknowledge that in National Accounts a great deal of these activities is accounted for at the cost of production, i.e. through the wage bill. In general, the distinction between the wage and the non-wage parts of $g$ turned out to be instrumental for the selection of a number of indicators that are related to the real or price parts of $g$ through the respective wage and non-wage parts in each case. As example, the evolution of real $g$ is related to public employment, and the evolution of the deflator of $g$ is linked to public wages per employee. In addition, given the importance of government consumption as a component of overall public spending (some 50% in the average OECD economy), we were able to find a number of timely-available, direct indicators on nominal budgetary execution. Despite the fact that the latter present the problem of being published in non-seasonally adjusted terms, it tends to present the best alternative given that provides a direct measure of $g$ in nominal terms, even though typically for the central government sector, a choice that might not be innocuous for highly fiscally decentralized countries like Germany and Spain.

After the extensive data search, nevertheless, we constraint ourselves in this study to a subset of variables that is available for the four countries under consideration and it is broadly homogeneous for all of them. Specifically, the variables included in our analysis cover the period 1995Q1-2013Q4 and are the following for each one of the considered cases (Germany, France, Italy and Spain): (i) quarterly seasonally-adjusted real government consumption, $g^R$; (ii) deflator of quarterly seasonally-adjusted government consumption, $g^D$; (iii) proxy to public employment in national accounts, $N^R$ (quarterly seasonally-adjusted "non-market services"); (iv) wages per public employee in national accounts, $W^P$ (quarterly seasonally-adjusted "non-market services"); (v) Central government consumption expenditure, $G^{RP}$ (monthly nominal, non-seasonally adjusted); (vi) Combined index of HICP Health (prices) and HICP Education

(prices), $p^P$ (monthly, non-seasonally adjusted); (vii) Annual planned government consumption from the Stability Programmes in real ($g^{Rf}$) and price ($g^{Df}$) terms.

*3.3. The information flow*

Annual targets taken from the Stability Programmes (SPs) and are assumed to be known in the first quarter of the year. This is a reflection of actual publication dates, on average. Indeed, before 2010 SPs were published at the very end of the year. Since 2010, nonetheless, SPs are published in the course of the first four months of the year, with end of April as the limit, in the framework of the so-called European Semester. As regards variables published at the monthly frequency, in turn, are typically known shortly after the month ends, while quarterly national accounts' data are published with a delay of 90 days.

*3.4. Related literature*

As mentioned above, the literature on fiscal forecasting offers only limited help to frame our paper. On the one hand, a strand of articles conceptually related to ours, which were quoted in the Introduction, focus on the analysis of the determinants of ex-post budgetary deviations (i.e. the difference between actual values and government forecasts), without entering into the vagaries of the elaboration of the fiscal forecast. On the other hand, the papers on short-term fiscal forecasting, also mentioned above, tend to concentrate on the impact of backward-looking fiscal information on the fiscal projection, and do not internalize the forward-looking targets. Within the literature on short-term macro forecasting few studies deal with individual components of GDP. Indeed, GDP is typically forecasted from an aggregate point of view, see e.g. Camacho and Pérez-Quirós (2010), or Banbura et al. (2010), and the references quoted therein. Exceptions are Baffigi et al. (2004), which follow a demand-side approach, Hahn and Skudelny (2008), that follow a supply-side approach, or Foroni and Marcellino (2013), who look at both sides of GDP. In those papers, nevertheless, $g$ and the relevant supply-side counterparts tend to be forecasted by means of univariate methods, or considered to be a residual, exogenous variable difficult to model and forecast, and considered to be erratic (in this latter regard see also Grassi et al., 2014). Another set of papers consider the elaboration of optimal government forecasts with a view to orient the ex-ante design of policies (see, for early contributions, Johansen, 1972, Granger, 1973, Johansen and Hersoug, 1975). Finally, the literature on "restricted forecasting", as in Gómez and Guerrero (2006), focuses on the question of which is the future path of a given model's forecasts that would lead to achieving a given government target.

*3.5. Some stylized facts*

In figures 1 and 3 we present real and price government consumption figures at the annual frequency against the corresponding targets for the four countries under study and the period 2006-2013. For $g^R$ (Figure 1) it is apparent that in most of the cases ex-post data (the dotted line) were above initial targets (the solid lines). It happens for Spain in all the years and for France in all but 2006, while for Germany and Italy this is the case in all years with the exception of 2010-2012. Thus, overall, one may say that governments spent more than they initially were committed to, i.e presented a pro-spending bias. At the same time, though, over time, observed values followed the apparent change in policy in Spain and Italy, countries that moved from positive registers of $g^R$ over 2006-2009/2010 to (strongly) negative rates of change in 2010-2013. Despite missing the initial targets, it seems that the change in policies had a persistent effect on the conduction of actual policies in those countries.

Interestingly, the overall picture for $g^D$ (Figure 3) is broadly the opposite. Governments predicted higher public wages and purchases' prices than recorded ex-post. This means that in terms of nominal government expenditure consumption the pro-spending bias was somewhat mitigated, leading in some cases to data being in line with initial targets. These observations do not need to be contradictory among them. In times of fiscal stress governments have incentives to report higher GDP real growth than expected, i.e. to present an optimistic bias in their economic forecast, which may be partially achieved by having more $g^R$, a component that weights some 20% of the total while they do not have any incentives to bias the prices.

One may ask the question of whether despite the fact that $g^R$ targets infra estimated actual values, it could be the case that in a framework of peer pressure to put public finances under control, some policy actions were taken to change an initially spending-loose course of action, once in the public debt-crisis period. This is what we try to answer with the material included in figures 2 and 4. In those figures we present forecasts for $g^R$ and $g^D$ computed on the basis of a purely backward-looking model, a second order autoregressive model, AR(2), that completely disregards any forward-looking elements of policy not incorporated in the inertia of the series themselves. We present forecasts done at the time of the first quarter of each year. Focusing on Spain and Italy, the two countries under more close EU-wide peer pressure, it is clear from figures 2 and 4 that both $g^R$ and $g^D$ tend to present lower growth rates than forecast with the AR(2) in Q1 of each year. This is in line with the change of policy regime (from positive to negative growth rates) taking place over time and the backward-looking model only capturing it with some delay. In that sense, we can conclude that, even though there is systematic bias in the

forecast of $g^R$ in some countries, something was done in those countries under pressure to change the dynamics of public expenses ex-post.

## 4. The modelling approach

*4.1. The model*

The heterogeneity in the data sources conditions the selection of the modeling approach. As briefly discussed above, to enrich the dataset available for forecasting we have to resort to monthly/quarterly indicators of the real component of government consumption, its deflator component or a mixture of both (nominal). With this in mind we decided to pose a factor model with two factors, one for the real part and one for the price part. The details are as follows. The model is a factor model, written in a general state-space form as

$$Y_t = H \times h_t + w_t$$
$$h_t = F \times h_{t-1} + v_t$$

(2)

with $Var(w_t) = R$, and $Var(v_t) = Q$. The vector of observed variables (all demeaned and logged) is

$$Y_t = \left( \Delta g_t^R, \Delta g_t^D, \Delta_4 N_t^R, \Delta_4 W_t^P, \Delta_4 G_t^{RP}, \Delta_4 p_t^P, \Delta_A \overline{g}_t^R, \Delta_A \overline{g}_t^D \right)$$

(3)

As can be seen, some of the variables are included in quarterly growth rates (first differences of the logs) and others in quarterly annual growth rates (4 lags differences of the logs of the quarterly series). The transformation chosen depends on the availability of the data. Those released seasonally adjusted are included in first differences, while those released non-seasonally adjusted are included in fourth differences to avoid the ad-hoc choice of a seasonal adjustment procedure. Finally, the two government targets, $\Delta_A \overline{g}_t^R$ and $\Delta_A \overline{g}_t^D$, are included in annual growth rates, referring to variables in annual frequencies.

The variables are decomposed into two common driving factors, the real ($\rho_t$) and the price ($\pi_t$) factors and an idiosyncratic component that follows an AR(2) structure with uncorrelated irregulars. The use of two factors is crucial for the integration of nominal variables in the model, and also for the joint use of real and price indicators. It is important to specify carefully which variables are function of the real factor and which are function of the nominal factor. In addition, it is worth mentioning that depending of the transformation of the variables (first

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differences, fourth differences or annual), the dynamic relation of the observed variable and the underlying factor change. In particular:

$$\Delta g_t^R = \delta_1 \rho_t + u_{g,t}^R \tag{3}$$

$$\Delta g_t^D = \theta_1 \pi_t + u_{g,t}^D \tag{4}$$

Real government consumption only depends on the real factor and deflator of government consumption depends only on the price factor. As regards public employment, $\Delta_4 N_t^R$, it is a function only of the real factor. The annual growth rate implies that, in a given period $t$, the relation with the underlying variable –which represents quarterly activity– is the accumulation of the last four periods. Therefore:

$$\Delta_4 N_t^R = \delta_2 \left( \rho_t + \rho_{t-1} + \rho_{t-2} + \rho_{t-3} \right) + u_{N,t}^R \tag{5}$$

In turn, wages of public employees depend only on the price factor:

$$\Delta_4 W_t^P = \theta_2 \left( \pi_t + \pi_{t-1} + \pi_{t-2} + \pi_{t-3} \right) + u_{W,t}^P \tag{6}$$

as well as the combination of the health and education price indexes, that only depends on the price factor:

$$\Delta_4 p_t^P = \theta_4 \left( \pi_t + \pi_{t-1} + \pi_{t-2} + \pi_{t-3} \right) + u_{p,t}^P \tag{7}$$

