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Keywords: fiscal rules, fiscal policy, euro area, forecasting.

JEL classification: H62, H63, H68.

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1 Introduction

The failure of the Stability and Growth Pact (SGP) and the European sovereign debt crisis have brought the implementation of fiscal rules to the fore of many policy discussions. In several countries, a clear constitutional agreement concerning targets for or restrictions on fiscal aggregates has been proposed in order to ensure sustainable government finances. The German 'debt brake' is one example of a fiscal rule; Snower, Burmeister, and Seidel (2011) propose another fiscal rule which would allow for a high degree of anti-cyclical policy and a nonzero long-run debt ratio. For any proposed fiscal rule, it is important to develop projections about the future path of the public debt and primary surpluses, in order to understand the effects that such a rule might have. In this paper, we project the path of the public debt and primary surpluses in four large euro area countries, based on a fiscal rule calibrated to an estimated fiscal reaction function under a set of different consolidation scenarios. We argue that our forecasting methodology could be used to compare the future paths of fiscal aggregates implied by different fiscal rules and to provide an early warning of impending pressure to run large primary surpluses.[1]

We start by formulating a fiscal rule where the primary surplus automatically adjusts to the output gap and to the public debt. This rule represents a fiscal analogue to a well-known monetary policy rule, and it corresponds with a set of estimated fiscal reaction functions presented by Plödt and Reicher (2014). These estimated fiscal reaction functions are compatible with other estimates from the empirical fiscal policy literature.[2] We then set up a forecasting model which consists of the fiscal rule, a law of motion for the debt, and a simple multiplier relationship between the primary surplus and output. Based on the forecasting model, we simulate the projected debt and primary surplus paths of Germany, Italy, Spain, and France following different specifications of the fiscal rule. We find that a fiscal rule that encourages a strong reduction in debt levels within twenty years would result in substantial pressure for Italy to run large primary surpluses. Germany, Spain, and France face less pressure in this regard. For countries such as Spain, the transition from primary deficits to primary surpluses would occur gradually. As to be expected, a stronger than expected growth scenario results in less pressure to run large primary surpluses, while a weaker than expected growth scenario or a higher than expected interest rate results in worse fiscal pressure.

[1] We define a 'fiscal reaction function' as a positive description for how fiscal policy may behave, while we refer to a 'fiscal rule' as a normative constraint on the conduct of future fiscal policy. We focus on fiscal rules calibrated to resemble a set of estimated fiscal reaction functions.

[2] See, for example, Girouard and André (2005) on the cyclicality of fiscal policy and Afonso and Hauptmeier (2009) on the response of fiscal policy to the debt.

Our forecasts aim at delivering an insight into the medium-run effects of this particular type of a fiscal rule and at providing some early warning of future fiscal pressures according to the desired degree of fiscal consolidation, which is important since fiscal consolidation itself has macroeconomic effects. The forecasting methodology that we set up in this paper may also serve as a framework to analyze the effects of other types of fiscal rules, in conjunction with previous studies. While we leave a detailed analysis of the revised SGP to future work, we compare our results with the debt paths implied by that Pact. We find that our fiscal rules promote a slower rate of consolidation than the SGP at the outset, while allowing for a strong rate of consolidation in later periods.[3] In this vein, our positive forecasting methodology might also facilitate the implementation of a normative fiscal rule and enhance the credibility of a country's commitment to it.

2 Specification

Following the specification of fiscal reaction functions in Plödt and Reicher (2014), our fiscal rule allows for a response of primary surpluses to fluctuations in output Y_t and to the previous period's end-of-period debt-GDP ratio B_{t-1}/Y_{t-1}. The output response of the fiscal rule, governed by the coefficient a, reflects the automatic adjustment of the primary surplus to the output gap due to automatic stabilizers along with any other systematic anti-cyclical policy actions typically undertaken by individual governments. For instance, if the change in the output gap is minus one percent following a recession, the primary surplus would fall by a times the fall in output. The debt response of the fiscal rule, governed by c, reflects the systematic response of the primary surplus to the debt-GDP ratio. Here, we model our rule based on the version of the fiscal reaction function estimated by Plödt and Reicher (2014) in first differences, such that:

$$\Delta \frac{P_t}{Y_t} = a \left(\frac{1}{1+\bar{g}_t} - \frac{Y_{t-1}}{Y_t} \right) + c\Delta \frac{B_{t-1}}{Y_{t-1}} + \varepsilon_t, \tag{1}$$

where $\bar{g}_t$ is the potential growth rate of the economy. We focus on such a parsimonious rule because it captures the twin objectives of fiscal policy to stabilize output and to stabilize the debt level. Bénétrix and Lane (2013) and others look at more extensive fiscal reaction functions, finding some response of the government balance to the financial

[3] See Barnes, Davidsson, and Rawdanowicz (2012) for a practical evaluation and critical discussion of the revised SGP, which may encourage a very low steady-state debt ratio. Additionally, Barnes, Davidsson, and Rawdanowicz (2012) assume that the future path of output is exogenous, while we assume that output is endogenously determined through a simple multiplier mechanism. In fact, we have faced significant problems with stability and existence in simulating the effects of the debt path target under the revised SGP, to the extent that fiscal multipliers significantly deviate from zero.

cycle. Since we assume that the financial cycle (and also inflation and interest rates) are exogenous in our model, we instead use a relatively simple fiscal rule in order to focus on the issues related to different consolidation speeds.

While the proposed rule of Snower, Burmeister, and Seidel (2011) is specified in levels, we find in Plödt and Reicher (2014) that a specification in levels (with a proper allowance for persistence in residuals) and a specification in first differences both deliver similar coefficients to each other. Both specifications indicate that fiscal impulses have a high degree of extrinsic persistence. In practical terms, this set of results implies that the debt-GDP ratio has a unit root or a near-unit root. This persistence needs to be taken into account when making forecasts or designing alternative fiscal rules which resemble past behavior. We use the specification in first differences because it is more parsimonious than the specification in levels, and small refinements on our specification lead to a gradual transition toward more contractionary fiscal policy in the medium run. As Barnes, Davidsson, and Rawdanowicz (2012) point out, a specification in levels without an allowance for a slow transition, such as a '1/20' rule, would force a sharp contraction of fiscal policy upon impact. Seemingly minor issues related to the specification of a fiscal rule can yield vastly different policy prescriptions when put into application.

