A toolkit to strengthen government budget surveillance *

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Abstract

In this paper we develop a comprehensive short-term fiscal forecasting system, useful for real-time monitoring of government's borrowing requirement in Spain, a country that has been at the center of the recent European sovereign debt crisis, not least because of sizeable failures to meet public deficit targets. The system is made of a suite of models, with different levels of disaggregation (bottom-up vs top-down; general government vs sub-sectors) suitable for the automatic processing of the large amount of monthly/quarterly fiscal data published nowadays by Spanish statistical authorities. Our tools are instrumental for ex-ante detection of risks to official projections, and thus can help in reducing the ex-post reputational costs of budgetary deviations. On the basis of our results, we discuss how official monitoring bodies could expand, on the one hand, their toolkit to evaluate regular adherence to targets (moving beyond a legalistic approach) and, on the other, their communication policies as regards sources of risks of (ex-ante) compliance with budgetary targets.

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1 Introduction

Government accountability is an essential principle of democracy through which elected and non elected officials are obliged to explain to the parliament and the public in general their decisions, actions and the consequences of these decisions and actions (see Ahmed et al., 2005; Leal et al., 2008). Most developed countries do have in place a framework of political, legal, and administrative mechanisms designed to control government bodies and officials. Typically, these controls focus on the adherence of the designed policies to the extant legal framework, and are not designed to influence the ex-ante design of policies nor the ex-post responsibility of policy-makers as regards the performance of their actions.

Planning errors can have enormous influence on the economy, in particular those related to budgetary policies. For example systematic and/or sizeable budgetary forecast errors may spur waves of lack of confidence on current governmental policies, and as a consequence affect the economy as a whole via e.g. by tightening the constraints on financing channels for firms. In addition, above-fundamentals financing of the public debt imposes a burden on future generations of taxpayers. Indeed, it can be claimed that the reputational costs associated to lack of adherence of budgetary outcomes to ex-ante budgetary targets were among the group of fundamental drivers behind the recent sovereign debt crisis in the particular case of Spain, within the broader euro-area crisis.

As a consequence, a significant change in the fiscal governance framework took place since the end of 2011 in Spain, whereby an enhanced framework of national budgetary surveillance entered into force as of mid-2012, enshrined in high-ranked legal documents (Constitution and Royal Organic Law), including a huge leap forward in the availability of fiscal statistics and the procedures governing all stages of budgetary planning, including the design and the implementation phases. By now the link between the quality of fiscal frameworks and budgetary discipline is a well-proven fact (see, e.g. von Hagen, 2010). The new budgetary surveillance framework still has to prove its usefulness to control the behaviour of policy makers, as regards budgetary matters, in particular in the face of upcoming electoral periods. But even assuming that policy makers were to have the will to fully implement all the legal procedures in place and were to publish timely and non-controversial real-time fiscal data, two potential weaknesses remain.

First, more information does not necessarily mean better understanding and trust from users, including private and public analysts. On the contrary, it has become increasingly difficult for pri-

vate and public analysts alike to follow and interpret the continuous flow of monthly fiscal data that is currently published by official statistical agencies in Spain. Indeed, just to quote one example, in March 2012 the only monthly publication about government's budgetary execution did refer to the central government, while since the beginning of 2013 the Spanish statistical authorities do disseminate monthly information following national accounts' definitions for the central, regional and social security sectors, including individual regional governments. This is a level of dissemination of data on public accounts that has no parallel nowadays in Europe. Nevertheless, at the same time, significant and not clearly explained revisions of headline, annual past fiscal data occurred in 2012 and 2013, spurring doubts in private investors and analysts. Just to quote one example, in a Reuters' press news published as recently as November 2013, one could read: "Spain's erratic reporting of fiscal figures, especially from its regional authorities, and repeated revisions to data have fuelled investor mistrust in the government's effort to reduce one of the euro zone's largest public deficits".[1]

Second, the budgetary control and monitoring procedures and institutions currently in place in Spain,[2] pose too much weight on the ex-post adherence of policy outcomes to certain legal and administrative clauses, more than to the ex-ante design and reporting of policy actions, and the real-time monitoring of budgetary execution. This is the standard approach in continental Europe, but it remains to be seen if this approach would be able to detect in a timely fashion fiscal slippage, and to send early-warning signals that could help develop timely corrective actions.

It is against this framework that in this paper we propose a broad set of models and tools suitable for real-time monitoring of fiscal plans, including the assessment of the probability of meeting fiscal targets, that allow for a quick and efficient processing of a vast amount of incoming monthly and quarterly information pertaining to most revenue and expenditure categories, and for all sub-sectors of the General Government. Being aware that budget planning and implementation is more an art than a science (as claimed, for example, by Leal, Pérez, Tujula and Vidal, 2008), we are at the same time convinced that looking at short-term fiscal data (i.e. data on the actual implementation of fiscal plans) through the lens of the kind of tools and models we put forward in our paper could provide a neutral and transparent assessment of adherence of observed budgetary

[1] 13 November 2013, Reuters on-line, "Spain sets up fiscal watchdog, doubts linger on independence".

[2] In particular the legal provisions on budgetary surveillance procedures included in the new Budgetary Stability Law (May 2012), but also the mandate of the recently created "Independent Fiscal Authority" (AIRF[3]), and other comptroller institutions like the IGAE (State Accounts Comptroller) or the Court of Exchequer ("Tribunal de Cuentas").

data against the monthly/quarterly path consistent with the achievement of annual fiscal targets. In particular, our models address the following questions:

- Which is the impact of a just published figure (pertaining to any government sub-sector) on the probability of meeting the annual general government borrowing target?
- Are just published quarterly general government figures in line with the estimated path consistent with meeting the annual general government borrowing target?
- Are intra-annual data on given tax or spending items consistent with the implementation of ex-ante defined tax-increases/decreases or spending cuts?

On the basis of our results, we discuss how official monitoring bodies could expand, on the one hand, their toolkit to evaluate regular adherence to targets (moving beyond a legalistic approach) and, on the other, their communication policies as regards sources of risks of (ex-ante) compliance with budgetary targets, and the convenience to launch, when needed,ex-ante corrective actions. It is important to stress upfront in the paper that we see the usefulness of our models as a benchmark for the interpretation of newly available data, and not as a substitute of the in-depth analysis normally carried out by fiscal experts in policy institutions. A detailed knowledge of institutional and special factors is a key ingredient for the short-term analysis of fiscal data, which could be further exploited in conjunction with the toolkit presented in this paper.[4]

The rest of the paper is organized as follows. In Section 2 we briefly review the related literature, stressing the contributions of the current paper. The system presented in our paper could serve as a side tools within the monitoring steps prescribed by current national fiscal rules in Spain. To make this clear, in Section 3 we describe a number of institutional issues, namely the territorial organization of Spain, one of the most fiscally decentralized countries in Europe, the extant framework of national fiscal rules, posing special emphasis on budgetary control and monitoring clauses, and the significant advances in fiscal transparency of the past few years. We also provide a description of ex-ante targets set in real-time by Governments over the period 2008-2013, as well as its adherence to ex-post, published figures, to make explicit the needs to incorporate further tools in the national surveillance process. Then, in Section 5 we turn to the description of the data available and the publication lags of official information, to move next in Section 6 to the discussion of the methodological vagaries of our models, and present formally their potential uses for actual

[4] Along the same lines see also the discussion of Leal, Pedregal and Pérez (2010).

policy-makers. Finally, in Section 7 we show some counterfactual, empirical results to somehow justify the validity of our approach, in particular by means of a truly real-time example on the case of the fiscal year 2011. Finally, in Section 8 we provide the main conclusions of the paper.