Regarding central government consumption expenditure, it is a nominal variable, and therefore it depends on the real and price factors:

$$\Delta G_t^{RP} = \delta_3 \left( \rho_t + \rho_{t-1} + \rho_{t-2} + \rho_{t-3} \right) + \theta_3 \left( \pi_t + \pi_{t-1} + \pi_{t-2} + \pi_{t-3} \right) + u_{Gt}^{RP} \tag{8}$$

Finally, the two government target variables, annual planned government consumption in real and price terms, are moving average functions of the real and price factors respectively. The assumption is that, once demeaned, ex-ante plans are equal to ex-post data up to a random disturbance, i.e.

$$\Delta_A \overline{g}_t^R = \Delta_A g_t^R + u_t^{Rf} \tag{9}$$

$$\Delta_A \overline{g}_t^{Df} = \Delta_A g_t^D + u_t^{Df} \tag{10}$$

Thus, once both the observed and the target real/price government consumption variables have been computed as deviations from their own means, the historical discrepancies estimated between ex-ante targets and ex-post observed data amount to the moments of the $u_t^{Df}$ and $u_t^{Rf}$ random errors. Now, using (4) and (9) yields:

$$\Delta_A \overline{g}_t^{Rf} = \delta_1 \left( \frac{1}{4}\rho_t + \frac{2}{4}\rho_{t-1} + \frac{3}{4}\rho_{t-2} + \rho_{t-3} + \frac{3}{4}\rho_{t-4} + \frac{2}{4}\rho_{t-5} + \frac{1}{4}\rho_{t-6} \right) +$$
$$+ \left( \frac{1}{4}u_{g,t}^R + \frac{2}{4}u_{g,t-1}^R + \frac{3}{4}u_{g,t-2}^R + u_{g,t-3}^R + \frac{3}{4}u_{g,t-4}^R + \frac{2}{4}u_{g,t-5}^R + \frac{1}{4}u_{g,t-6}^R \right) + u_t^{Rf} \tag{11}$$

and using (5) and (10) allows as to express $\Delta_A \overline{g}_t^D$ as:

$$\Delta_A \overline{g}_t^D = \theta_1 \left( \frac{1}{4}\pi_t + \frac{2}{4}\pi_{t-1} + \frac{3}{4}\pi_{t-2} + \pi_{t-3} + \frac{3}{4}\pi_{t-4} + \frac{2}{4}\pi_{t-5} + \frac{1}{4}\pi_{t-6} \right) +$$
$$+ \left( \frac{1}{4}u_{g,t}^D + \frac{2}{4}u_{g,t-1}^D + \frac{3}{4}u_{g,t-2}^D + u_{g,t-3}^D + \frac{3}{4}u_{g,t-4}^D + \frac{2}{4}u_{g,t-5}^D + \frac{1}{4}u_{g,t-6}^D \right) + u_t^{Df} \tag{12}$$

Equations (3) to (12) and the AR(2) structure of the factors and the idiosyncratic shocks configure the structure of the matrices *H, F, Q* and *R* in (2). A full description of these matrices can be found in Appendix A. The monthly information of some of the indicators is transformed into quarterly frequency by calculating in each month the quarterly growth rate. The AR(2) structure is assumed to provide the most parsimonious representation of sinusoidal impulse response function, as it is already standard in the literature of factor models.

### 4.2. Alternative assumptions to model policy targets

Alternative models will differ in the way they approach (1), (9) and (10) above, i.e. in the way the policy targets enter the model. As mentioned above in Section 2, we are interested in three basic experiments, which can be described with different assumptions regarding (9) and (10).

In the first case of interest we set $\Delta_A \overline{g}_t^R = \Delta_A g_t^R$, for all years before the current year *T* (the same for the deflator equation), which amounts to assuming that governments met their commitments in the past (i.e. $\Psi_{T-1} = 0_{1 \times T-1}$ in equation 1). In this way the model will treat relations (9) and (10) as almost identities, only different because the time series of $\Delta_A \overline{g}_t^R$ used to estimate the model will have at each time one observation more than $\Delta_A g_t^R$, namely the one corresponding to the target for the current year *T* (assigned to the last quarter of year *T*). The intuition for this case is the following: at each forecast origin, the target value for year *T*

receives full credibility as if the government had always predicted correctly the actual value in the past. Therefore, any given consumption expenditure proposed will receive full credit in terms of predictive power on the future value of $\Delta_A g_t^R$ (the same applies to the government deflator).

In the second case we do not constraint $\Psi_T$, i.e. it is composed of the genuine differences between ex-post actual values and ex-ante government targets, and thus the estimation of the parameters in (9) and (10) are allowed to reflect the different historical accuracy/credibility of the government. In this case targets receive as much credibility as the one gained by the government on the basis of its past performance during the sample period.

The third case is one in which equations (9) and (10) are excluded from the model, and thus the forward-looking information provided by the government targets is not taken into consideration. This model reflects the best possible forecast of the next realization of government consumption growth (real and deflator) made by an agent that takes into account all the information available in period $t$ on the actual implementation of government plans and assigns zero weight to government announcements.

*4.3. Additional considerations*

First, the empirical exercises that follow are of a pseudo real-time nature. This means that we implement counterfactual exercises assuming that the data available today for a past year/quarter/month was available at that time, i.e. we disregard the potential impact of data revisions in shaping the real-time decisions of policy makers. This approach is dictated by the lack of availability of consistent real-time data for our dataset.

Second, we use an AR(2) model as a naïve forecasting alternative to our factor models. This means that as a minimum we are going to check that the proposed models beat this alternative. It is worth mentioning that it is a well-established fact in the relevant forecasting literature that autoregressive models are hard-to-beat alternatives (see e.g. Hess and Iwata, 1997).

Third, we take two standard measures of forecasting performance. The standard Mean Squared Error, to compare the predictability of the relevant variables across countries, as well as the ratio of RMSEs of models to the AR(2) alternative. Diebold and Mariano test is employed, to test for the null hypothesis of no difference in the accuracy of two competing forecasts.

Fourth, all the comparisons are going to be made on the basis of a recursive forecasting exercise over the forecasting window 2006Q1 to 2013Q4.

## 5. Empirical results

The main results of the paper are shown in tables 1 and 2, on the one hand, and figures 5, 6 and 7, on the other.

In Table 1 we present the forecast accuracy statistics: MSE, ratio of RMSE and DM for one quarter-ahead forecasts. The following results are worth highlighting:

(i) According to the MSEs, there are strong differences in the predictability across countries. Countries as France are relatively easy to forecast because the dynamics are very stable over time, while countries as Spain, subject to strong changes in fiscal policies are difficult to predict.

(ii) The consideration of the short-term information provided by the selected indicators is useful to infer short-term developments, as clear from the better forecasting performance of Model 3 (no government targets), versus the AR(2), that only uses information on the dynamics of government consumption. This is true for all countries when forecasting real and nominal government growth. The results for the deflator are more erratic and, in general, there is no gain with respect to the AR(2) dynamics. This first result is very important, to the light of the literature mentioned above on the "erraticity" of public spending forecasting. However we show here that there is room for short term modelling using indicators and this result is robust across countries.

(iii) The inclusion of targets is not helpful to infer the current situation of ongoing plans, as judged by the 1-quarter-ahead forecasting capabilities of the different models; indeed, Model 3 is not beaten by Model 1 or Model 2. This is a strong result. There is no gain in using government plans. The intuition of the results for Model 1 is different than the one for Model 2. In the case of Model 1 (*imperfect past credibility*) the intuition is easy. If there are a succession of government plans with different degrees of credibility, that are usually not successful, the model endogenously does not take those predictions, implying a zero weight to those official government forecast, producing forecasts that are non-distinguishable from the "no government targets" specification. More complicated is the intuition of the results of the model Model 2 (*perfect past credibility*). The results are the worst, even though we give full credibility to the government plans. In every period of time, we assume that the forecast of the government is the best possible one. It is as good that we give the maximum credibility assuming that the forecast is the future observation of an annual sequence where the forecast of the government is equal to the realized value. Therefore, our sequence of "past forecasts" has a very high weight in the future estimated values for the realizations of

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government consumption real and nominal. The problem is that this maximum weight is misleading because systematically, governments are wrong in one direction or another, implying that the forecasted values are also very incorrect.

Table 2, in turn, presents the results of the forecasts for the whole year, computed from each quarter on a recursive basis. During the first quarter of the year the forecast requires nowcasting and one, two and three period ahead forecast. The second quarter requires nowcasting and one and two period ahead, the third quarter requires nowcasting and one period ahead forecast and the fourth quarter is only nowcasting. As in Table 1, there are also marked differences among MSEs between countries, in particular, both the real government consumption and the deflator are more easily predicted in Germany and France, and to a lesser extent Italy for $g_t^R$, than in the case of Spain. However, in the case of countries subject under scrutiny, as in the case of Spain, the three modeling alternatives beat the AR(2). This initial result reflects the differences among countries in the policy stance. Indeed, in the case of Spain there was a change in policy (from fiscal expansion to fiscal consolidation) that gives some explanatory role to the short-term information but also to the targets. At medium horizon (2-3 quarters) there is some anchoring from the targets, that, even though, as we saw in Table 1, does not necessarily help us to forecast in the nowcasting arena, they give is some idea on the changes in trends that diminish dramatically the estimated errors. Thus, the main result of Table 2 is that policy targets add information beyond the inertia of *g,* which is valuable at times of policy changes (of particular interest is the case of Spain).