In addition to our baseline rule, we also consider a rule of the form:

$$\Delta\frac{P_t}{Y_t} = a\left(\frac{1}{1+\bar{g}_t} - \frac{Y_{t-1}}{Y_t}\right) + c\Delta\frac{B_{t-1}}{Y_{t-1}} + d^{CR}\left(\frac{B_{t-1}}{Y_{t-1}} - b^{CR}\right)_+ + \varepsilon_t. \tag{2}$$

The additional term $\left(\frac{B_{t-1}}{Y_{t-1}} - b^{CR}\right)_+$ equals the excess debt ratio, i.e. the extent to which the debt-GDP ratio in the previous period exceeds the critical level b^{CR}. Following Snower, Burmeister, and Seidel (2011), we set b^{CR} to 0.6 to reflect the 60 percent debt limit laid out by the SGP. The coefficient d^{CR} captures the degree to which the primary surplus is expected to incrementally adjust in response to the excess debt ratio, in order to bring the long-run debt-GDP ratio back below its critical value.

3 Calibration of the fiscal rule

We base our calibration on the estimates presented by Plödt and Reicher (2014) of a fiscal reaction function that corresponds with the fiscal rule (1). The estimates are based on yearly data from the European Commission's AMECO database, extended with data from the OECD for Italy and Spain. Most time series begin in the late 1960s or early 1970s and always end in 2007, in order to allow us to focus on fiscal policy before the

Great Recession. We use country-specific estimates as well as a panel estimate based on an unbalanced panel of all euro area countries excluding Luxembourg. We estimate (1) using two-stage least squares to deal with the possible endogeneity of output. Please see Plödt and Reicher (2014) for all details concerning the data and estimation procedure.

Table 1 contains the estimated coefficients governing the fiscal reaction function for our subset of countries. The panel estimates indicate a relatively strong average reaction of primary surpluses to the business cycle for the euro area, with a response of the primary surplus to the output gap between 0.4 and 0.5. Primary surpluses in the euro area also respond strongly, on average, to past debt levels, with a coefficient of about 0.09. Responses for individual countries vary, with Germany showing an especially strong degree of fiscal consolidation in response to the debt and France showing a particularly strong degree of anti-cyclicality in fiscal policy. Italian fiscal policy, meanwhile, is nearly acyclical, and it responds moderately to the debt level. It is worth noting that estimates at the country level come with a considerable degree of noise, and so we consider the euro area estimates as well, since these estimates potentially provide useful information about the conduct of fiscal policy at the country level.

We start with the estimated fiscal reaction functions as a baseline. We then vary the degree in our rule to which normal fiscal policy must be augmented by consolidation when the debt-GDP is above a certain ratio. By doing this, we can see the extent to which different required degrees of fiscal consolidation in levels result in different debt and output paths. These different possible versions of our rule represent a starting point for thinking about this issue, and they do not represent the final word on this issue.

4 Forecasting methodology

We set up a simple framework for medium-run projections under different assumptions regarding the coefficients governing the fiscal rule as well as regarding a handful of key parameters. To do this, we first derive the counterfactual level of output that would prevail in the absence of meaningful fiscal policy. We assume that output is related to the primary surplus and to the baseline level of output through a simple multiplier relationship. Then, based on the fiscal rule and the law of motion for debt, we jointly derive the equilibrium primary surplus, level of debt, and level of output through time. By comparing the paths of these objects under different sets of assumptions, we can understand the role which different assumptions may play in affecting the likely future path of fiscal policy.

4.1 Deriving the baseline level of output

To account for the endogeneity of output, we derive a 'zero-fiscal' baseline level of actual and potential output featuring no debt or primary net lending or borrowing. Zero-fiscal output is the level of output that would prevail in the absence of any fiscal interventions. We assume that zero-fiscal output is exogenous to the fiscal policymaker.

First, we assume a simple multiplier relationship, where output is equal to zero-fiscal output Y_t^* plus the effects of the primary surplus P_t mediated through a multiplier m, such that:

$$Y_t = Y_t^* - mP_t. \tag{3}$$

Similarly, potential output is equal to zero-fiscal potential output $\bar{Y}_t^*$ plus the effects of the long-run (potential) primary surplus $\bar{P}_t$ mediated through a multiplier m, such that:

$$\bar{Y}_t = \bar{Y}_t^* - m\bar{P}_t, \tag{4}$$

where $\bar{P}_t$ is given by the formula:

$$\bar{P}_t = \left(\frac{(1+\bar{i}_t)}{(1+\bar{\pi}_t)(1+\bar{g}_t)} - 1 \right) B_{t-1}, \tag{5}$$

where $\bar{i}_t$ and $\bar{\pi}_t$ equal the assumed trend interest rate and trend inflation rate, respectively.

We calculate zero-fiscal actual and potential output in this manner through 2014, based on forecasts published by the European Commission. We then calculate the zero-fiscal log output gap, which is equal to $log(Y_t^*/\bar{Y}_t^*)$. We assume that in the years beyond 2014, the zero-fiscal log output gap is equal to 0.8 times its previous value, and that zero-fiscal potential output grows at its trend rate $\bar{g}_t$. We then calculate the path of zero-fiscal output Y_t^* implied by these two laws of motion. This value is used as an input into the next step.

4.2 Forecasting the primary balance and output level

Equations (2) and (3) jointly determine the equilibrium fiscal balance in the years after 2014. By combining the two equations and using our forecast values of Y_t^*, we generate our forecast value of P_t which satisfies the condition:

$$P_t = \frac{1}{1+mj_t} \left(Y_t^* j_t - aY_{t-1} \right), \tag{6}$$

where:

$$j_t = \frac{P_{t-1}}{Y_{t-1}} + c\Delta\frac{B_{t-1}}{Y_{t-1}} + d^{CR}\left(\frac{B_{t-1}}{Y_{t-1}} - b^{CR}\right) + a\frac{1}{1+\bar{g}_t} + \varepsilon_t. \tag{7}$$

We assume that the white noise process ε_t is set to zero in the future. Given a value of P_t from (6), we calculate Y_t using (3). Finally, we calculate the end-of-period debt stock using the law of motion:

$$B_t = \frac{(1+i_t)}{(1+\pi_t)}B_{t-1} - P_t. \tag{8}$$

We iterate through these steps beginning in 2015 (the year in which we assume the fiscal rule to take effect) and then for every following year in the subsequent two decades.

5 The effects of different fiscal rules

5.1 Specification of convergence scenarios

We first simulate the path of the debt-GDP ratio and the primary balance-GDP ratio under our rule in first differences using potential output as a structural indicator, for both country-specific and euro area-wide fiscal rule coefficients. We then conduct an exercise to see what role the choice of different coefficients d^{CR} on the excess debt level may play, for a range of realistic values for that coefficient in conjunction with the euro area-wide fiscal rule coefficients. We argue that the choice of d^{CR} faces a tradeoff between medium-run debt stabilization and the desire for an accommodative fiscal policy path in the medium run. We choose coefficient values of d^{CR} that are in line with the euro area-wide estimates of Plödt and Reicher (2014). Estimates for individual countries of d^{CR} are not available due to the limited experiences of many individual countries above the 60 percent threshold.