2 Related literature

Monitoring public finances in the very short-run by means of high-frequency fiscal data has not been an issue traditionally tackled in the literature, even though it is usually part of the routine of practitioners. For the case of Spain a clear predecessor of our work is Leal et al. (2010). The fact that budgetary projections are prepared in annual terms, given an annual budgetary cycle, in the framework of annual models, and the discretionary nature of many government measures set up for the entire year, have traditionally limited the role of high-frequency fiscal data for monitoring annual budgetary targets in the course of the year. The standard practice for factoring-in new intra-annual fiscal information on revised annual fiscal targets and projections is via informed, judgemental add-in factors (Leal et al, 2008). In this framework, official annual fiscal targets and projections tend to display well-documented political biases and/or large forecast errors.[5] Even without judging the determinants of fiscal forecasts, some recent episodes show large forecast errors linked to official annual fiscal projections. On the development of early-warning tools for fiscal developments, a recent strand of the literature has shown that intra-annual fiscal data, when modelled appropriately, contains extremely valuable and useful information for forecasting annual fiscal aggregates, enabling earlier detection of episodes of fiscal deterioration (or improvement) than traditional methods. For the case of Spain, some recent contributions of the latter literature are Fernández-Caballero, Pérez and Pedregal (2012), Leal, Pérez and Pedregal (2010), and Leal and Pérez (2009; 2005).[6]

Three of these papers focus on one sub-sector of the Spanish general government sector. On the one hand, Fernández-Caballero, Pérez and Pedregal (2012) look at sub-national governments' budgetary data. They make three main contributions. First, they compile a dataset on quarterly and monthly sub-national governments' spending variables, and indicators, by reviewing all available,

[5] See Strauch et al. (2004), Moulin and Wierts (2006), Annett (2006), Pina and Venes (2008), Jonung and Larch (2006), Leal et al. (2008), Merola and Pérez, 2013, and the references quoted therein.

[6] On related grounds, for applications for the euro area aggregate and/or pools of euro area countries' data see Pérez (2007), Silvestrini et al. (2008), Onorante et al. (2009), Pedregal and Pérez (2010), Paredes et al. (2009), Asimakopoulos et al. (2013).

scattered sources, and put together a database usable for economic analysis. Second, they exploit the compiled information by fitting time-series, mixed-frequencies models to the data, and show the forecasting and monitoring capabilities of the selected short-term spending indicators. Third, they show that official annual budgetary targets presented useful guidance as to the actual course of sub-national fiscal spending, in particular when combined with short-term indicators-based forecasts. On the other hand, Leal and Pérez (2009) focus on the central government sector. They develop a temporal aggregation ARIMA model to monitor and forecast the annual Spanish central government deficit in order to detect in advance a possible deterioration of the annual public sector balance, using monthly data. They compare the predictive performance of the proposed model with competing forecasting methods, such as annual forecasts directly derived from monthly ARIMA models, and official forecasts published by the government. The results confirm the large improvement in forecasting performance of the aggregated ARIMA system when compared to other alternatives. Finally, Leal and Pérez (2005) assess adherence to announced budgetary targets of a set of fiscal revenue data for the AC of Andalusia, by employing the methodology of Kanda (2002) to evaluate the likelihood of meeting annual fiscal revenue targets, given partial-year monthly data.

In turn, Leal, Pérez and Pedregal (2010), put forward a more general approach. They construct multivariate, state-space mixed-frequencies models for the main components of the Spanish General Government sector made up of blocks for each one of its subsectors: Central Government, Social Security and aggregate of Regional and Local government sectors. Each block is modelled through its total revenue and expenditure categories, and encompasses a number of indicators, depending on data availability.

The contribution of the our paper can be seen, from the methodological point of view, as a step forward from Leal, Pérez and Pedregal (2010). Their mixed-frequencies approach is particularly relevant for the case of Spain, given its institutional set-up and the specific data availability for the different sub-sectors. In our paper we explore a much broader set of models, confronting their quite aggregated models with a number of single-variable models, thus enabling a clean comparison of bottom-up versus top-down approaches to the problem at hand: monitoring and forecasting general government borrowing requirements. A second contribution of our paper is that we cover the whole euro area period, 1999Q1 till 2012Q4, i.e. in particular we cover all crisis years up to the last fiscal year for which data is available as of the cut-off date of information for our paper.[7] Finally, and quite notably, our paper goes beyond previous only research-oriented academic contributions, and

[7]The 2013 fiscal outcome will only be published at the end of March 2014.

provides in addition to the research contribution a fully-implementable toolbox usable for real-time monitoring of public finances. As regards the latter, a database of monthly and quarterly fiscal indicators fully updated every week is provided with the paper,[8] as well as a fully-documented MATLAB toolbox that uploads the data, runs all the models and provides standardized output files, also available from the authors upon request. All in all, some 20 different models are run over a dataset including more than 300 fiscal variables, and this is done automatically in a few hours of computing time.

3 The institutional framework

A number of institutional matters have to be discussed before jumping to the econometric methodology. This is so, because, first, Spain is a quite fiscally decentralized country, but has been so in following successive waves of fiscal decentralization since the early 1980s. This devolution process is also reflected in the different coverage of available fiscal time series over time. Secondly, the Budgetary Stability Law that entered into force in May 2012 implied a substantial step forward in two respects quite relevant for the purposes of our paper. On the one hand, the law posed quite some emphasis on ex-ante and ex-post monitoring and control procedures. On the other hand, the Law has contributed fundamentally to the transparency of fiscal accounts, meaning that a huge additional amount of fiscal data has become public since May 2012. Finally, Spain is a member of the European Union, and as such is also subject to supra-national fiscal rules. In particular, since 2009 the Spanish Government has been under an "Excessive Deficit Procedure" (EDP), i.e. it has to respect annual fiscal targets set by the European Council that have to be met by the Spanish authorities.

The following subsections touch upon these issues.

3.1 The territorial structure

Spain is currently one of the most decentralized countries in the European Union. As an example, in 2010 close to 50% of general government expenditure was carried out by sub-national governments, with about 35% and 13% in the hands of regional governments and local governments, respectively (see, e.g. Hernández de Cos and Pérez, 2013). This is the result of a gradual transfer of responsibilities for the management of specific services from the Central Government to the

[8] See also de Castro et al. (2014) for details on the input database.

Regional Governments (Autonomous Communities, AC) since the beginning of the 1980s. In particular, sub-national governments are currently responsible for close to 100% of public expenditure on health care and education, and they manage a significant part of other expenditure functions. The transfer of expenditure responsibilities from the Central Government (CG) to the ACs has, however, neither come about at the same pace, nor have they been on the same scale in all ACs. The main differences concern the time at which the various ACs took over education and health competencies.

In parallel to this process of devolution of expenditure responsibilities to the regions, a financing system for the sub-national governments was also progressively developed. Again, the process was not completely homogeneous across regions, and changed more or less every five years. Before 1987, ACs were basically financed with CG transfers. As of the 1992 regional financing arrangements (for the five-year period 1992-1996) introduced for the first time a specific tranche of the share in Central government revenue, corresponding to the share of 15% of "territorial" personal income tax payments (those arising within each region). Subsequent agreements widened AC's tax resources and extended the regulatory powers of ACs in relation to assigned taxes. In particular, the last reform of the financing agreements was approved at the end of 2009. The new system raised the amount of taxes transferred (to 50% in the case of the personal income tax and VAT; to 58% in the case of excise duties on manufactured production of alcohol, tobacco and hydrocarbons)[9] and ACs received additional powers to modify their rates in some of these taxes.[10] [11]

In the case of local governments, the spending responsibilities assigned to them are regulated by the Local Government Act of 1985, which establishes a minimum list of services to be provided by them, the so-called compulsory services. This list of "compulsory services" increases with population size.[12] As a result, the financing system of local governments also changes with size. In particular, under the current system that entered into force in 2004, local governments revenues come from own taxes, property, fees and surcharges on central and regional taxes, subsidies, reg-

[9] ACs keep the 100% collection of the hydrocarbon-oil retail sales, electricity tax, property and stamp duty tax, tax of registration of motor vehicles, taxes on gaming, wealth tax and inheritance and gift tax.

[10] With the exception of the VAT, excise duties and electricity tax.