This result is reinforced by Figure 5 in which we dissect forecasts of $\Delta g_t^R$ by forecast origin, showing forecast errors in this case, making clear how targets are useful especially at the beginning of the year, when little information is known about actual policies. Focusing on the case of Spain again, the *"perfect past credibility"* alternative performs better at forecast origins in Q1 and Q2, given that the information content on annual changes of observed data quarterly data is quite low, a fact that is clear when inspecting the lines corresponding to Model 3 (*no targets*) in particular in Q1 and for the years 2009-2012. As regards Model 1 projections ("im*perfect past credibility"*), they lie in between the other two alternatives. As the government starts implementing the *g* plans (at least partially) in the successive quarters, the deviation displayed by the Model 1 and Model 3 alternatives get reduced, while at the same time Model 2 forecasts become less adaptive as they pose a significant weight on annual policy targets. At the end of the year, when the forecast horizon is Q4, forecast of Model 2 almost coincides with the target (for all the countries), even though, according to our timing convention only Q3 figures

for $g_t^R$ and the quarterly indicators are known so that the information set is far for being complete.

The latter point appears to be clearer in figures 6 and 7 where we look at the same information from the angle of iterative forecasts, i.e. we show how models learn and adapt throughout the year to new incoming information. The "*no targets*" (Model 3) and "*imperfect past credibility*" (Model 1) alternatives tend to approach the final outcome on a monotonous way, more quickly in the second case as the target convey useful information on the direction of change of $\Delta g_t^R$. On the other hand, as regards the case with "*perfect past credibility*" (Model 2), the learning process is even faster at the beginning of the year in the cases in the years in which the target is informative, but then as the quarters goes by, it ends up inheriting the "policy bias" of the target.

## 6. Conclusions

We show that ex-ante government targets may convey useful information about ex-post policy developments in certain circumstances, in particular when policy changes drastically, even when past policy credibility is low, and when there is limited information about the implementation of plans (e.g. at the beginning of a fiscal year). In addition, our models are instrumental to unveil the current course of policy in real-time. Our approach complements a well-established branch of the literature that finds politically-motivated biases in policy targets.

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# Table 1. Unveiling *g* plans for the current year (T): one-quarter-ahead forecasts

## GERMANY

| DE | MSE | RATIO OF RMSE TO AR(2) | DIEBOLD MARIANO TEST | | |
|---|---|---|---|---|---|
| | | | AR(2) | Model 1 | Model 2 |
| **REAL GOVERNMENT CONSUMPTION** | | | | | |
| **Model 1. Imperfect past credibility** $(\Delta g_t^{Rf} \neq \Delta g_t^{R}$, for t< T) *(IP_IF)* | 0.41 | 0.96 | -0.44 | | |
| **Model 2. Perfect past credibility** $(\Delta g_t^{Rf} = \Delta g_t^{R}$, for t< T) *(PP_IF)* | 2.30 | 2.27 | 1.91 | 1.95 | |
| **Model 3. No government targets** *(NoT)* | 0.36 | 0.90 | -1.76 | -0.77 | -1.99 |
| **DEFLATOR OF GOVERNMENT CONSUMPTION** | | | | | |
| **Model 1. Imperfect past credibility** $(\Delta g_t^{Rf} \neq \Delta g_t^{R}$, for t< T) *(IP_IF)* | 0.19 | 0.97 | -0.31 | | |
| **Model 2. Perfect past credibility** $(\Delta g_t^{Rf} = \Delta g_t^{R}$, for t< T) *(PP_IF)* | 0.93 | 2.16 | 2.13 | 2.19 | |
| **Model 3. No government targets** *(NoT)* | 0.21 | 1.03 | 0.51 | 0.53 | -2.06 |
| **NOMINAL GOVERNMENT CONSUMPTION** | | | | | |
| **Model 1. Imperfect past credibility** $(\Delta g_t^{Rf} \neq \Delta g_t^{R}$, for t< T) *(IP_IF)* | 0.66 | 0.96 | -0.31 | | |
| **Model 2. Perfect past credibility** $(\Delta g_t^{Rf} = \Delta g_t^{R}$, for t< T) *(PP_IF)* | 1.57 | 1.49 | 1.93 | 2.40 | |
| **Model 3. No government targets** *(NoT)* | 0.57 | 0.90 | -1.75 | -0.69 | -2.34 |

## FRANCE

| | MSE | RATIO OF RMSE TO AR(2) | DIEBOLD MARIANO TEST | | |
|---|---|---|---|---|---|
| | | | AR(2) | Model 1 | Model 2 |
| **REAL GOVERNMENT CONSUMPTION** | | | | | |
| **Model 1. Imperfect past credibility** $(\Delta g_t^{Rf} \neq \Delta g_t^{R}$, for t< T) *(IP_IF)* | 0.04 | 1.01 | 0.09 | | |
| **Model 2. Perfect past credibility** $(\Delta g_t^{Rf} = \Delta g_t^{R}$, for t< T) *(PP_IF)* | 2.06 | 6.94 | 2.02 | 2.02 | |
| **Model 3. No government targets** *(NoT)* | 0.04 | 0.99 | -0.67 | -0.15 | -2.02 |
| **DEFLATOR OF GOVERNMENT CONSUMPTION** | | | | | |
| **Model 1. Imperfect past credibility** $(\Delta g_t^{Rf} \neq \Delta g_t^{R}$, for t< T) *(IP_IF)* | 0.02 | 1.26 | 1.79 | | |
| **Model 2. Perfect past credibility** $(\Delta g_t^{Rf} = \Delta g_t^{R}$, for t< T) *(PP_IF)* | 0.28 | 4.58 | 3.16 | 3.05 | |
| **Model 3. No government targets** *(NoT)* | 0.01 | 0.95 | -1.11 | -2.38 | -3.18 |
| **NOMINAL GOVERNMENT CONSUMPTION** | | | | | |
| **Model 1. Imperfect past credibility** $(\Delta g_t^{Rf} \neq \Delta g_t^{R}$, for t< T) *(IP_IF)* | 0.05 | 0.95 | -0.50 | | |
| **Model 2. Perfect past credibility** $(\Delta g_t^{Rf} = \Delta g_t^{R}$, for t< T) *(PP_IF)* | 2.02 | 6.18 | 2.06 | 2.07 | |
| **Model 3. No government targets** *(NoT)* | 0.05 | 0.96 | -1.05 | 0.20 | -2.07 |

Table 1 (cont'd). Unveiling *g* plans for the current year (T): one-quarter-ahead forecasts

## ITALY

| | MSE | RATIO OF RMSE TO AR(2) | DIEBOLD MARIANO TEST | | |
| --- | --- | --- | --- | --- | --- |
| | | | AR(2) | Model 1 | Model 2 |
| **REAL GOVERNMENT CONSUMPTION** | | | | | |
| **Model 1. Imperfect past credibility** ($\Delta g_t^{Rf} \neq \Delta g_t^{R}$, for t< T) *(IP_IF)* | 0.27 | 1.04 | 0.82 | | |
| **Model 2. Perfect past credibility** ($\Delta g_t^{Rf} = \Delta g_t^{R}$, for t< T) *(PP_IF)* | 3.66 | 3.83 | 1.95 | 1.94 | |
| **Model 3. No government targets** *(NoT)* | 0.23 | 0.96 | -1.93 | -1.58 | -1.97 |
| **DEFLATOR OF GOVERNMENT CONSUMPTION** | | | | | |
| **Model 1. Imperfect past credibility** ($\Delta g_t^{Rf} \neq \Delta g_t^{R}$, for t< T) *(IP_IF)* | 7.26 | 1.45 | 1.65 | | |
| **Model 2. Perfect past credibility** ($\Delta g_t^{Rf} = \Delta g_t^{R}$, for t< T) *(PP_IF)* | 15.08 | 2.09 | 1.31 | 1.06 | |
| **Model 3. No government targets** *(NoT)* | 3.19 | 0.96 | -0.34 | -2.18 | -1.39 |
| **NOMINAL GOVERNMENT CONSUMPTION** | | | | | |
| **Model 1. Imperfect past credibility** ($\Delta g_t^{Rf} \neq \Delta g_t^{R}$, for t< T) *(IP_IF)* | 7.79 | 1.38 | 1.54 | | |
| **Model 2. Perfect past credibility** ($\Delta g_t^{Rf} = \Delta g_t^{R}$, for t< T) *(PP_IF)* | 22.67 | 2.36 | 1.80 | 1.65 | |
| **Model 3. No government targets** *(NoT)* | 3.62 | 0.94 | -0.61 | -2.13 | -1.90 |

## SPAIN

| | MSE | RATIO OF RMSE TO AR(2) | DIEBOLD MARIANO TEST | | |
| --- | --- | --- | --- | --- | --- |
| | | | AR(2) | Model 1 | Model 2 |
| **REAL GOVERNMENT CONSUMPTION** | | | | | |
| **Model 1. Imperfect past credibility** ($\Delta g_t^{Rf} \neq \Delta g_t^{R}$, for t< T) *(IP_IF)* | 2.18 | 0.88 | -1.90 | | |
| **Model 2. Perfect past credibility** ($\Delta g_t^{Rf} = \Delta g_t^{R}$, for t< T) *(PP_IF)* | 10.20 | 1.89 | 1.69 | 1.82 | |
| **Model 3. No government targets** *(NoT)* | 2.36 | 0.91 | -1.62 | 0.83 | -1.79 |
| **DEFLATOR OF GOVERNMENT CONSUMPTION** | | | | | |
| **Model 1. Imperfect past credibility** ($\Delta g_t^{Rf} \neq \Delta g_t^{R}$, for t< T) *(IP_IF)* | 2.26 | 0.97 | -0.41 | | |
| **Model 2. Perfect past credibility** ($\Delta g_t^{Rf} = \Delta g_t^{R}$, for t< T) *(PP_IF)* | 6.24 | 1.62 | 1.78 | 1.75 | |
| **Model 3. No government targets** *(NoT)* | 2.20 | 0.96 | -0.66 | -0.32 | -1.75 |
| **NOMINAL GOVERNMENT CONSUMPTION** | | | | | |
| **Model 1. Imperfect past credibility** ($\Delta g_t^{Rf} \neq \Delta g_t^{R}$, for t< T) *(IP_IF)* | 5.20 | 0.96 | -0.57 | | |
| **Model 2. Perfect past credibility** ($\Delta g_t^{Rf} = \Delta g_t^{R}$, for t< T) *(PP_IF)* | 9.41 | 1.29 | 1.54 | 1.88 | |
| **Model 3. No government targets** *(NoT)* | 4.88 | 0.93 | -1.42 | -0.58 | -1.94 |