We always assume a debt criterion of $b^{CR} = 0.6$ and a fiscal multiplier of $m = 0.9$. We allow the other parameters to vary. We calibrate our other parameter values to reflect the recent experiences of the countries in question. For the baseline values of $1+\bar{g}_t$ and $1+\bar{\pi}_t$ we use the geometric mean of gross growth in potential GDP and in the GDP deflator over the period 1999-2012, which includes periods both before and after the crisis. In the same vein, we assume that the trend interest rate $\bar{i}_t$ equals its mean over the period 1999-2012. Table 2 summarizes the baseline calibration. We investigate the effects of different assumptions regarding these quantities in the subsequent section.

Figures 1 through 4 show the projections for Germany, Italy, Spain, and France, respectively, under four calibrations of the fiscal rule. For each of these figures, we plot the path of the debt-GDP ratio in the upper left panel and the path of the primary balance-

GDP ratio in the upper right panel. Projections for real GDP are displayed in the bottom panel of each figure. In addition, we compare the implied debt paths with those given by a simple '1/20' rule according to the Fiscal Compact. We have attempted to compute paths of the primary surplus and of output which would support the '1/20' debt path. Unfortunately, for high debt-multiplier combinations such as those encountered in our simulations, we find that such paths do not in general exist. The main problem lies in that the debt-GDP ratio consists of two parts – a debt part and a GDP part. Above a certain debt threshold, an attempted fiscal contraction actually raises the debt ratio on impact, through multiplier effects on output. For realistic parameter values, a strict adherence to the '1/20' debt path in fact leads to explosive oscillations in output, the primary surplus, and the level of the debt. We hope to address this important issue in future work related to the design and implementability of fiscal rules, restricting our current exercise to a simulation of a primary surplus rule calibrated to past data.

In our current simulations, we distinguish between the following different scenarios in terms of the design of the fiscal rule:

1. Country-specific estimates for the pre-crisis response to the business cycle a and to debt growth c (see Table 1). The debt level correction factor d^{CR} is set to zero. This baseline scenario is intended to illustrate a fiscal rule based on the individual characteristics of each euro area country's fiscal policymaking process.

2. Euro area-wide estimates for the pre-crisis response to the business cycle a and to debt growth c (see Table 1). The debt level correction factor d^{CR} is set to zero. This scenario allows for a comparison between the fiscal policy paths implied by country-specific fiscal policy and an average euro area-wide fiscal policy process.

3. Euro area-wide estimates for the pre-crisis response to the business cycle a and to debt growth c (see Table 1). The debt level correction factor d^{CR} is set to 0.005, which is within the confidence bands presented by Plödt and Reicher (2014).

4. Euro area-wide estimates for the pre-crisis response to the business cycle a and to debt growth c (see Table 1). The debt level correction factor d^{CR} is set to 0.01, which is double the value from the previous scenario.

5.2 Results for different convergence scenarios

Projections for all four countries suggest a high sensitivity of the path of the debt-GDP ratio to small changes in d^{CR} over a twenty-year forecast horizon, with the larger differences coming later in the horizon. Projections for Germany (Figure 1) suggest that a

fiscal rule calibrated to scenario 1 or scenario 2 would result in a rapid stabilization of the debt-GDP ratio at a level near 80 percent (scenario 1) or 70 percent (scenario 2). The difference between these two debt paths comes about because Germany would be expected to reduce its primary surplus more rapidly under scenario 1 than under scenario 2 in response to a rapid fall in the debt-GDP ratio early during the forecast period. Increasing d^{CR} from zero to 0.005 (scenario 3) would result in a debt-GDP ratio of about 65 percent in twenty years, while increasing d^{CR} to 0.01 (scenario 3) seems sufficient to reduce the debt-GDP ratio to below 60 percent within the next twenty years. All four scenarios imply a path for the primary surplus that does not exceed three percent of GDP, with longer-term primary surpluses all relatively close to their current values.

For Italy, the different fiscal rule scenarios would imply a much wider range of variation in the paths of future debt and primary balances (Figure 2). Scenarios 1 and 2 would result in a debt-GDP ratio in twenty years' time of about 120 percent and 110 percent, respectively, with a primary surplus stabilized at about three percent of GDP. The future path of the debt-GDP ratio is extremely sensitive to d^{CR}. A value of 0.005 (scenario 3) would reduce Italy's debt-GDP ratio to about 80 percent in twenty years, and a value of 0.01 (scenario 4) would result in a debt-GDP ratio below 60 percent. However, both of these rules would require a primary surplus ratio of about five percent and over six percent of GDP, respectively. Were Italy to credibly reduce its debt-GDP ratio below 60 percent in twenty years, it would require an ambitious degree of fiscal austerity in the medium term. Note that the medium-run debt-GDP ratio implied by scenario 4 would be relatively close to the ratio based on a simple '1/20' rule, with the '1/20' rule requiring a more aggressive rate of debt reduction in the shorter run.

Projections for Spain (Figure 3) all point toward a persistently high debt-GDP ratio in the medium run, as Spain must first slow the growth in its debt-GDP ratio before actively working to reduce it. Scenarios 1 and 2 would result in a debt-GDP ratio which would level off at about 120 or 110 percent, respectively, in twenty years. Even with larger consolidation coefficients (scenarios 3 and 4), the debt ratio does not fall below 60 percent within twenty years, although it begins to fall rapidly in the later years. Spanish fiscal consolidation is accomplished at first with a slow move toward small primary surpluses from large primary deficits. While Italian fiscal consolidation faces challenges from the size of the surpluses required to significantly reduce the debt-GDP ratio, Spanish fiscal consolidation faces fewer challenges along that particular dimension. Under all four scenarios, Spain would be allowed to run substantial primary deficits in the short run.

Projections for France (Figure 4) depend strongly on assumptions regarding d^{CR}. Projections without an explicit level component (scenarios 1 and 2) seem to result in debt-GDP ratios which stabilize around 90 or above 100 percent of GDP, respectively. Under scenario 3, the debt-GDP ratio remains near 85 percent after twenty years, while under scenario 4, the debt-GDP ratio falls to nearly 70 percent. While none of these scenarios results in a debt-GDP ratio below 60 percent, scenario 4 results in a significant reduction of the debt-GDP ratio. Scenario 4 would require a primary surplus ratio of about three percent of GDP in the medium run while allowing for short-run deficits.