[11] In addition, the criteria for distributing the different tax revenues and transfers to the regions changed (i.e. the so-called Guarantee Fund, Global Sufficiency Fund, Competitiveness fund and Cooperation fund). See e.g. Hernandez de Cos and Pérez (2013) for further details on this issue.

[12] For additional details see, e.g. Solé-Ollé and Bosch (2007). On January 2014 a new "Local government reform act" entered into force, that incorporated a number of new elements to the definition of services provided by local governments.

ulated prices, fines and sanctions. In the case of local governments that are capitals of a province or AC, or which have over 75,000 inhabitants, they are also assigned a part of the personal income tax, VAT and taxes on alcohol, hydrocarbons and tobacco.[13]

The long process of devolution of spending and revenue capabilities to the regions has several implications for the purposes of our project. Firstly, changes in system/spending responsibilities (substantial up to 2002 for spending, and up to 2009 for revenue) induce structural breaks in the time series of the sub-sectors of the general government, and make it difficult the evaluation of the performance of dedicated models on the basis of past data. Regional/local government data of sufficient quality and at the quarterly/monthly frequency has only been disseminated quite recently, and its usefulness in general-purpose models is still limited (see the discussion in Fernández-Caballero et al., 2010). Secondly, notwithstanding the previous comment, it is possible to set up models for the sub-sectors of the general government, but more from a forward-looking point of view, i.e. it is hard to validate them on the basis of standard, out-of-sample forecasting exercises, but this does not invalidate its potential use for current policy-making.

3.2 The budgetary surveillance framework

In September 2011 it was decided to reinforce the prevailing framework of budgetary rules in Spain with the approval of a constitutional reform. The reform enshrines in the Constitution the obligation for all tiers of general government to adjust their conduct to the principle of budgetary stability. Subsequently, on 27 April 2012, the Organic Law of Budgetary Stability and Financial Sustainability (BSL) implementing this constitutional reform was approved, replacing the stability laws in force. The BSL made significant amendments to the definitions of and the mechanisms for determining the deficit, debt and public spending limits applicable to the different levels of government, along with changes in correction procedures and mechanisms in the event of slippage (see, e.g. Hernaández de Cos and Pérez, 2013).

The BSL establishes a very detailed procedure for the annual setting of budgetary objectives for the overall general government sector and its agents. Further, it details the mechanisms for the monitoring of the fulfilment of these objectives, it establishes significant improvements in terms of transparency of public finances and it provides for a set of instruments to prevent slippage or to redress it should it arise. In the first quarter of year t+1 the Ministry of Finance has to issue a report stating which tiers of the general government met their targets. When, in normal

[13] Between 1% and 2% depending on the tax and whether it is a municipal or provincial one.

circumstances, a central, regional or local administration fail to meet the budgetary stability, public debt or spending rule objectives, they shall draw up a Financial Economic Plan (FEP) providing for the correction of the slippage within 1 year. If the exceptional circumstances envisaged in the Law occur, the emergence of slippage will require the submission of rebalancing plans (RP) that include the paths envisaged to attain once more the budgetary stability or public debt objective. In that case, the Law sets no deadline for correction.

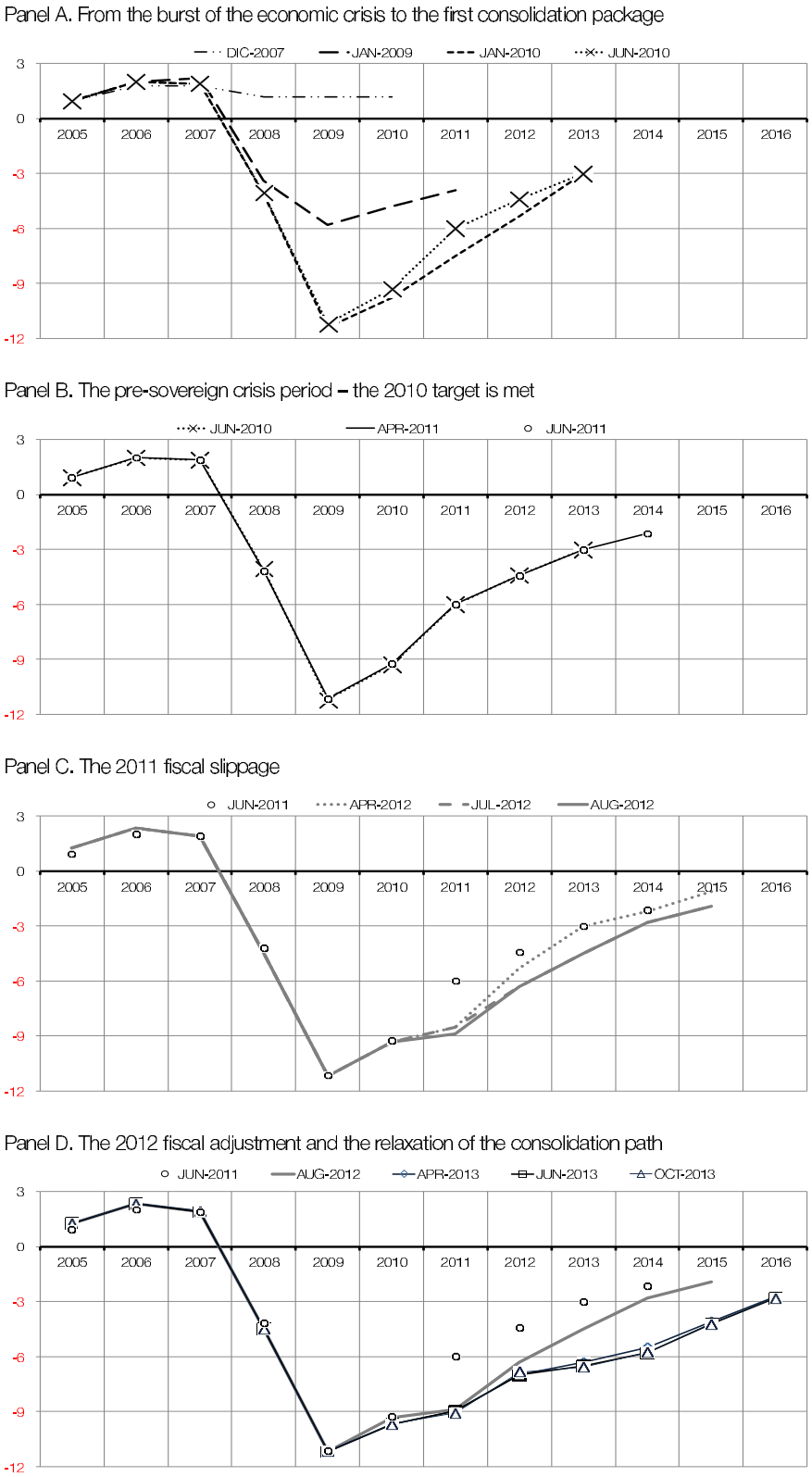
As regards FEP and RP, some intra-annual monitoring procedures are envisaged. The Ministry of Finance shall report quarterly on the monitoring of all ongoing FEP and RP. If, in any report, slippage in the application of the measures were to be verified, the level of government responsible shall be required to correct it. If, in the following quarterly report, it is verified that the measures of the plan have not been complied with and that this may lead to non-compliance with the stability objective, the Ministry may impose the coercive measures envisaged in the Law. In the one year and a half in which this clauses have been applied so far, quarterly reports have been issued only on non-compliant regional governments, and even though they have been an improvement with respect to previous practice, they tend to adopt a backward-looking perspective, and no preemptive action has been asked, despite repeated occurrence of non-compliance with pre-set fiscal targets. Precisely, it is in these type of quarterly reports in which the use of additional tools could be of help.