Table 2. The role of policy targets and incoming-data in the anticipation of the yearly outcome of real government consumption

## GERMANY

| | MSE | RATIO OF RMSE TO AR(2) | DIEBOLD MARIANO TEST | | | |
| --- | --- | --- | --- | --- | --- | --- |
| | | | AR(2) | Model 1 | Model 2 | Model 3 |
| **REAL GOVERNMENT CONSUMPTION** | | | | | | |
| **Model 1. Imperfect past credibility** ($\Delta g_t^{Rf} \neq \Delta g_t^{R}$, for t< T) *(IP_IF)* | 0.32 | 0.93 | -0.49 | | | |
| **Model 2. Perfect past credibility** ($\Delta g_t^{Rf} = \Delta g_t^{R}$, for t< T) *(PP_IF)* | 0.71 | 1.39 | 3.58 | 3.25 | | |
| **Model 3. No government targets** *(NoT)* | 0.32 | 0.93 | -1.27 | -0.01 | -3.59 | |
| **Model 4. Government targets** *(T)* | 1.19 | 1.80 | 4.09 | 4.20 | 4.20 | 4.12 |
| **DEFLATOR OF GOVERNMENT CONSUMPTION** | | | | | | |
| **Model 1. Imperfect past credibility** ($\Delta g_t^{Rf} \neq \Delta g_t^{R}$, for t< T) *(IP_IF)* | 0.16 | 0.90 | -0.58 | | | |
| **Model 2. Perfect past credibility** ($\Delta g_t^{Rf} = \Delta g_t^{R}$, for t< T) *(PP_IF)* | 0.14 | 0.86 | -0.68 | -0.31 | | |
| **Model 3. No government targets** *(NoT)* | 0.25 | 1.14 | 2.19 | 1.21 | 1.17 | |
| **Model 4. Government targets** *(T)* | 0.20 | 1.02 | 0.12 | 0.90 | 2.69 | -0.50 |
| **NOMINAL GOVERNMENT CONSUMPTION** | | | | | | |
| **Model 1. Imperfect past credibility** ($\Delta g_t^{Rf} \neq \Delta g_t^{R}$, for t< T) *(IP_IF)* | 0.33 | 0.75 | -1.00 | | | |
| **Model 2. Perfect past credibility** ($\Delta g_t^{Rf} = \Delta g_t^{R}$, for t< T) *(PP_IF)* | 0.49 | 0.92 | -0.47 | 1.98 | | |
| **Model 3. No government targets** *(NoT)* | 0.52 | 0.95 | -0.87 | 0.83 | 0.17 | |
| **Model 4. Government targets** *(T)* | 0.75 | 1.14 | 0.68 | 3.92 | 2.69 | 0.92 |

## FRANCE

| | MSE | RATIO OF RMSE TO AR(2) | DIEBOLD MARIANO TEST | | | |
| --- | --- | --- | --- | --- | --- | --- |
| | | | AR(2) | Model 1 | Model 2 | Model 3 |
| **REAL GOVERNMENT CONSUMPTION** | | | | | | |
| **Model 1. Imperfect past credibility** ($\Delta g_t^{Rf} \neq \Delta g_t^{R}$, for t< T) *(IP_IF)* | 0.08 | 1.11 | 0.50 | | | |
| **Model 2. Perfect past credibility** ($\Delta g_t^{Rf} = \Delta g_t^{R}$, for t< T) *(PP_IF)* | 0.48 | 2.74 | 3.41 | 3.83 | | |
| **Model 3. No government targets** *(NoT)* | 0.06 | 0.98 | -1.21 | -0.61 | -3.42 | |
| **Model 4. Government targets** *(T)* | 0.50 | 2.77 | 3.62 | 4.04 | 0.77 | 3.64 |
| **DEFLATOR OF GOVERNMENT CONSUMPTION** | | | | | | |
| **Model 1. Imperfect past credibility** ($\Delta g_t^{Rf} \neq \Delta g_t^{R}$, for t< T) *(IP_IF)* | 0.05 | 1.04 | 0.39 | | | |
| **Model 2. Perfect past credibility** ($\Delta g_t^{Rf} = \Delta g_t^{R}$, for t< T) *(PP_IF)* | 0.12 | 1.63 | 2.24 | 2.71 | | |
| **Model 3. No government targets** *(NoT)* | 0.04 | 0.91 | -0.91 | -2.19 | -2.97 | |
| **Model 4. Government targets** *(T)* | 0.08 | 1.37 | 1.55 | 1.69 | -1.98 | 2.36 |
| **NOMINAL GOVERNMENT CONSUMPTION** | | | | | | |
| **Model 1. Imperfect past credibility** ($\Delta g_t^{Rf} \neq \Delta g_t^{R}$, for t< T) *(IP_IF)* | 0.11 | 0.94 | -0.32 | | | |
| **Model 2. Perfect past credibility** ($\Delta g_t^{Rf} = \Delta g_t^{R}$, for t< T) *(PP_IF)* | 0.45 | 1.87 | 2.56 | 3.44 | | |
| **Model 3. No government targets** *(NoT)* | 0.11 | 0.93 | -0.90 | -0.08 | -2.98 | |
| **Model 4. Government targets** *(T)* | 0.46 | 1.90 | 2.58 | 3.53 | 0.80 | 3.01 |

Table 2 (cont'd). The role of policy targets and incoming-data in the anticipation of the yearly outcome of real government consumption
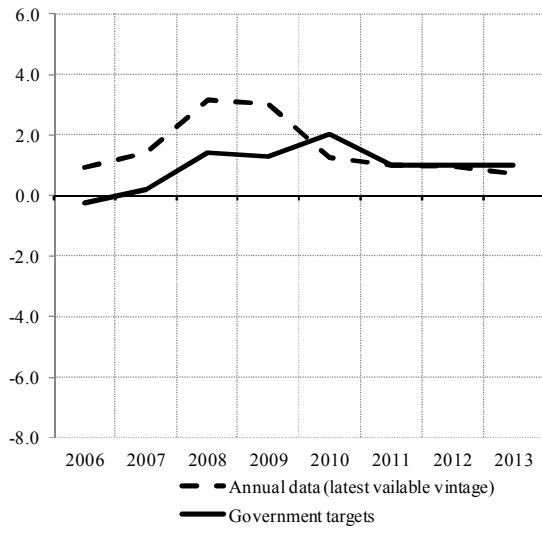
## ITALY

| | MSE | RATIO OF RMSE TO AR(2) | DIEBOLD MARIANO TEST | | | |
|---|---|---|---|---|---|---|
| | | | AR(2) | Model 1 | Model 2 | Model 3 |
| **REAL GOVERNMENT CONSUMPTION** | | | | | | |
| **Model 1. Imperfect past credibility** ($\Delta g_t^{Rf} \neq \Delta g_t^R$, for t< T) *(IP_IF)* | 0.54 | 1.00 | 0.00 | | | |
| **Model 2. Perfect past credibility** ($\Delta g_t^{Rf} = \Delta g_t^R$, for t< T) *(PP_IF)* | 1.01 | 1.37 | 1.89 | 1.81 | | |
| **Model 3. No government targets** *(NoT)* | 0.48 | 0.95 | -2.11 | -0.44 | -2.20 | |
| **Model 4. Government targets** *(T)* | 1.08 | 1.42 | 1.76 | 1.90 | 0.69 | 2.04 |
| **DEFLATOR OF GOVERNMENT CONSUMPTION** | | | | | | |
| **Model 1. Imperfect past credibility** ($\Delta g_t^{Rf} \neq \Delta g_t^R$, for t< T) *(IP_IF)* | 4.77 | 2.03 | 1.45 | | | |
| **Model 2. Perfect past credibility** ($\Delta g_t^{Rf} = \Delta g_t^R$, for t< T) *(PP_IF)* | 1.46 | 1.13 | 0.44 | -1.35 | | |
| **Model 3. No government targets** *(NoT)* | 1.68 | 1.21 | 1.24 | -1.47 | 0.28 | |
| **Model 4. Government targets** *(T)* | 2.91 | 1.59 | 1.63 | -0.97 | 1.79 | 1.37 |
| **NOMINAL GOVERNMENT CONSUMPTION** | | | | | | |
| **Model 1. Imperfect past credibility** ($\Delta g_t^{Rf} \neq \Delta g_t^R$, for t< T) *(IP_IF)* | 5.71 | 1.51 | 1.18 | | | |
| **Model 2. Perfect past credibility** ($\Delta g_t^{Rf} = \Delta g_t^R$, for t< T) *(PP_IF)* | 3.07 | 1.11 | 0.57 | -0.96 | | |
| **Model 3. No government targets** *(NoT)* | 2.83 | 1.06 | 0.64 | -1.26 | -0.24 | |
| **Model 4. Government targets** *(T)* | 5.19 | 1.44 | 1.75 | -0.24 | 2.00 | 1.72 |