Altogether, based on the four scenarios, a debt reduction coefficient d^{CR} of 0.01 would substantially set the debt ratio onto a sustained downward path in all four countries. For two of the four countries, the debt ratio would not reach 60 percent after twenty years, although it would fall significantly from current levels. For Italy, such a degree of consolidation would come at the cost of a primary balance in excess of six percent of GDP, which is extremely high compared with historical experience for advanced countries. For the other three countries, consolidation would not have nearly such drastic implications for the primary balance. For France and especially Spain, consolidation would happen gradually, with a slow transition from primary deficits to primary surpluses occurring over several years. Differences in the level of real GDP are relatively minor across scenarios, with Italy again being the main exception. Here, the medium-run level of real GDP under scenario 4, would be around 2 percent smaller than under scenario 1.

6 Effects of growth and interest rate scenarios

6.1 Specification of growth and interest rate scenarios

To illustrate the relationship among fiscal policy, growth, and interest rates, we first note that the law of motion (8) implies the following law of motion for the debt-GDP ratio:

$$\frac{B_t}{Y_t} = \frac{(1+i_t)}{(1+\pi_t)(1+g_t)}\frac{B_{t-1}}{Y_{t-1}} - \frac{P_t}{Y_t}, \tag{9}$$

where $1+g_t$ equals the gross growth rate of output Y_t/Y_{t-1}. In order to maintain a constant debt-GDP ratio, the primary surplus ratio must be given by:

$$\frac{P_t}{Y_t} = \left(\frac{(1+i_t)}{(1+\pi_t)(1+g_t)} - 1\right)\frac{B_{t-1}}{Y_{t-1}}. \tag{10}$$

Based on equation (10), the primary surplus ratio necessary to maintain a stable debt ratio is increasing in the debt ratio and interest rates and decreasing in inflation and growth.

Based on the logic of equation (10), we quantitatively evaluate three additional scenarios, using scenario 1 as a baseline. To the degree that different growth and interest rate scenarios affect the constraints faced by governments, future fiscal policy must adjust to accommodate these realities. The additional scenarios are as follows:

5. Scenario 1, but with potential growth 0.5 percentage points higher than previously projected.

6. Scenario 1, but with potential growth 0.5 percentage points lower than previously projected.

7. Scenario 1, but with trend interest rates 1 percentage point higher than previously projected.

Given the obvious uncertainty particularly with regard to long-run growth paths, scenarios 5 through 7 might offer some information about the robustness of the fiscal policy projections under scenario 1.

6.2 Results for different growth and interest rate scenarios

Figures 5 through 8 examine the effects of these three different scenarios in comparison with scenario 1. In all four cases, as expected, a higher growth projection results in a somewhat lower debt-GDP ratio with a somewhat lower primary surplus. A lower growth projection results in a somewhat higher debt-GDP ratio with a somewhat higher primary surplus. The effects are somewhat larger in absolute terms in countries with a higher debt ratio, such as Italy, and somewhat smaller in countries such as France and Germany. As with lower growth, a higher interest rate also affects the future path of fiscal policy in all four countries. Not surprisingly, a higher interest rate will result in a higher debt-GDP ratio and a higher primary balance required to stabilize that ratio. Again, the effects of higher interest rates are larger in absolute value for countries with a higher debt level, with a one percentage point higher interest rate pushing the Italian primary surplus by the end of the forecast period up toward a level close to four percent of GDP. This is in the absence of any meaningful consolidation in debt levels. In contrast, a higher interest rates only marginally affects countries' future path of real GDP.

Scenarios 5 through 7 reflect the effects of different growth and interest rate outcomes on countries under a situation where they do not seek to consolidate the debt-GDP ratio

to a level below 60 percent. To the extent that this remains a goal, we evaluate three more analogous scenarios taking this goal into account. Under these three scenarios, we start with scenario 4 (the euro area-wide fiscal rule with a consolidation coefficient d^{CR} of 0.01) as a baseline. These scenarios are as follows:

8. Scenario 4, but with potential growth 0.5 percentage points higher than previously projected.

9. Scenario 4, but with potential growth 0.5 percentage points lower than previously projected.

10. Scenario 4, but with trend interest rates 1 percentage point higher than previously projected.

These scenarios enumerate the constraints faced by policymakers who wish to significantly reduce their debt levels under different possible growth and interest rate outcomes.

Figures 9 through 12 describe the different paths of the debt-GDP ratio and primary surplus-GDP ratio under scenarios 8 through 10 against a baseline of scenario 4. As expected, a higher growth rate again puts less pressure onto fiscal policymakers to run primary surpluses, while a lower growth rate or higher interest rate would result in higher primary surpluses required to reduce the debt. Under all of these scenarios, the debt-GDP ratio follows a similar path relative to scenario 4, for all four countries. What differs is the primary balance required to support these debt paths. In Germany, Spain, and France, the primary surplus required to support these debt paths remains below four percent of GDP throughout the forecast horizon. For Italy, the situation is different. Scenario 4 already requires a primary surplus above six percent of GDP at its peak. A more favorable growth path (scenario 8) would result in primary surpluses below those under scenario 4, though still in excess of five percent of GDP at its peak. A less-favorable growth path (scenario 9) or interest rate path (scenario 10) would put yet more pressure on Italy to run extremely large primary surpluses. To the extent that governments face constraints against running such large primary surpluses, Italy may experience difficulties in implementing a fiscal rule that features strong consolidation in the level of debt if potential growth were to fall below its baseline rate.

7 Conclusion

We have explored a number of different scenarios regarding the future path of fiscal policy in four major euro area countries using a simple and flexible fiscal rule, based on the past

behavior of fiscal policy. This rule features a strong degree of anti-cyclical fiscal policy, consolidation in debt growth, and possibly consolidation in debt levels. Our results with respect to different fiscal rules indicate that subtle differences in the debt level consolidation coefficient d^{CR} may have large effects on the path of the future debt-GDP ratio over a horizon of twenty years. For countries such as Italy, a high rate of debt consolidation would come at the cost of an extremely high ratio of the primary surplus to GDP. For Germany, Spain, and France, consolidation in the debt level toward the 60 percent cutoff would not require such large primary surpluses. In all four countries, under the rule that we analyze, consolidation would occur incrementally, so that a rapid increase in primary surpluses does not occur at the outset.

The level of the primary surplus needed in order to stabilize and reduce the debt ratio varies positively with the interest rate and negatively with the growth rate of real GDP. However, even if potential growth were to improve by 0.5 percentage points per year, a rapid pace of consolidation in Italy would still require a primary surplus ratio above five percent of GDP. Under a variety of growth and interest rate assumptions, Germany, Spain, and France would still require a primary surplus below four percent of GDP. We caution that our results assume away any other fiscal policy shocks or business cycle shocks. Our forecasts, therefore, should be viewed as a rough guide as to the characteristics of different consolidation scenarios based on past behavior, rather than as providing a full set of stochastic confidence intervals.