In addition to the BSL, the Spanish Parliament approved in November 2013 the creation of the so-called "Independent Fiscal Responsibility Authority" (AIRF), that should be fully operational over the first half of 2014. According to the law that establishes this new figure, its aim is "to guarantee effective compliance by all public authorities with the principle of budgetary stability and financial stability", principles that were introduced in Spanish legislation by the September 2011 constitutional reform and subsequently developed in the BSL in 2012. The AIRF would be in charge of issuing non-binding reports on macroeconomic forecasts and budgetary plans, and monitoring adherence of the different public administrations to budgetary targets. It remains to be seen how this mandate will be implemented.

4 Budgetary targets during the crisis and beyond

Since the burst of the economic and financial crisis in 2008, the adherence of realized government policies to budgetary targets has been a story of defeats, in most European countries. Certainly,

Figure 1: Multi-annual budgetary targets and outcomes over the crisis: 2008-2013. General government balance targets as percentage of GDP.



SOURCE: SPU, PP, BSO. The budget balance excludes the one-off impact of financial assistance to the banking sector in 2011, 2012 and 2013.

it has been the case in Spain. The difficulties in forecasting government borrowing needs are well documented in the literature, not only by governments, but also by other fiscal forecasters.[14] An unanticipated revision of the estimated deficit by the government can be unpredictable (due to unforeseen adverse economic shocks and their impact via automatic stabilizers) or predictable if some type of strategic/electoral behaviour is considered, as the literature on politically-motivated fiscal forecasts might suggest. Without entering into any type of positive analysis, in this subsection we describe the target public deficit paths defined by the Spanish and European authorities over the period 2008-2013. We also confront those targets with ex-post, real-time realized outcomes to highlight the need to incorporate additional elements in standard toolkits to detect in advance budgetary slippage. This is done in Figure 1.

According to the Spring 2009 EDP notification, the general government recorded a deficit of 3.8% of GDP in the fiscal year 2008. By June 2008 most national and international institutions still projected a budgetary surplus for 2008, and only some institutions timidly turned their estimates to small deficits for the whole year after the summer. Nevertheless, as late as October 2008 the government still estimated a deficit of 1.5% of GDP, slightly above the 1.6% deficit projected by the European Commission around the same date (see EC, 2008). The same estimate for 2008 was kept as a reference by the government in the budget law for 2009 that passed parliamentary approval at the end of December. At the beginning of January, though, in the framework of the updated Stability Programme for 2008-2012 (line "JAN-2009" in Panel A of Figure 1), the government provided an estimated deficit for 2008 of 3.4% of GDP, close to the final figure. At the same time, the whole medium-term deficit target path was revised downwards, and the objective for 2009 was set at close to 6% of GDP.

Nevertheless, the deepening of the crisis and, mainly, the enacted fiscal stimulus packages enacted at the end of 2009 led the general government deficit well beyond 11% of GDP. Also in the summer of 2009 Spain was put under an "Excessive Deficit Procedure" (EDP), whereby the "Excessive deficit" had to be corrected by 2013 (i.e. in 2013 the overall government deficit had to be at or below 3%). The significant deterioration of public finances led to the May 2010 public debt crisis, that forced the government to launch a sizeable fiscal consolidation package, including across-the-board spending cuts that hinged particularly on the wage bill. The medium-term target of a deficit of 3% of GDP in 2013 was maintained, but part of the assumed fiscal consolidation effort was frontloaded to 2011 (difference between lines "JUN-2010" and "JAN-2010" in Panel A).

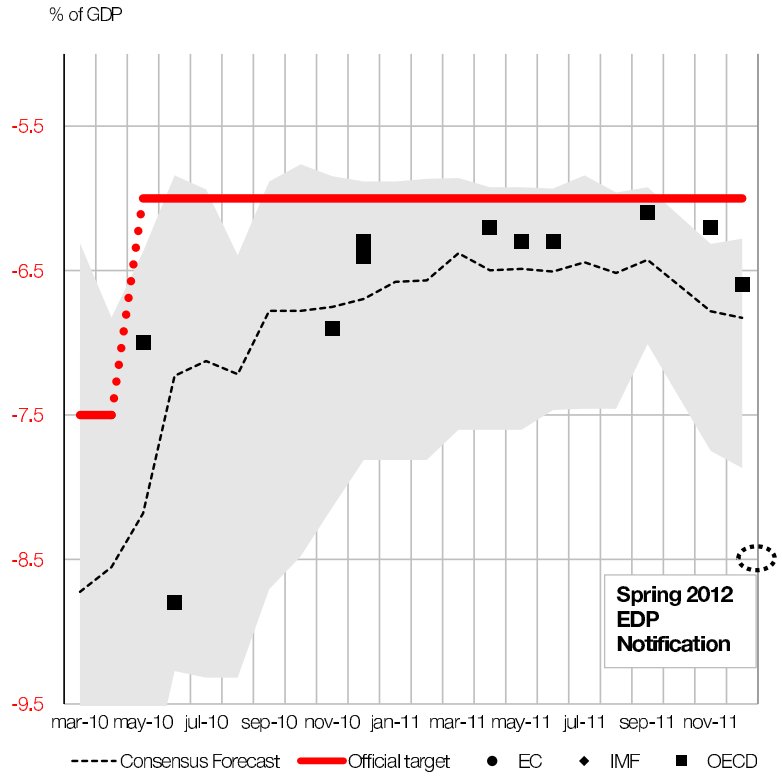
[14] See, e.g. Hannon (2014).

The May 2010 fiscal adjustment plan was perceived by markets and international organizations as broadly credible, given that the 2010 revised fiscal target was met. The successive medium-term plan/objetives (April 2011, June 2010) kept the same targets, also in line with the EDP requirements. This is clear from Panel B of Figure 1. The government insisted until the very end of 2011 that the objective of a 6% of GDP deficit in 2011 was reachable. But the April 2012 publication of the 2011 budgetary outcome shown a public deficit outcome well-above 8.5%. As shown in Figure 2, the government managed to anchor the expectations of private forecasters (summarized by the mean of the "Consensus Forecast" panel) and independent public analysts (European Commission, OECD and IMF). The anticipated budgetary deviation was on average less than 1% of GDP, and even the most extreme forecaster fall short of the deficit figure published in Spring 2012 (a deficit of 8.5% of GDP in 2011), that was even revised upwards in subsequent revisions.

The fiscal slippage of 2011 brought about a substantial reaction in the markets, and the European Council, also in view of adverse macroeconomic projections, decided to loosen the adjustment path toward the EDP, that was postponed by one year to 2014 (Panel C of Figure 1). In the year 2012 the fiscal adjustment was quite sizeable, also in view of adverse economic conditions, and the deficit was significantly reduced (in particular in structural terms), even though the target deficit-to-GDP ratio was missed by some half percent of GDP. In view of the effective action taken by the Spanish government in 2012, the path of adjustment towards the 3% was relaxed again in June 2013, in such a way that the end to the EDP procedure was postponed till 2016.

The previous discussion has been kept on purpose at a descriptive level, and also the focus on the crisis. There are no published studies on the economic and political-economy determinants of budgetary deviations for the general government in Spain. Nevertheless, some papers have documented for the central government sector (*Estado*) the existence of systematic biases in budget estimates when compared to realized outcomes, for the pre-crisis period (since the 1980s till 2009). In this respect see Leal and Pérez (2009) and Pons and Solé (2001) that analyze these issues in empirical frameworks in which economic, institutional and political-economy controls are included. See also de more descriptive approach of Edo (2012). On the determinants of the budgetary deviations of regional governments see Leal and López-Laborda (2013) and Argimón and Martí (2006).

Figure 2: The 2011 fiscal targets (red, horizontal lines): forecast prepared by different private and public institutions for the general government balance in 2011, from different forecast origins.



SOURCE: SPU, Consensus Forecast, OECD, IMF and EC Spring and Autumn reports, several years. The grey area represents the distance between the max and min forecast within the Consensus Forecast pool of forecasters.