## SPAIN

| | MSE | RATIO OF RMSE TO AR(2) | DIEBOLD MARIANO TEST | | | |
|---|---|---|---|---|---|---|
| | | | AR(2) | Model 1 | Model 2 | Model 3 |
| **REAL GOVERNMENT CONSUMPTION** | | | | | | |
| **Model 1. Imperfect past credibility** ($\Delta g_t^{Rf} \neq \Delta g_t^R$, for t< T) *(IP_IF)* | 1.18 | 0.62 | -2.05 | | | |
| **Model 2. Perfect past credibility** ($\Delta g_t^{Rf} = \Delta g_t^R$, for t< T) *(PP_IF)* | 1.23 | 0.64 | -1.47 | 0.12 | | |
| **Model 3. No government targets** *(NoT)* | 2.23 | 0.86 | -2.11 | 1.84 | 1.10 | |
| **Model 4. Government targets** *(T)* | 2.70 | 0.94 | -0.32 | 2.39 | 3.09 | 0.58 |
| **DEFLATOR OF GOVERNMENT CONSUMPTION** | | | | | | |
| **Model 1. Imperfect past credibility** ($\Delta g_t^{Rf} \neq \Delta g_t^R$, for t< T) *(IP_IF)* | 0.88 | 0.69 | -1.96 | | | |
| **Model 2. Perfect past credibility** ($\Delta g_t^{Rf} = \Delta g_t^R$, for t< T) *(PP_IF)* | 1.51 | 0.90 | -0.53 | 2.14 | | |
| **Model 3. No government targets** *(NoT)* | 2.23 | 1.10 | 0.53 | 1.29 | 0.59 | |
| **Model 4. Government targets** *(T)* | 1.27 | 0.83 | -0.77 | 1.08 | -1.17 | -0.76 |
| **NOMINAL GOVERNMENT CONSUMPTION** | | | | | | |
| **Model 1. Imperfect past credibility** ($\Delta g_t^{Rf} \neq \Delta g_t^R$, for t< T) *(IP_IF)* | 2.62 | 0.61 | -1.91 | | | |
| **Model 2. Perfect past credibility** ($\Delta g_t^{Rf} = \Delta g_t^R$, for t< T) *(PP_IF)* | 2.34 | 0.58 | -1.63 | -0.42 | | |
| **Model 3. No government targets** *(NoT)* | 6.00 | 0.92 | -0.97 | 1.94 | 1.63 | |
| **Model 4. Government targets** *(T)* | 1.62 | 0.48 | -1.62 | -0.90 | -1.30 | -1.63 |

Figure 1. Bias in real government consumption targets.

**Germany**



Annual data (latest vailable vintage)
Government targets

**France**



Annual data (latest vailable vintage)
Government targets

**Italy**



Annual data (latest vailable vintage)
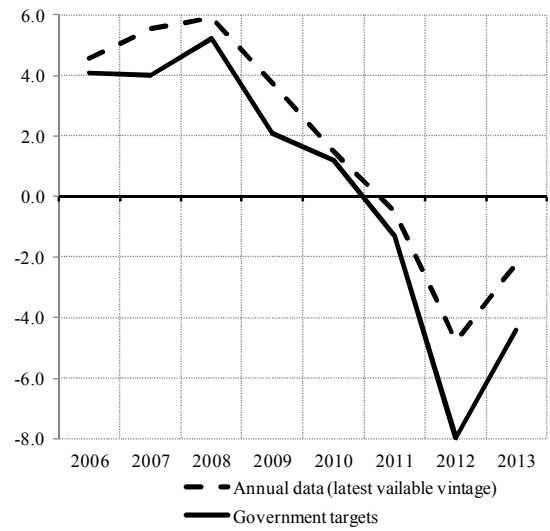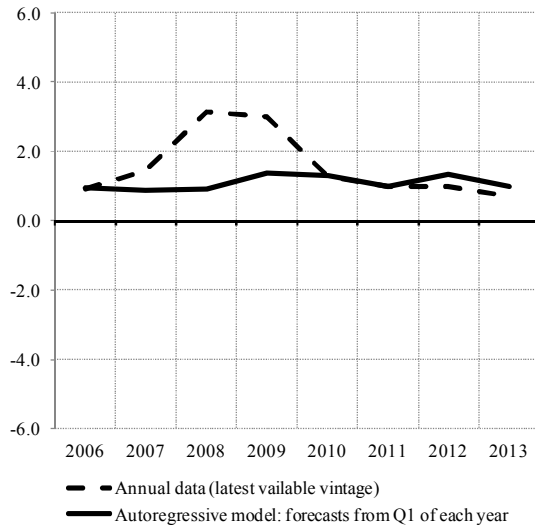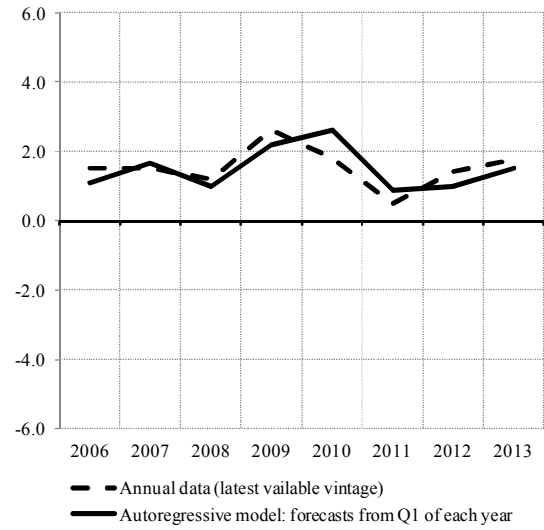Government targets

**Spain**



Annual data (latest vailable vintage)
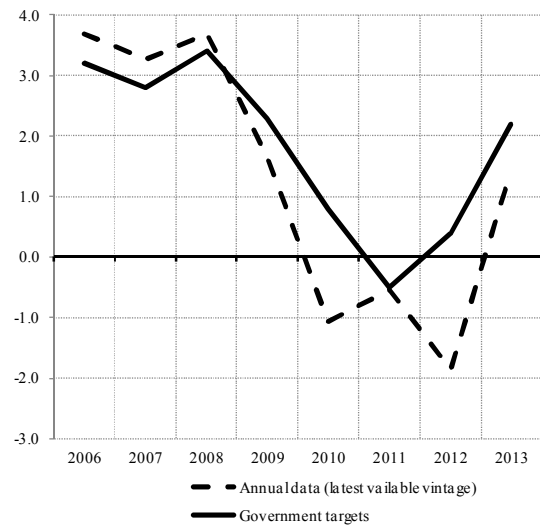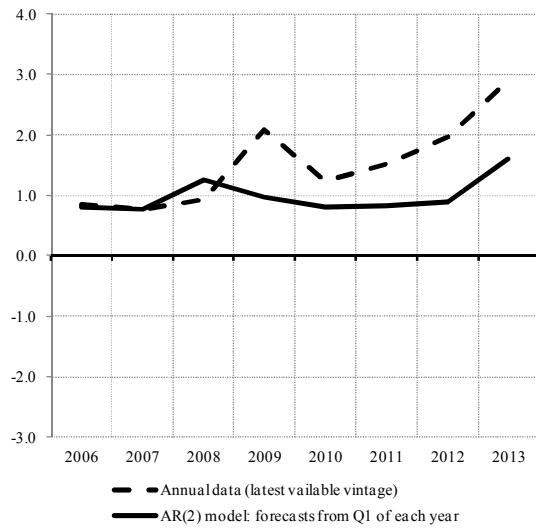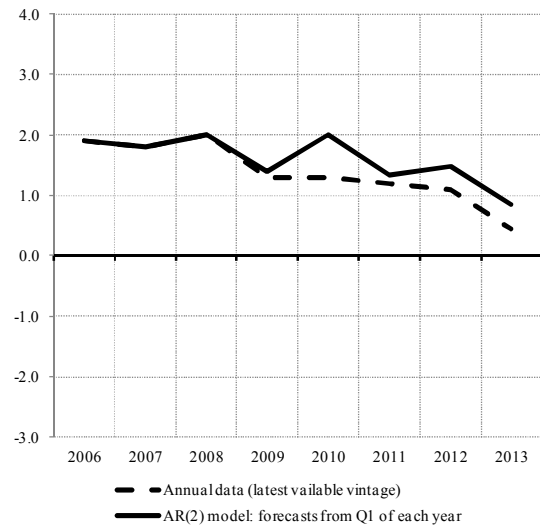Government targets
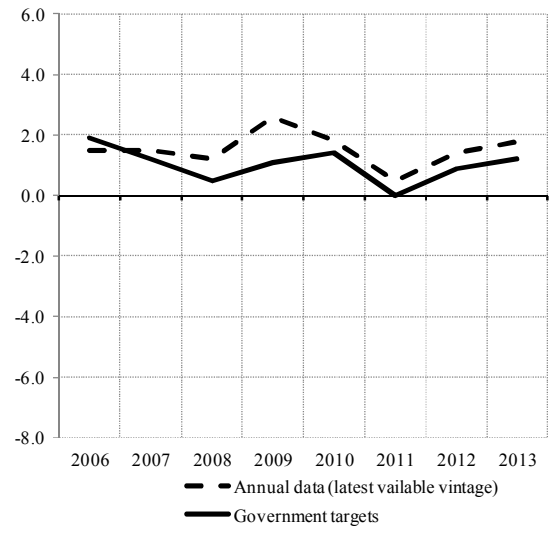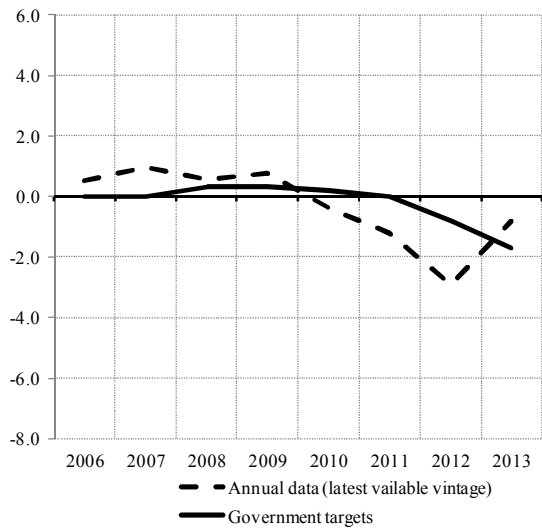
Figure 2. The predictability of real government consumption: the figure presents forecast produced with the model $g_t = \alpha + \rho_1 g_{t-1} + \rho_2 g_{t-2} + \zeta_t$ estimated with the information available in the first quarter of each year.
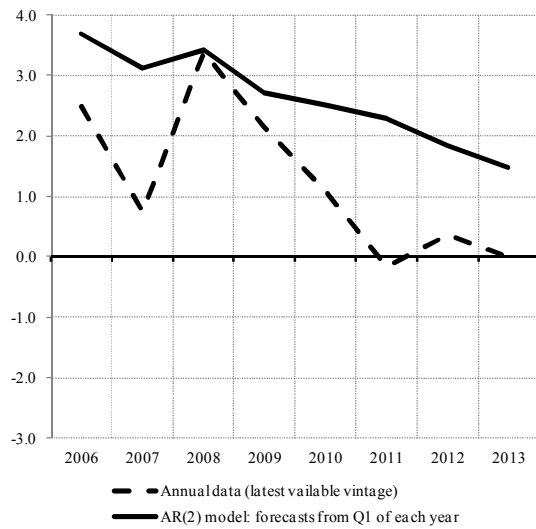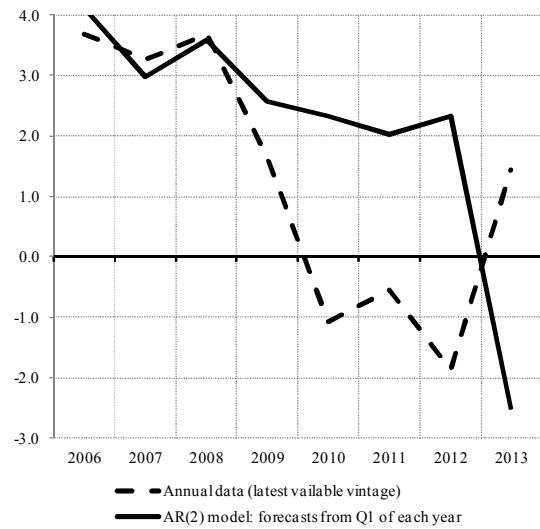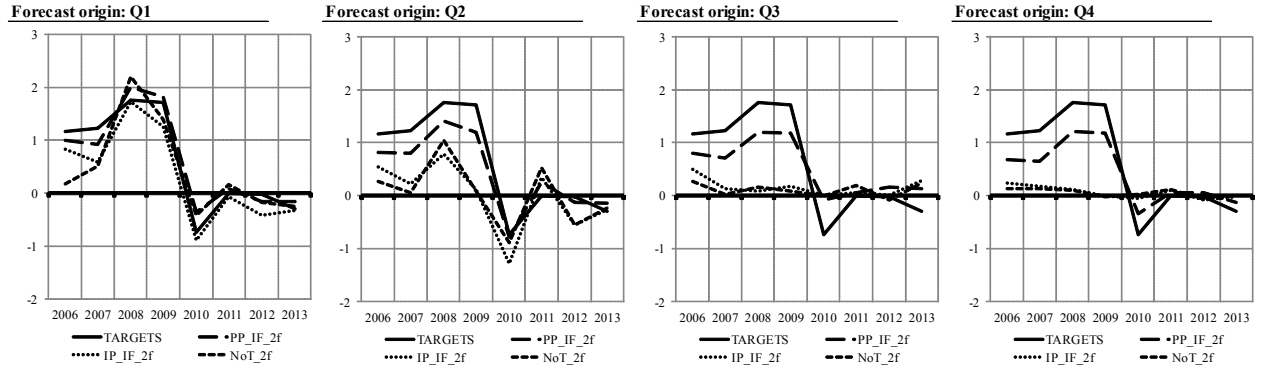
**Germany**