A useful set of extensions to our exercise would be to compare our results with those from alternative fiscal rules, in order to illuminate the tradeoffs policymakers face when choosing the form of a fiscal rule. Our attempts to simulate the '1/20' rule indicate that a poorly-designed rule might actually destabilize the economy at worst or be unenforceable at best. We believe that given that a fiscal rule is desired, a flexible, simple rule that substantially resembles past behavior would be more likely to succeed. Our results also indicate that an accurate reading of the potential growth rate in the economy may help to produce significantly more precise projections of future primary surpluses. The accurate estimation of potential growth is a particular issue in countries such as Spain (as well as Ireland and Greece). The difficulty of measuring potential growth and the level of the output gap in real time may lead to misleading inferences regarding future fiscal pressures.

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Table 1: Estimation results for a fiscal reaction function in first differences. This table corresponds to table 5 in Plödt and Reicher (2014).

Country	*const.*	c	a
Germany	−0.006	0.526	0.470
	(0.004)	(0.171)	(0.353)
Italy	−0.001	0.129	0.074
	(0.003)	(0.079)	(0.317)
Spain	0.001	0.026	0.629
	(0.002)	(0.049)	(0.203)
France	−0.004	0.216	1.039
	(0.002)	(0.092)	(0.390)
Panel	0.000	0.087	0.443
	(0.001)	(0.021)	(0.110)

Standard errors are given in parentheses.

Table 2: Baseline calibration of additional parameters.

Country	$1+\bar{g}_t$	$1+\bar{\pi}_t$	$1+\bar{i}_t$	$\frac{(1+\bar{i}_t)}{(1+\bar{\pi}_t)(1+\bar{g}_t)}$
Germany	1.0129	1.0089	1.0440	1.0216
Italy	1.0069	1.0207	1.0493	1.0210
Spain	1.0235	1.0274	1.0463	0.9950
France	1.0155	1.0180	1.0433	1.0092

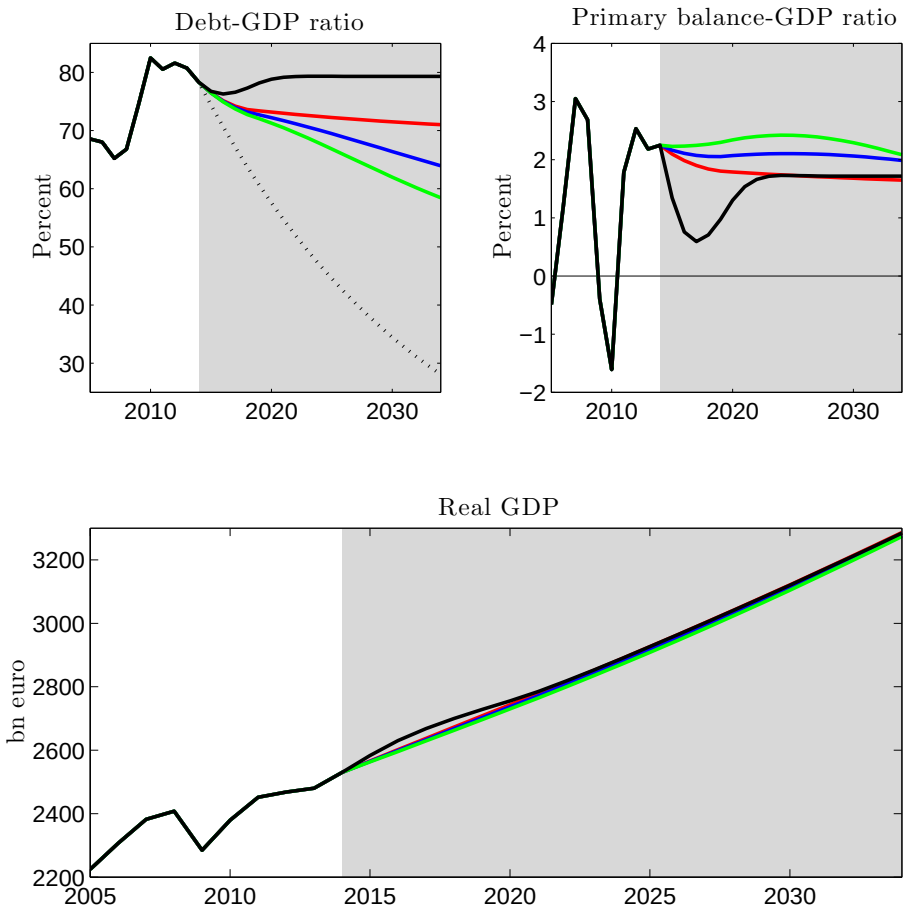

Figure 1: Projections for **Germany** under fiscal rule. Implications of different designs of the fiscal rule. *Black, solid line:* Country-specific estimates of a and c, no correction factor (scenario 1). *Red, solid line:* EA-wide estimates of a and c, no correction factor (scenario 2). *Blue, solid line:* EA-wide estimates of a and c, $d^{CR} = 0.005$ (scenario 3). *Green, solid line:* EA-wide estimates of a and c, $d^{CR} = 0.01$ (scenario 4). *Black, dotted line:* '1/20' rule.