5 Description of the data and publication lags

5.1 The data

As mentioned above, the excellent coverage of central government budgetary execution accounts at the monthly frequency, kept on loosing relevance as the devolution process to regional governments continued over the 1990s and, specially, the 2000s. The BSL posed a great deal of emphasis on the transparency of budget plans and the production of new budgetary execution statistics. As regards the former, the BSL states that the budgets of all general government tiers should include exact information so as to relate the balance of revenue and spending in the budget to net lending or net borrowing according to the European System of Accounts (ESA). As regards the latter, the BSL establishes some minimum reporting requirements for ACs and municipalities, including most notably monthly outturns of ACs revenue and spending, and quarterly outturns in the case of local governments, along with all the information needed to calculate the budgetary outturn in terms of national accounts.[15] Thus, from June 2012, the IGAE began to regularly publish quarterly accounts of all general government sub-sectors in terms of ESA95. Also, since October 2012, the statistical agencies have been publishing regularly ACs monthly accounts in terms of budgetary accounts and, since March 2013, ACs and Social Security monthly accounts in terms of national accounts.

From the point of view of fitting empirical models, the newly published time series, that cover at most one year and a half, are of limited use. Nevertheless, they will become the series of references, and have to be somehow connected to the rest of the information on which a wealth of historical information is available.

Table 3 shows a summary of the main variables included in the dataset employed in the paper. It comprises a total amount of some 300 time series, taken from different official providers of statistics (IGAE, INE, BDSICE, Bank of Spain), and covers the period 1985-2013. The data covers the General Government sector and its subsectors. Part of the dataset is in line with ESA95 standards, while another part follows public accounts (cash) accounting rules.

[15] Ministerial Order HAP/2105/2012 of 1 October 2012 implementing the reporting obligations envisaged in the BSL.

Figure 3: Summary of the data used in the surveillance system.

Non-financial series	ESA95 coverage*	Periodicity	Sample period	Basis	Source**	Units
General government total revenue General government total expenditure	S.13 GG	Annual, quarterly	1985-2012 (2012Q1-2013Q3)	ESA95	INE (BADESPE database), IGAE	Mrd EUR
Central government total revenue Central government total expenditure	S.1311 CG					
Regional government total revenue Regional government total expend.	S.1311 RG					
Social Security total revenue Social Security total expenditure	S.1314 SS					
General government total revenue General government total expenditure	S.13 GG	Quarterly	1995-2013	ESA95	IGAE, Eurostat	
Labour force survey: GG employment Monthly aff. to soc.sec.in non-market Investment of Estado Public work tenders		Monthly, Quarterly	1995-2013		IGAE, INE, Eurostat, other	
Direct taxes Indirect taxes VAT taxes Social security contributions Other revenues Real government consumption Nominal Government consumption Public investment Other capital expenditure Interest payments Social payments Subsidies Other expenditures PUBLIC DEBT	S.13 GG S.1311 subsector (Estado)	Monthly, or Quarterly	1985-2013	ESA95	IGAE and INE	
Total cash non-financial receipts	S.1314 subsector (Social Security System)			Cash	BDSICE database (cod. 731102G)	
Total contributory social benefits Pensions Unemployment benefits					BDSICE database (cod. 731210)	
Total expenditure	S.1314 subsector (Public State Employment Service)				Public State Emp. Service	
Ceded (own) taxes of regional governments	Regional governments	Monthly	1984-2013	Cash	BDSICE database	
Shared taxes Personal income tax Corporate Taxes VAT Excise duties	Central + regional + local governments	Monthly	1995-2013	Cash	BDSICE database (cod. 753100)	

(*) ESA European System Account; GG General Government; CG Central Government; LG Regional and Local Governments' aggregate; SS Social Security.

(**) INE Spanish National Institute; IGAE General Comptroller of the State Administration

5.2 Publication lags and timing convention

Quarterly non-financial accounts for the General government and all its sub-sectors are published regularly with a delay of 90 days. Monthly data for the State sector ("Estado") is published with a lag of one month. Also with a lag of one month are published the data on shared taxes' collection, and social security system outturns, in both cases in cash terms. As regards the newly available information, monthly national accounts data for the Central Government, the ACs and the Social Security, are published with a delay of broadly two months.

For the counterfactual, forecasting exercises that will follow in a subsequent section of the paper, following the information provided in the previous paragraph we replicate the real-time constraints faced by real-time fiscal policy analysts, and thus we adopt the timing rules displayed in Table 1, following the standard dates of dissemination of data at the different frequencies. In the table we show the available information in each quarter of a given year. Annual ESA95 figures for year $t-1$ are first released by Eurostat/IGAE in March/April of year t but the validation processes by Eurostat of figures reported by the national statistical agency render April/May as the actual date in which usable/reliable figures are available to an outside analyst. Thus, from a quarterly observation perspective, it is fair to assume that the annual figure for year $t-1$ is only available in the second quarter of year t. In a related fashion, the quarterly ESA95 figures for the fourth quarter of year $t-1$ are only available in the course of the second quarter of year t. Regarding monthly national accounts and cash accounts, we follow the assumption of availability with a lag of two months. We deem this convention also as a fair heuristic representation of reality, on average.

Nevertheless, it is worth mentioning that we will not use real-time data, but revised data as available in October 2013. Of course, the empirical exercises that follow would have some counterfactual features in that data revisions might have affected the lessons drawn from the application of the toolbox in relation to a today's re-creation. Given the absence of historical data records, it is not possible to fully re-create the real-time nominal fiscal series that would have been available at each point in time time. Nevertheless, we illustrate the specific case of the year 2011 for which we have compiled a truly real-time database for four different months of each year.

Table 1: Timing rules.

	Q1 year t (March)	Q2 year t (June)	Q3 year t (September)	Q4 year t (December)
Available annual (A)	A $t-2$ (March)	A $t-1$ (April)	A$t-1$	A $t-1$
Available quarterly (Q)	Q3 $t-1$	Q4 $t-1$ (April)	Q1 t	Q2 t
Available monthly (M)	Jan. t	Jan-April t	Jan-July t	Jan-October t

6 Main features of the toolkit

6.1 A suite of models

Given the different sampling frequencies of the time series included in our dataset, we estimate multivariate, mixed-frequencies models, of the unobserved components type (along the lines of Harvey and Chun, 2000). These type of models have been used with success in the field of fiscal forecasting (see e.g. Asimakopoulos et al., 2013; Pedregal and Pérez, 2010; Leal, Pedregal and Pérez, 2010). Their flexibility allows us to accommodate a number of policy-relevant exercises, most notably: (i) production of unconditional forecasts for all the variables of interest that can be used to assess in real-time the probability of meeting the annual official fiscal targets; (ii) distribution across quarters of annual fiscal forecasts (official government targets, or European Commission forecasts) on the basis of the available short-term fiscal information, to assess consistency of fiscal plans with incoming data.

In particular, the toolkit is designed to produce a number of forecasts, along the following lines: (i) Unconditional forecasts: tool to assess the relevance and consistency of incoming fiscal data with stated annual budgetary plans; (ii) Forward-looking policy measures and conditional forecasts: sometimes, in particular at the beginning of the year incoming fiscal data cannot capture the impact of just announced fiscal plans for the whole year. How to incorporate this? First: using incoming data to fix current-quarter figure, conditional to the annual target. Second: are incoming figures (from a 1-q-ahead perspective) compatible with the quarterly profile consistent with the annual target? Third: need to move regular monitoring to the quarterly frequency (crucial role of conditional paths for this); (iii) A probabilistic assessment of compliance with annual budgetary targets, beyond point estimates, as it will be explained later on; (iv) Unconditional forecasts as a

device to update conditional forecasts: how to use unconditional forecasts to update conditional forecasts

We develop a number of models that look at the data from different, complementary approaches. In particular:

- Model 1 ("Joint model"): this is an aggregated model for total revenues and expenditures of the general government sector in national accounts. Three "indicators" (public accounts series pertaining to the central government and the social security system) are used for each general government aggregate, but the model is estimated jointly so that the dynamics of revenues and expenditures are jointly determined. This is in line with the literature, that predicts a tight linkage between revenues and expenditures (in the form of ni-directional causality relationships). The model is set up and estimated at the monthly frequency.