- Annual data (latest vailable vintage)
- Autoregressive model: forecasts from Q1 of each year

**France**



- Annual data (latest vailable vintage)
- Autoregressive model: forecasts from Q1 of each year

**Italy**



- Annual data (latest vailable vintage)
- Autoregressive model: forecasts from Q1 of each year

**Spain**



- Annual data (latest vailable vintage)
- Autoregressive model: forecasts from Q1 of each year
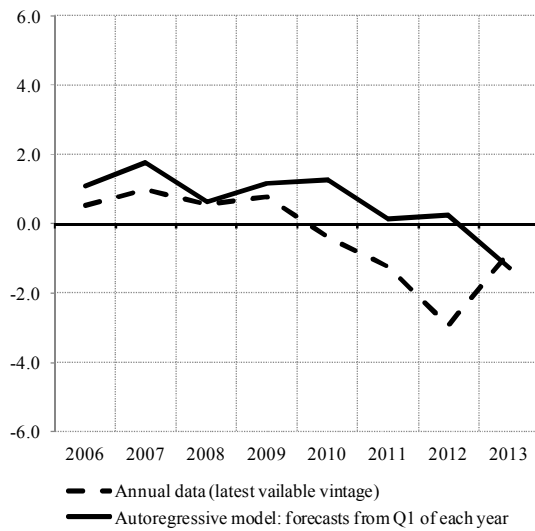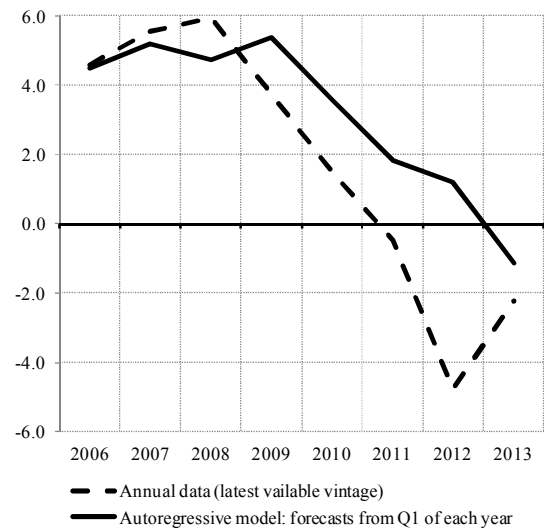
Figure 3. Bias in the price component of government consumption targets.

**Germany**



- - Annual data (latest available vintage)
—— Government targets

**France**



- - Annual data (latest available vintage)
—— Government targets

**Italy**



- - Annual data (latest available vintage)
—— Government targets

**Spain**



- - Annual data (latest available vintage)
—— Government targets
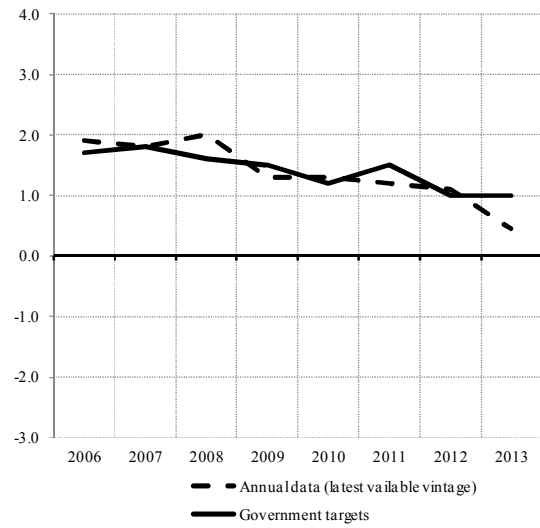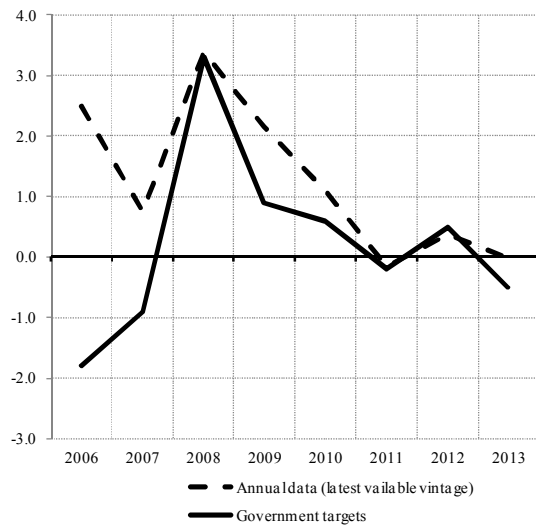
Figure 4. The predictability of the price component of government consumption: the figure presents forecast produced with the model $g_t = \alpha + \rho_1 g_{t-1} + \rho_2 g_{t-2} + \zeta_t$ estimated with the information available in the first quarter of each year.