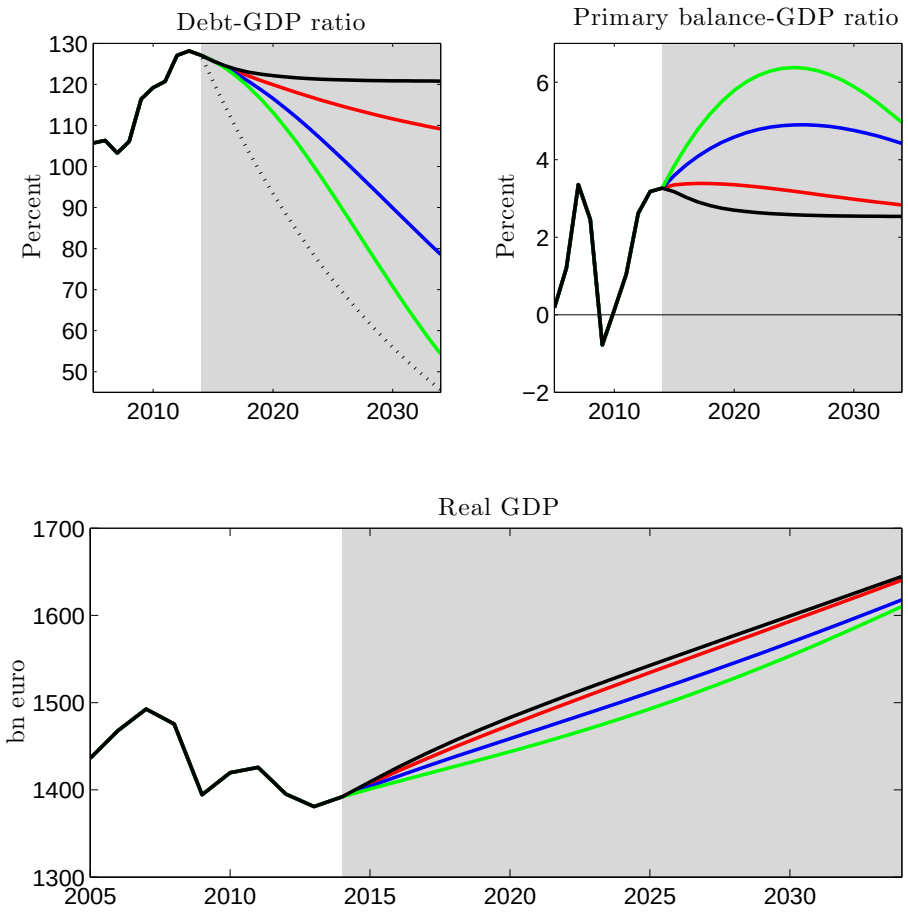

Figure 2: Projections for **Italy** under fiscal rule. Implications of different designs of the fiscal rule. *Black, solid line:* Country-specific estimates of a and c, no correction factor (scenario 1). *Red, solid line:* EA-wide estimates of a and c, no correction factor (scenario 2). *Blue, solid line:* EA-wide estimates of a and c, $d^{CR} = 0.005$ (scenario 3). *Green, solid line:* EA-wide estimates of a and c, $d^{CR} = 0.01$ (scenario 4). *Black, dotted line:* '1/20' rule.

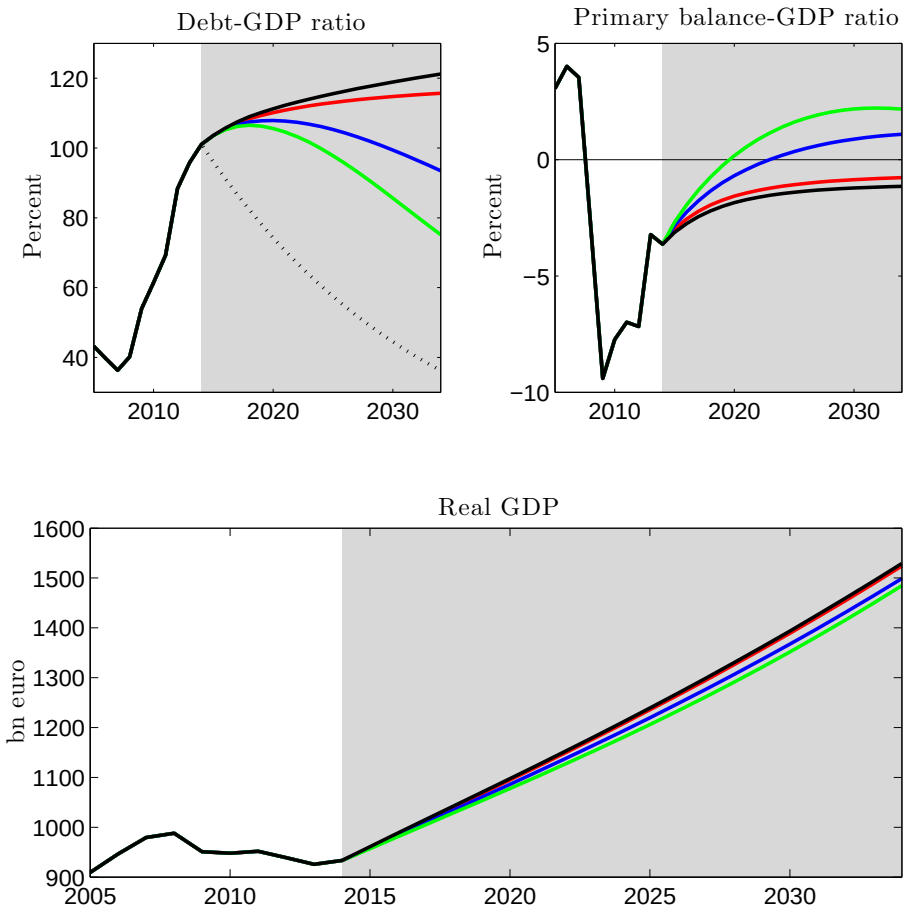

Figure 3: Projections for **Spain** under fiscal rule. Implications of different designs of the fiscal rule. *Black, solid line:* Country-specific estimates of a and c, no correction factor (scenario 1). *Red, solid line:* EA-wide estimates of a and c, no correction factor (scenario 2). *Blue, solid line:* EA-wide estimates of a and c, $d^{CR} = 0.005$ (scenario 3). *Green, solid line:* EA-wide estimates of a and c, $d^{CR} = 0.01$ (scenario 4). *Black, dotted line:* '1/20' rule.