- Model 2 ("Direct model"): this is an aggregated model for the general government sector balance in national accounts terms. Short-term indicators are the monthly balances of the sub-sectors of the general government, in public accounts' terms. The model is set up and estimated at the monthly frequency.

- Model 3 ("Disaggregated model, components of total revenues and total expenditures"): single models for each one of the sub-components of total general government revenues and expenditures are produced independently, and forecasts for the general government borrowing requirements are produced by bottom-up aggregation. The models are set up and estimated at the quarterly frequency.

- Model 4 ("Disaggregated model, total revenues and total expenditures"): single models for total general government revenues and expenditures are produced independently, and forecasts for the general government borrowing requirements are produced by substraction. The models are set up and estimated at the quarterly frequency.

- Model 5 ("Joint, sectoral models"): models by each one of the sub-sectors of the General Government (Central, ACs, Social Security) along the lines of Model 1. Forecasts for the general government borrowing requirements are produced by aggregation.

- Model 6 ("Direct, sectoral models"): models by each one of the sub-sectors of the general government (Central, ACs, Social Security) along the lines of Model 2. Forecasts for the general government borrowing requirements are produced by aggregation.

The classes of models considered allow in particular to address the questions of interest, while at the same time providing information on the "bottom-up versus top-down" dichotomy and the "aggregate general government versus approach by sub-sectors" dichotomy.

All the models can be written in a common general form as described in the next sub-section.

6.2 Methodology

Our approach is closely related to Harvey and Chung (2000), Moauro and Savio (2005), and Proietti and Moauro (2006). [16] These papers use a temporal aggregation method that relies on the information contained on related indicators observed at the desired higher frequency. The statistical treatment of structural time series models is based on the state space form and the Kalman Filter (see Harvey, 1989). In our case this approach allows the estimation of a monthly model using annual, quarterly and monthly observations, and permit changes over time arising from an increase in sample size.

More specifically, all the models developed in our paper fit with the following general discussion. The description in this Section follow Pedregal and Pérez (2010) and Leal et al. (2010). The starting point of the modeling approach is to consider a multivariate Unobserved Components Model known as the Basic Structural Model (Harvey, 1989). A given time series is decomposed into unobserved components which are meaningful from an economic point of view (trend, T_t, seasonal, S_t, and irregular, e_t). Equation (1) displays a general form, where t is a time sub-index measured in quarters, z_t denotes the variable in ESA95 terms expressed at an annual and quarterly sampling interval (depending on availability) for our objective time series, and u_t represents the vector of quarterly indicators.

$$\begin{bmatrix} \mathbf{z}_t \\ \mathbf{u}_t \end{bmatrix} = \mathbf{T}_t + \mathbf{S}_t + \mathbf{e}_t \tag{1}$$

The general consensus in this type of multivariate models in order to enable identifiability is to build SUTSE models (Seemingly Unrelated Structural Time Series). This means that components of the same type interact among them for different time series, but are independent of any of

[16] Other approaches for modeling data at different sampling intervals are the methods based on regression techniques (Chow and Lin, 1971, Guerrero, 2003), the MIDAS (MIxed DAta Sampling) approach (see Ghysels, Santa-Clara & Valkanov, 2004, Clements and Galvão, 2007), the state space approaches of Liu and Hall (2001) and Mariano and Murusawa (2003), or the ARMA model model with missing observations of Hyung and Granger (2008).

the components of different types. In addition, statistical relations are only allowed through the covariance structure of the vector noises, but never through the system matrices directly. This allows that, trends of different time series may relate to each other, but all of them are independent of both the seasonal and irregular components. The full model is a standard BSM that may be written in State-Space form as (see Harvey, 1989)

$$\mathbf{x}_t = \mathbf{\Phi x_{t-1}} + \mathbf{E w_t} \tag{2}$$

$$\begin{bmatrix} \mathbf{z}_t \\ \mathbf{u}_t \end{bmatrix} = \begin{bmatrix} \mathbf{H} \\ \mathbf{H}^u \end{bmatrix} \mathbf{x}_t + \begin{bmatrix} \epsilon_t \\ \mathbf{v}_t \end{bmatrix} \tag{3}$$

where $\epsilon_t \sim N(0, \Sigma_\epsilon)$ and $\mathbf{v}_t \sim N(0, \Sigma_{\mathbf{v}_t})$. The system matrices $\mathbf{\Phi}$, $\mathbf{E}$, $\mathbf{H}$ and $\mathbf{H}^u$ in equations (2)-(3) include the particular definitions of the components and all the vector noises have the usual Gaussian properties with zero mean and constant covariance matrices (ϵ_t and $\mathbf{v}_t$ are correlated among them, but both are independent of $\mathbf{w}_t$). The particular structure of the covariance matrices of the observed and transition noises defines the structures of correlations among the components across output variables. The mixture of frequencies, and the estimation of models at the quarterly frequency, implies combining variables that at the quarterly frequency can be considered as stocks with those being pure flows. Thus, given the fact that our objective variables are observed at different frequencies, an accumulator variable has to be included

$$C_t = \begin{cases} 0, & t = \text{first quarter} \\ 1, & \text{otherwise} \end{cases} \tag{4}$$

so that the previous model turns out to be

$$\begin{bmatrix} \mathbf{z}_t \\ \mathbf{x}_t \end{bmatrix} = \begin{bmatrix} C_t \otimes \mathbf{I} & \mathbf{H\Phi} \\ \mathbf{0} & \mathbf{\Phi} \end{bmatrix} \begin{bmatrix} \mathbf{z}_{t-1} \\ \mathbf{x}_{t-1} \end{bmatrix} + \begin{bmatrix} 1 & \mathbf{HE} \\ \mathbf{0} & \mathbf{E} \end{bmatrix} \begin{bmatrix} \epsilon_t \\ \mathbf{w}_t \end{bmatrix} \tag{5}$$

$$\begin{bmatrix} \mathbf{z}_t \\ \mathbf{u}_t \end{bmatrix} = \begin{bmatrix} \mathbf{I} & \mathbf{0} \\ \mathbf{0} & \mathbf{H}^u \end{bmatrix} \begin{bmatrix} \mathbf{z}_t \\ \mathbf{x}_t \end{bmatrix} + \begin{bmatrix} \mathbf{0} \\ \mathbf{I} \end{bmatrix} \mathbf{v}_t \tag{6}$$

Given the structure of the system and the information available, the Kalman Filter and Fixed Interval Smoother algorithms provide an optimal estimation of states. Maximum likelihood in the time domain provides optimal estimates of the unknown system matrices, which in the present context are just covariance matrices of all the vector noises involved in the model. The use of the models selected and the estimation procedures described in the previous paragraph, allows the estimation of models with unbalanced data sets, i.e. input variables with different sample

lengths. This is a feature of relevance for the construction of the database at hand, given occasional differences in temporal coverage of indicators.

In our case, particular empirical specifications for each variable will be considered in the light of the available information (fiscal indicators). Let us provide some examples. For instance, for the case of the individual model for total government revenues, **z** comprises total government revenues in National Accounts terms, a variable that is available at the annual frequency from 1986-1999 and at the quarterly frequency from 2000Q1-2012Q4, while **u** is a matrix composed of three series (available at the quarterly frequency for the whole sample period): (i) a proxy to general government total revenues in public accounts (cash) terms; (ii) Central government total revenues and (iii) Social Security (SSS+SPEE) sector's total revenues. Models with more than one National Accounts variable also fit within the general formulation of this Section. In those cases, **z** includes several variables and thus **u** would have been a matrix with indicators by blocks for each component of **z**. For example, in the case of the model that jointly estimates and forecasts total revenues (TOR) and total expenditures (TOE) **z**= {TOR, TOE }.