**Germany**



- Annual data (latest vailable vintage)
- AR(2) model: forecasts from Q1 of each year

**France**



- Annual data (latest vailable vintage)
- AR(2) model: forecasts from Q1 of each year

**Italy**



- Annual data (latest vailable vintage)
- AR(2) model: forecasts from Q1 of each year

**Spain**



- Annual data (latest vailable vintage)
- AR(2) model: forecasts from Q1 of each year

Figure 5. The role of the budgetary target in model projections of real government consumption: the figure presents forecast errors committed by each model from each forecast origin (Q1, Q2, Q3, Q4)

**Germany**



**France**
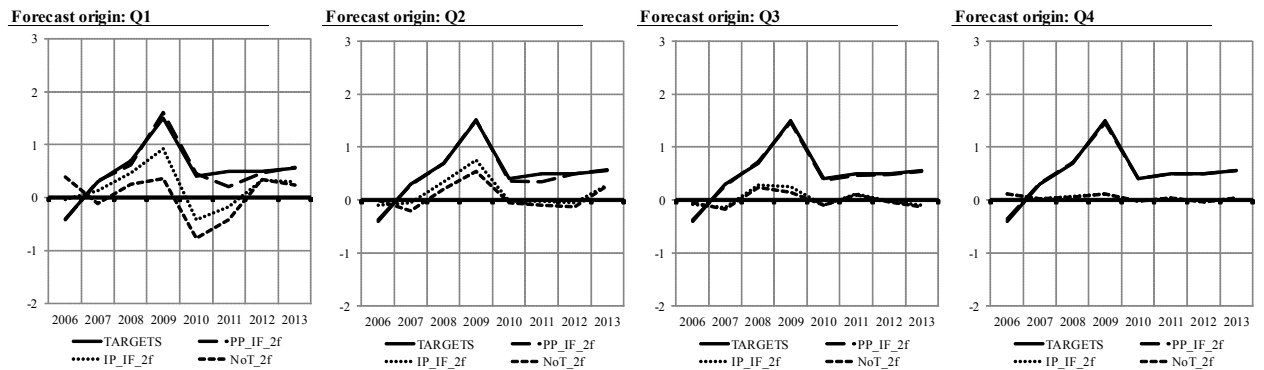


**Italy**
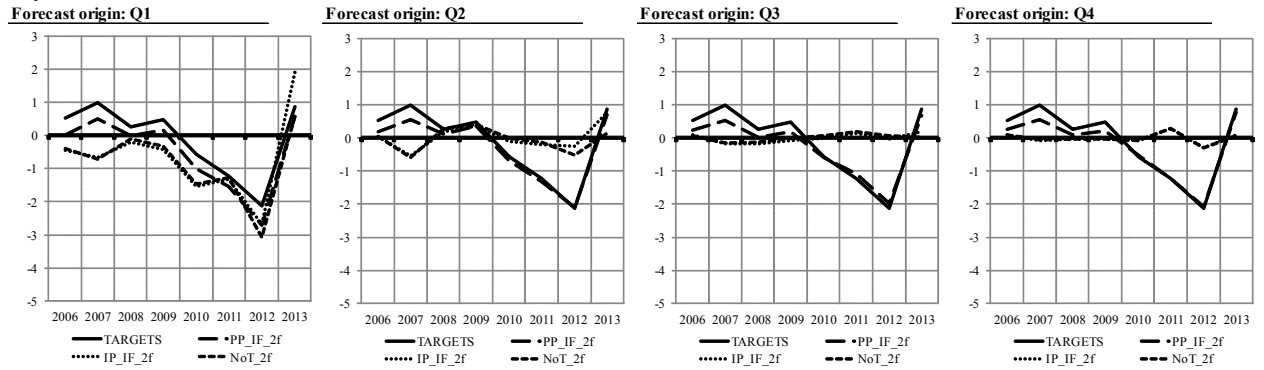


**Spain**
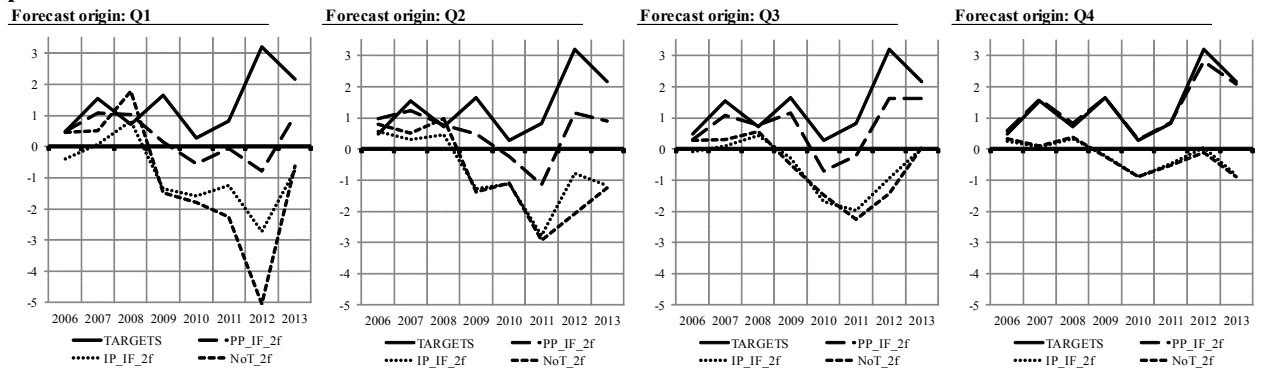
Figure 6. The evolution of the iterative real government consumption forecasts during the year ("learning"): Germany and France.
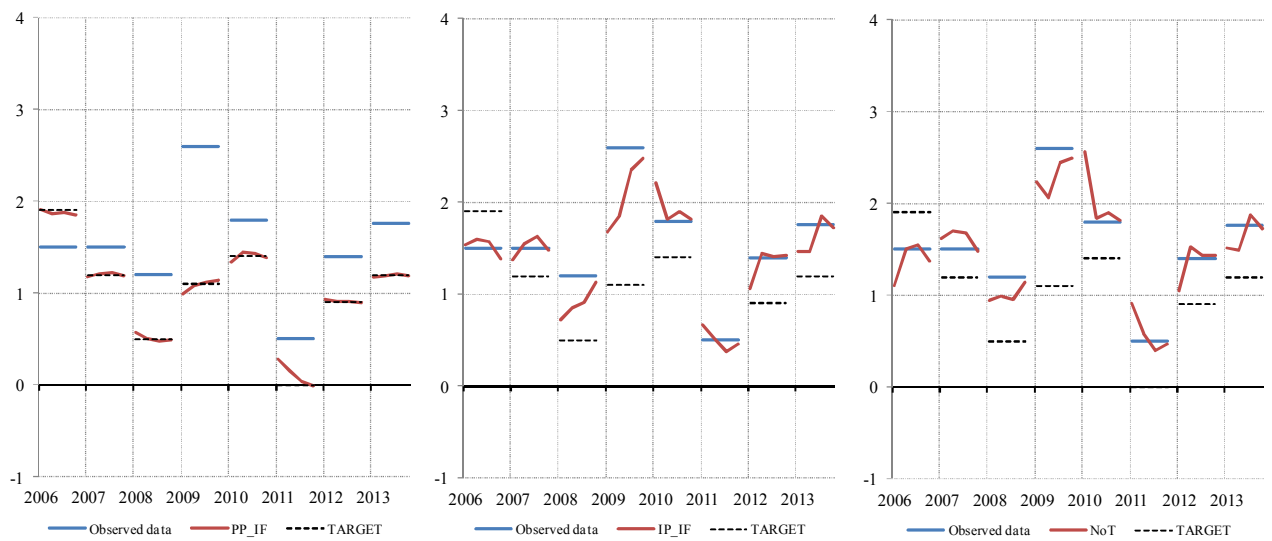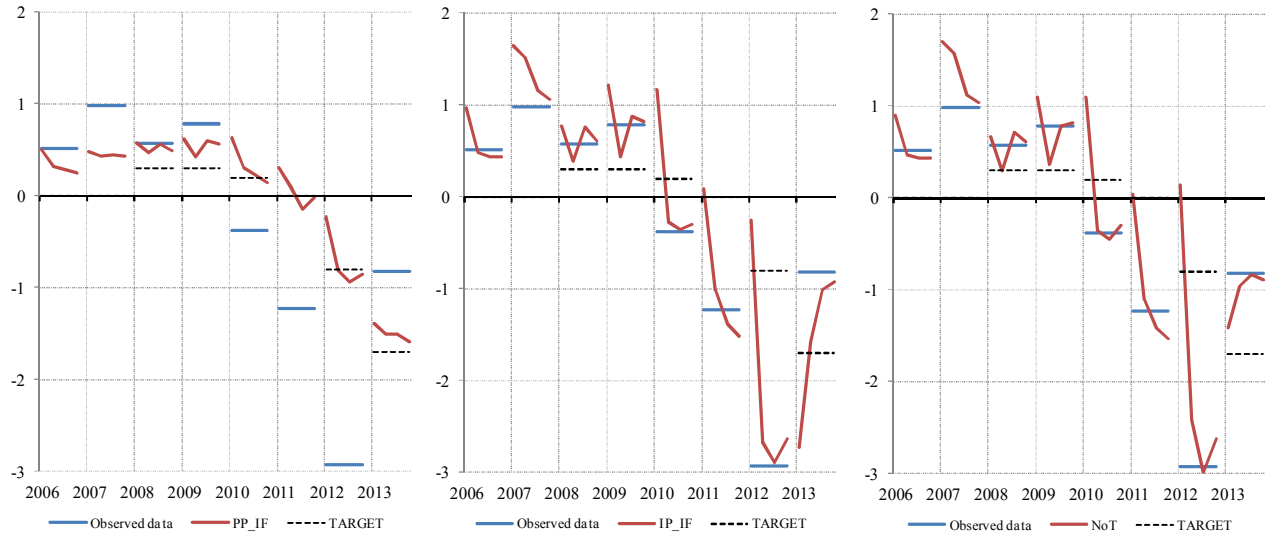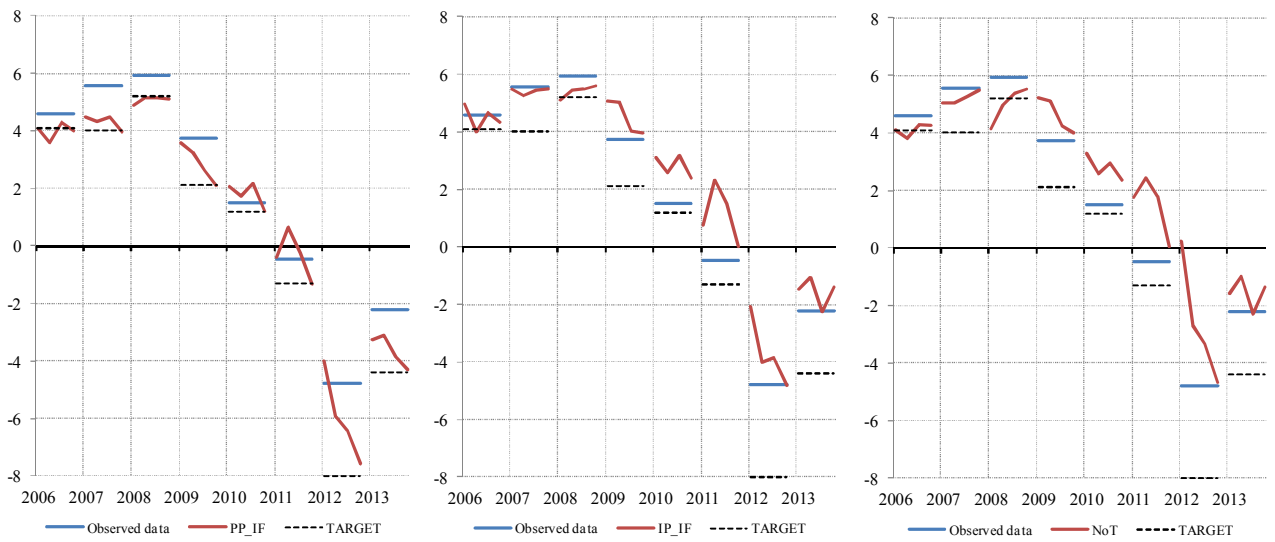
**Germany**