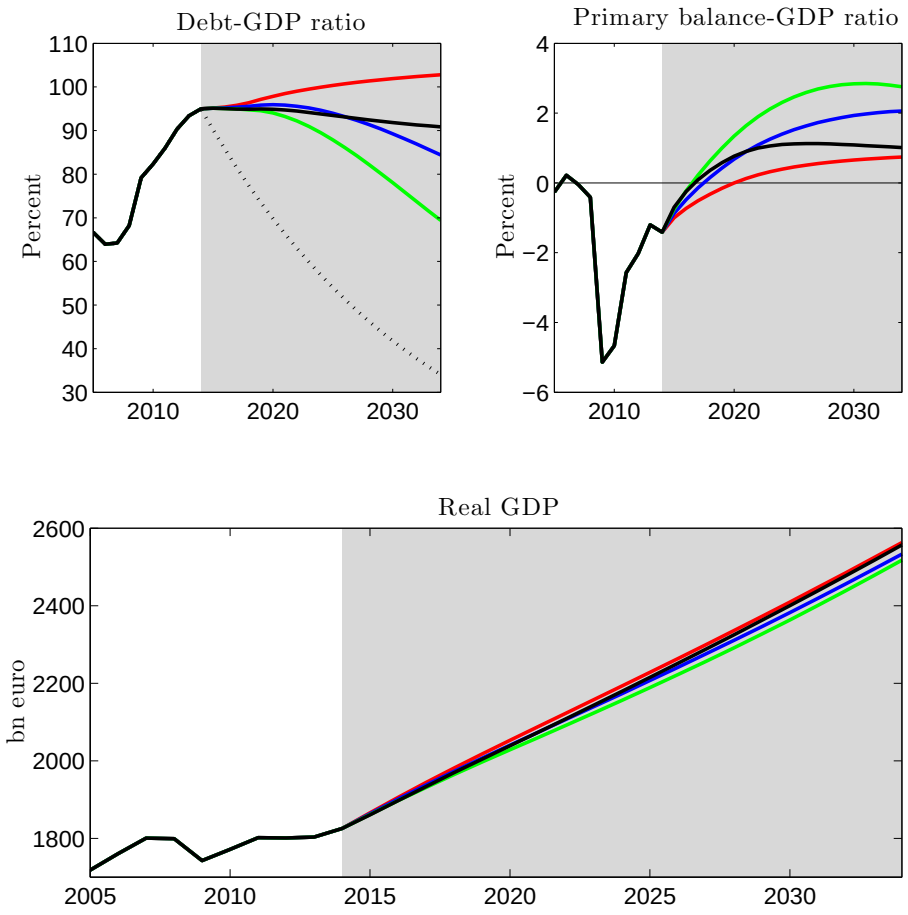

Figure 4: Projections for **France** under fiscal rule. Implications of different designs of the fiscal rule. *Black, solid line:* Country-specific estimates of a and c, no correction factor (scenario 1). *Red, solid line:* EA-wide estimates of a and c, no correction factor (scenario 2). *Blue, solid line:* EA-wide estimates of a and c, $d^{CR} = 0.005$ (scenario 3). *Green, solid line:* EA-wide estimates of a and c, $d^{CR} = 0.01$ (scenario 4). *Black, dotted line:* '1/20' rule.

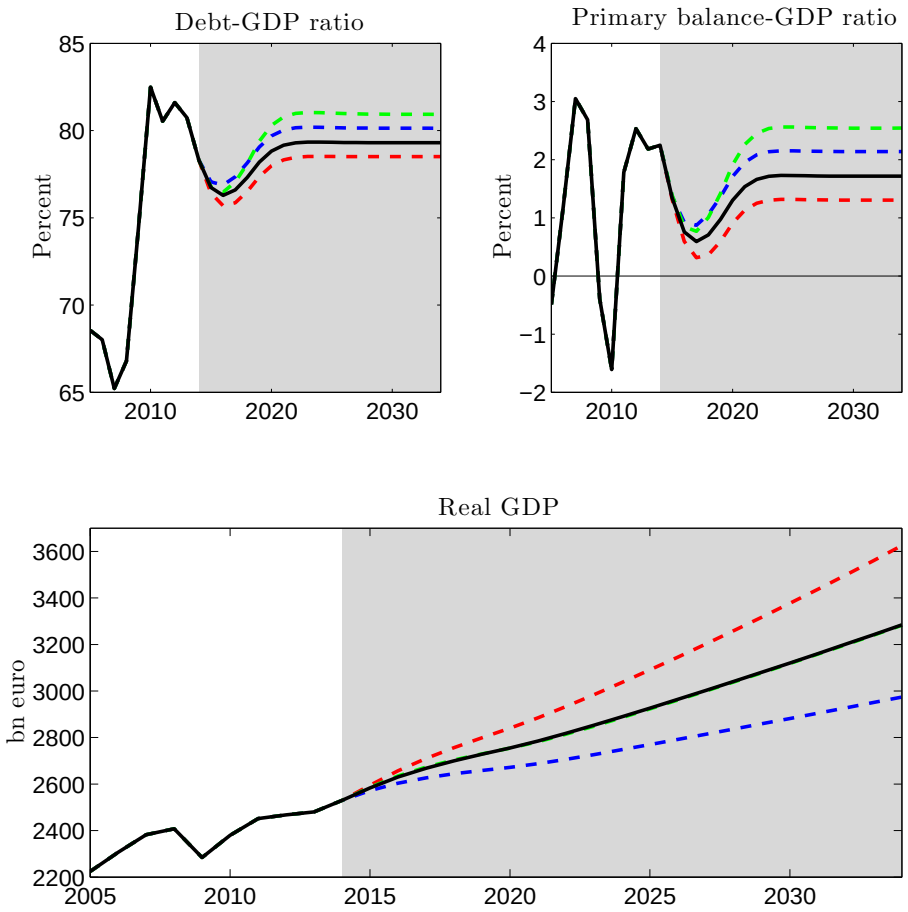

Figure 5: Projections for **Germany** under fiscal rule. Implications of different macroeconomic projections. *Black, solid line:* Country-specific estimates of a and c, no correction factor (scenario 1). *Red, dashed line:* Growth projections 0.5 percentage points higher (scenario 5). *Blue, dashed line:* Growth projections 0.5 percentage points lower (scenario 6). *Green, dashed line:* Interest rate projections 1 percentage point higher (scenario 7).

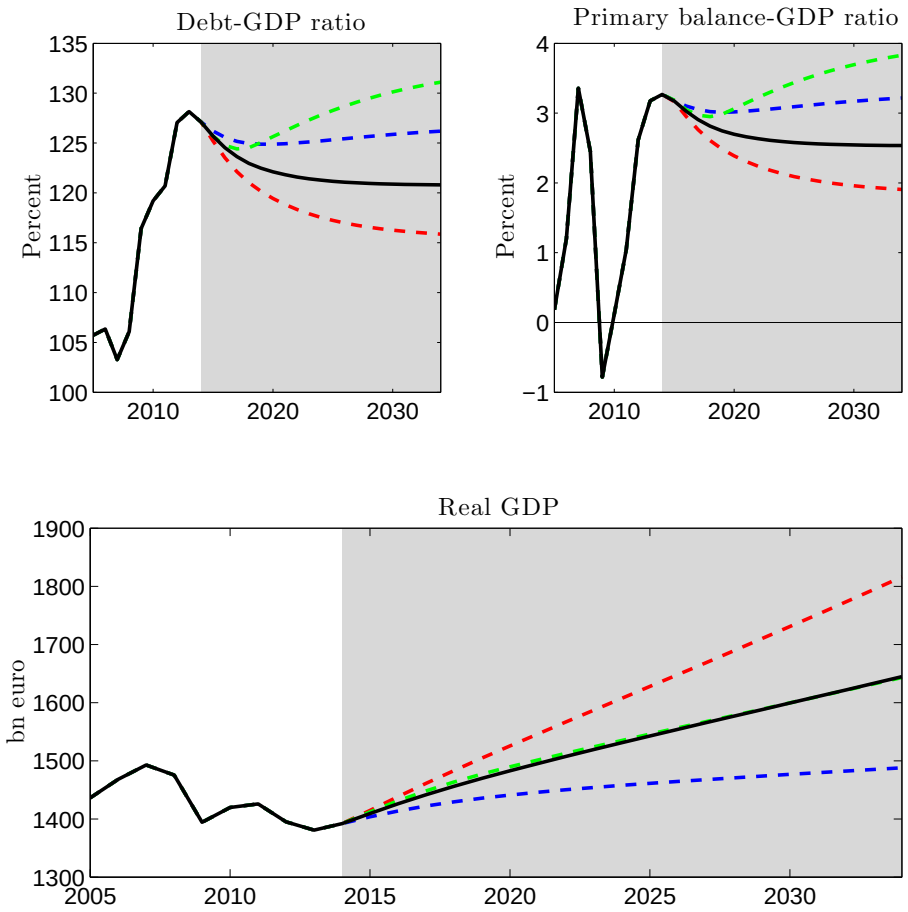

Figure 6: Projections for **Italy** under fiscal rule. Implications of different macroeconomic projections. *Black, solid line:* Country-specific estimates of a and c, no correction factor (scenario 1). *Red, dashed line:* Growth projections 0.5 percentage points higher (scenario 5). *Blue, dashed line:* Growth projections 0.5 percentage points lower (scenario 6). *Green, dashed line:* Interest rate projections 1 percentage point higher (scenario 7).