6.3 Evaluating the probability of meeting the budgetary target

Building constrained forecasts for the indicated variable is straightforward in the present State Space framework, since it is as simple as setting the particular values for the indicated at the right time and running the models with time aggregation. Other approaches would need further analysis and calculations (see e.g. Gómez and Guerrero, 2006). The forecasts of the indicators would show a path compatible with all the information available, i.e. the indicated and leading indicators information and the estimated model, no matter how improbable such constrain may result.

We can still go one step further, by testing whether given targets by any independent public or private agencies are met by means of compatibility tests based on the model and its forecasts distributions. Following and adaptation of Gómez and Guerrero (2006) for a general State-Space model, let's assume all noises in the model are Gaussian, R is the vector of m future targets supplied by an independent agency and Y_F the forecasts of the model, with covariance matrix Δ_y. Meeting the constraints imply that $R = Y_F + u$, with $u \sim N(0, \Delta_u)$ and independent of any other noises in the model. Then, the compatibility test consists of evaluating the distance $d = R - Y_F$, which distribution is $N(0, \Delta_u + \Delta_y)$. For the estimated values in a particular model the compatibility test is based on $K = d' \left(\Delta_u + \Delta_y\right)^{-1} d \ /m \sim F_{m,T-np-1}$. When $u = 0$ the constraints are binding implying that should be met exactly, while the case of unbinding constraints imply that they are only

met approximately, maybe because the targets are forecasts themselves. The main inconvenient of the unbinding constraints is that an estimation of Δ_u is needed, and it is not simple how to estimate it.

The previous distribution may also be used to provide an estimated probability of meeting the constraints. In this regard, a distinction between deficit and revenues on one hand, and expenditures on the other, has to be taken into account. Certainly, the probability of meeting a deficit or revenue target is $P(Y_F \geq R)$, while the probability of meeting the expenditure target is $P(Y_F \leq R)$.

7 Some empirical illustrations

We perform a rolling forecasting exercise in which the selection of the forecast origin and the information set available at each date are carefully controlled for. In particular we evaluate the forecasts generated from four forecast origins per year from March 1999 to December 2012 (this makes up to 14 $\times$ 4 projections at each forecast horizon). The first forecast origin is March 1999, and following the timing convention outlined before (see Table 1) the annual information available covers up to the year 1997, the quarterly information up to 1998:Q3, and the monthly information up to January 1999. The second forecast origin is June 1999, with annual information up to 1998, quarterly up to 1998:Q4 and monthly up to January-April 1999. Then we move the forecast origin to September 1999 and so on and so forth until December 1999.

We present two standard quantitative measures of forecasting performance. Firstly, the ratio of the Root Mean Squared Errors (RMSE) of the different alternative models with respect to an annual random walk (i.e. no-change) alternative . Secondly, we also look at a qualitative measure of forecast performance, namely, the predicted change in the variable of interest. We focus on the forecast performance for annual projections, i.e. forecasts generated from each forecast origin for the end of the current year, as this is the main horizon of use for mechanical, time-series based forecast. From the point of view of a practitioner, forecasts of fiscal variables for a horizon longer than the current year is of less importance. Our tools are developed to monitor the budget, and the latter, in the case of Spain, follows an annual cycle. The main results of these exercises are presented in Table 2. In that table we show the relative root mean squared error of our models compared to the annual random walk extrapolation for a number of cases: (i) aggregate of the forecast errors generated for the whole year from all forecasts origins (baseline); (ii) forecasts errors computed on the basis of forecasts computed taking as forecasts origin the first quarter (Q1), the

second (Q2), the third (Q3) and the fourth (Q4); (iii) these exercises are presented for the whole sampleused for the rolling forecasting exercise ("Full sample"), for the "pre-crisis" sample (1999-2007), and for the crisis sample (2008-2012). The following messages can be highlighted from Table 2 for the results for the general government balance.

First, when looking at the full sample, and pooling all forecast errors (resulting from forecast origins Q1 to Q4), the most aggregated models (i.e. those that model directly the budget deficit), models 1 (general government) and model 6 (sub-sectors), is the best. All other models are close to these ones, with the exception of model 4. This relative ranking of models is broadly kept when looking into forecasts from each origin (Q1 to Q4, taken individually). Thus, with the exception of models 3 versus 4, in the other two cases more aggregate models outperform more disaggregated models. This can be taken as evidence that bottom-up approaches are not necessarily better than top-down ones, at least as regards forecast accuracy. Of course, in real-time, bottom-up approaches provide the advantage of giving a more comprehensive view, which can be an asset in cases like the current one in which overall performance across models is not overwhelmingly different. The main results on bottom-up versus top-down holds when looking into sub-samples.

Second, in general, the forecast accuracy of all models is better in the crisis sample than in the "expansion" one. This may reflect the fact that the models can do a fair job in periods of significant changes, while in a period with no fiscal stress and persistent economic growth, it is more difficult to beat a simple extrapolation of the past.

Third, across quarters, the forecasting performance of all models improves when more information about revenue collection and the implementation if spending plans kicks-in. This is quite clear for the second half of the year compared to forecasts prepared in the first half. In particular, in Q3 a fair amount of information for the first half of the year is assumed to be available, but only the first quarter of the general government accounts, while in Q4 the first half of the year is fully known. For projections prepared from forecast origin Q2 things are quite different. As in our timing convention, this is the quarter in which the annual figure of year $t-1$ is known, and this seems to create a discontinuity in how models process incoming information,as forecast accuracy is the worsens compared to Q1-based forecasts, a fact that may be linked to the realization of past data revisions, including the appearance of "hidden spending" not reflected in monthly/quarterly indicators, as in the case of 2011.

Fourth, when looking at revenue and expenditure errors, it is clear that absolute errors tend to be lower than government balance one. In particular, models are better at forecasting spending

than revenue.

Finally, in Table we compare the performance of the mechanical application of the models in a pseudo-real time exercise with the forecasts of the European Commission. The latter take into account not only observed data, but also all available, forward-looking information on budgetary plans, including additional corrective packages enacted by the governments in the course of the year. Even bearing in mind that we are comparing against a difficult-to-beat benchmark, the usefulness of the models to complement the views of the EC, or to provide risks surrounding EC's forecasts are clear, in particular when comparing to the combination of models [... to be added...]. In Table it is apparent that when a wealth of short-term information is available, i.e towards Q3, the data is already quite informative about the implementation of spending plans and/or the behaviour of revenue collection.

And additional exercise, this time a truly real-time one, i.e. based on the exact dataset available at each point in time, is shown in figure 4. In this figure we show a real-time application regarding the budgetary deviation of 2011. This is a very convincing illustration of the use of our system. As discussed in the methodological Section above, from each forecast origin, and conditional on the short-term information available, we can compute unconditional forecasts (as the ones shown in the previous tables) but also the consistency of these forecasts with government targets. This is what we show in the figures for total revenues and total expenditures (model 1) and those for the public deficits (models 1 and 2): the unconditional forecasts generated with each model from each forecast origin, and also the probability that the Government target were to be met (in parenthesis at the side of the date that defines the forecast origin).

8 Conclusions and policy discussion

On the basis of our results we claim that official monitoring bodies could expand, on the one hand, their toolkit to evaluate regular adherence to targets (moving beyond a legalistic approach) and, on the other, their communication policies as regards sources of risks of (ex-ante) compliance with budgetary targets as well as reasons for (ex-post) budgetary deviations had them occurred.