**France**



28
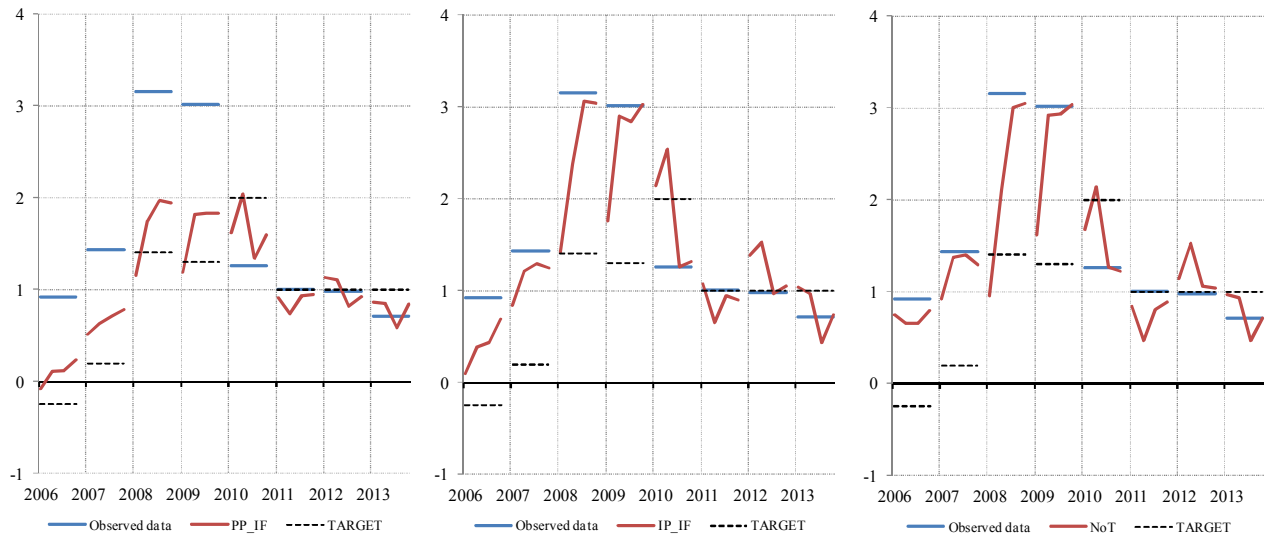
Figure 7. The evolution of the iterative real government consumption forecasts during the year ("learning"): Italy and Spain.

**Italy**



**Spain**

APPENDIX A

Full Description of the Kalman Filter Matrices

$$Y_t = H \times h_t + w_t$$
$$h_t = F \times h_{t-1} + v_t$$

$$Y_t = \left( \Delta g_t^R, \Delta g_t^D, \Delta_4 N_t^R, \Delta_4 W_t^P, \Delta_4 G_t^{RP}, \Delta_4 p_t^P, \Delta_A \bar{g}_t^R, \Delta_A \bar{g}_t^D \right)'$$
$$Y_t = H \times h_t + w_t$$
$$h_t = F \times h_{t-1} + v_t$$
$$Var(w_t) = R$$
$$Var(v_t) = Q$$

$$h_t = \begin{pmatrix} \rho_t, \rho_{t-1}, \rho_{t-2}, \rho_{t-3}, \rho_{t-4}, \rho_{t-5}, \rho_{t-6}, \pi_t, \pi_{t-1}, \pi_{t-2}, \pi_{t-3}, \pi_{t-4}, \pi_{t-5}, \pi_{t-6}, \dots \\ \dots u_{g,t}^R, u_{g,t-1}^R, u_{g,t-2}^R, u_{g,t-3}^R, u_{g,t-4}^R, u_{g,t-5}^R, u_{g,t-6}^R, u_{g,t}^D, u_{g,t-1}^D, u_{g,t-2}^D, u_{g,t-3}^D, \dots \\ \dots u_{g,t-4}^D, u_{g,t-5}^D, u_{g,t-6}^D, u_{N,t}^R, u_{N,t-1}^R, u_{W,t}^P, u_{W,t-1}^P, u_{p,t}^P, u_{p,t-1}^P, u_{G,t}^{RP}, u_{G,t-1}^{RP}, u_t^{Rf}, u_t^{Df} \end{pmatrix}$$

$$H = (H_1, H_2, H_3, H_4, H_5)$$

$$H_1 = \begin{pmatrix} \delta_1 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ \delta_2 & \delta_2 & \delta_2 & \delta_2 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ \delta_3 & \delta_3 & \delta_3 & \delta_3 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 1/4\delta_1 & 2/4\delta_1 & 3/4\delta_1 & \delta_1 & 3/4\delta_1 & 2/4\delta_1 & 1/4\delta_1 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 \end{pmatrix}$$

$$H_2 = \begin{pmatrix} 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ \theta_1 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ \theta_2 & \theta_2 & \theta_2 & \theta_2 & 0 & 0 & 0 \\ \theta_3 & \theta_3 & \theta_3 & \theta_3 & 0 & 0 & 0 \\ \theta_4 & \theta_4 & \theta_4 & \theta_4 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 1/4\theta_1 & 2/4\theta_1 & 3/4\theta_1 & \theta_1 & 3/4\theta_1 & 2/4\theta_1 & 1/4\theta_1 \end{pmatrix}$$

$$H_3 = \begin{pmatrix} 1 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 1/4 & 2/4 & 3/4 & 1 & 3/4 & 2/4 & 1/4 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 \end{pmatrix}$$

$$H_4 = \begin{pmatrix} 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 1 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 1/4 & 2/4 & 3/4 & 1 & 3/4 & 2/4 & 1/4 \end{pmatrix}$$

$$H_5 = \begin{pmatrix} 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 \end{pmatrix}$$

$$R = \begin{pmatrix} 0 & \dots & 0 \\ \dots & \dots & \dots \\ 0 & \dots & 0 \end{pmatrix}$$

$$F = \begin{pmatrix} F_1 & 0_{7x7} & 0_{7x7} & 0_{7x7} & 0_{7x10} \\ 0_{7x7} & F_2 & 0_{7x7} & 0_{7x7} & 0_{7x10} \\ 0_{7x7} & 0_{7x7} & F_3 & 0_{7x7} & 0_{7x10} \\ 0_{7x7} & 0_{7x7} & 0_{7x7} & F_4 & 0_{7x10} \\ 0_{10x7} & 0_{10x7} & 0_{10x7} & 0_{10x7} & F_5 \end{pmatrix}$$

$$F_1 = \begin{pmatrix} \phi_1 & \phi_2 & 0 & 0 & 0 & 0 & 0 \\ 1 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 & 0 \end{pmatrix} F_2 = \begin{pmatrix} \phi_3 & \phi_4 & 0 & 0 & 0 & 0 & 0 \\ 1 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 & 0 \end{pmatrix}$$

$$F_3 = \begin{pmatrix} \phi_5 & \phi_6 & 0 & 0 & 0 & 0 & 0 \\ 1 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 & 0 \end{pmatrix} F_4 = \begin{pmatrix} \phi_7 & \phi_8 & 0 & 0 & 0 & 0 & 0 \\ 1 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 & 0 \end{pmatrix}$$

$$F_5 = \begin{pmatrix} \phi_9 & \phi_{10} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & \phi_{11} & \phi_{12} & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & \phi_{13} & \phi_{14} & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & \phi_{15} & \phi_{16} & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \end{pmatrix}$$

$$Q = Diagonal(\varpi)$$

$$\varpi = \left(1,0,0,0,0,0,0,1,0,0,0,0,0,0,\sigma_1^2,0,0,0,0,0,0,\sigma_2^2 0,0,0,0,0,0,\sigma_3^2,0,\sigma_4^2,0,\sigma_5^2,0,\sigma_6^2,,0,\sigma_{7,}^2,\sigma_8^2\right)$$