[to be completed]

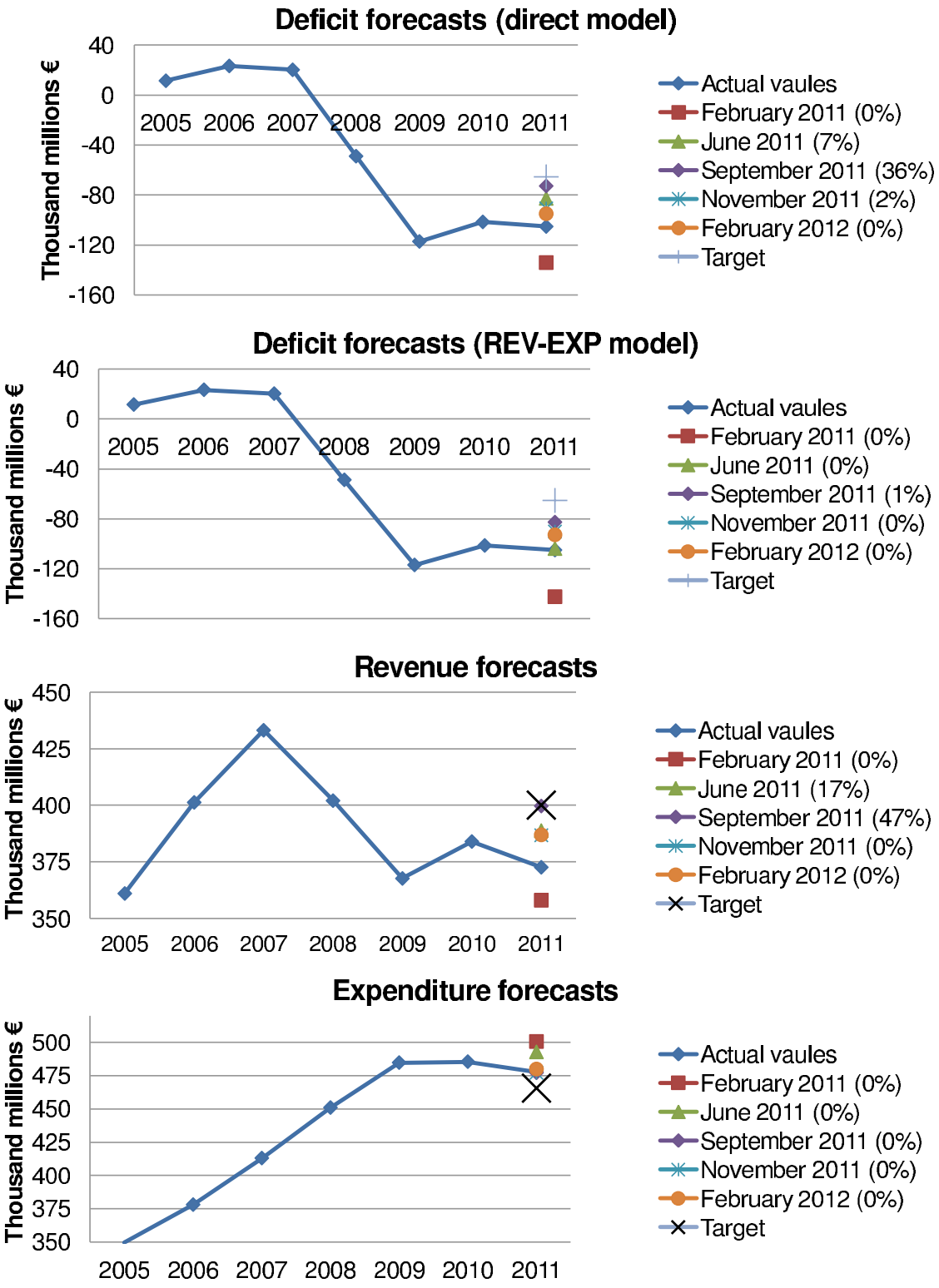
Table 2: Quantitative forecasting performance of alternative models: summary of results for the general government balance, total government revenue and total government expenditure. Forecast errors are computed as differences in levels (nominal) with respect to the observed value. The numbers in the table are ratios of RMSE of each model (labeled models 1 to 6) with respect to an annual random walk approach (no-change baseline).

	General government balance						**Total revenues**				**Total expenditures**			
	M1	M2	M3	M4	M5	M6	M1	M3	M4	M5	M1	M3	M4	M5
Full sample	0.72	0.70	0.72	1.11	0.77	0.66	0.56	0.62	0.86	1.20	0.37	0.38	0.63	1.11
Q1	0.76	0.69	0.69	1.03	0.80	0.65	0.52	0.54	0.76	0.91	0.34	0.37	0.55	0.82
Q2	0.95	0.94	0.99	1.44	1.00	0.86	0.82	0.85	1.15	1.56	0.48	0.52	0.86	1.53
Q3	0.58	0.65	0.69	1.16	0.68	0.58	0.58	0.75	0.94	1.52	0.42	0.34	0.70	1.40
Q4	0.44	0.41	0.41	0.83	0.46	0.50	0.33	0.45	0.70	1.24	0.26	0.23	0.53	1.23
Pre-crisis	1.66	1.38	0.94	0.77	0.92	0.70	0.28	0.27	0.27	0.51	0.23	0.22	0.26	0.53
Q1	1.58	1.09	0.90	0.66	0.68	0.54	0.21	0.32	0.24	0.36	0.21	0.22	0.23	0.37
Q2	2.19	1.99	1.40	1.05	1.34	0.94	0.49	0.23	0.36	0.68	0.28	0.29	0.33	0.70
Q3	1.55	1.38	0.82	0.88	1.04	0.75	0.33	0.18	0.29	0.69	0.22	0.19	0.29	0.71
Q4	1.36	1.36	0.48	0.61	0.86	0.79	0.16	0.20	0.25	0.56	0.27	0.20	0.25	0.61
Crisis	0.66	0.65	0.70	1.12	0.76	0.65	1.06	1.21	1.73	2.35	0.49	0.52	0.91	1.57
Q1	0.70	0.67	0.68	1.04	0.80	0.65	1.18	1.12	1.79	2.11	0.45	0.50	0.78	1.15
Q2	0.87	0.87	0.97	1.45	0.98	0.86	1.31	1.53	2.05	2.70	0.68	0.73	1.29	2.23
Q3	0.50	0.60	0.68	1.17	0.66	0.57	0.93	1.35	1.68	2.60	0.61	0.48	1.03	2.01
Q4	0.37	0.32	0.40	0.84	0.44	0.48	0.56	0.78	1.24	2.12	0.24	0.27	0.77	1.77

Table 3: Quantitative forecasting performance: selected models versus European Commission real-time forecasts (forecasted changes in deficit / forecasted rates of growth of revenue and spending). The numbers in the table are ratios of RMSE of each alternative with respect to an annual random walk approach (no-change baseline).

	Government balance			**Government revenue**			**Government expenditure**		
	M1	M2	EC	M1	M2	EC	M1	M2	EC
Full sample	2.22	1.27	0.70	0.23	0.17	0.25	0.19	0.27	0.18
Q1	2.39	1.15	0.53	0.15	0.13	0.21	0.22	0.30	0.16
Q2	2.87	1.74	0.95	0.33	0.21	0.32	0.20	0.29	0.20
Q3	0.80	1.05	0.95	0.27	0.15	0.32	0.12	0.21	0.20
Q4	1.84	1.33	0.59	0.27	0.27	0.22	0.14	0.19	0.21
Pre-crisis	1.43	1.41	0.95	0.30	0.29	0.29	0.24	0.21	0.17
Q1	1.17	1.07	0.98	0.22	0.35	0.28	0.20	0.19	0.13
Q2	1.93	2.06	0.94	0.53	0.24	0.32	0.30	0.28	0.21
Q3	1.71	1.46	0.94	0.35	0.19	0.32	0.24	0.18	0.21
Q4	1.17	1.37	0.89	0.11	0.17	0.24	0.30	0.20	0.18
Crisis	0.66	0.65	0.61	1.06	1.21	1.10	0.49	0.52	0.28
Q1	0.70	0.67	0.66	1.18	1.12	1.24	0.45	0.50	0.29
Q2	0.87	0.87	0.62	1.31	1.53	1.14	0.68	0.73	0.26
Q3	0.50	0.60	0.62	0.93	1.35	1.14	0.61	0.48	0.26
Q4	0.37	0.32	0.42	0.56	0.78	0.63	0.24	0.27	0.27

Figure 4: Real-time computation of unconditional forecasts and the probability of meeting the Government targets.



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