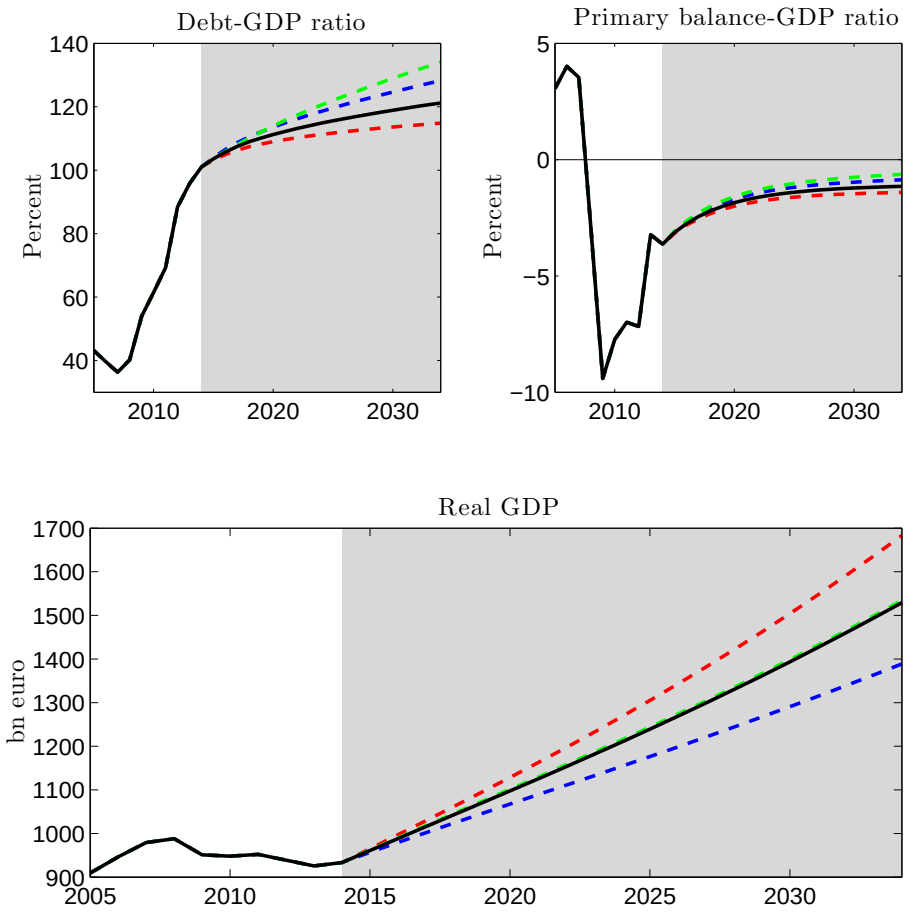

Figure 7: Projections for **Spain** under fiscal rule. Implications of different macroeconomic projections. *Black, solid line:* Country-specific estimates of a and c, no correction factor (scenario 1). *Red, dashed line:* Growth projections 0.5 percentage points higher (scenario 5). *Blue, dashed line:* Growth projections 0.5 percentage points lower (scenario 6). *Green, dashed line:* Interest rate projections 1 percentage point higher (scenario 7).

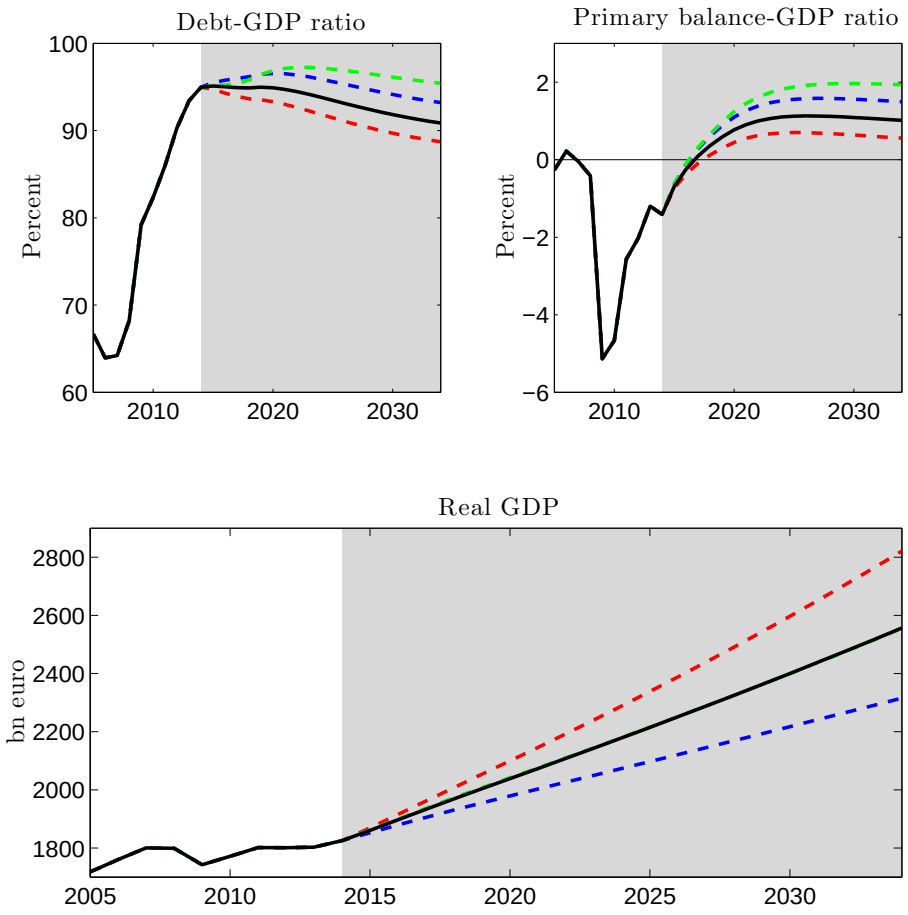

Figure 8: Projections for **France** under fiscal rule. Implications of different macroeconomic projections. *Black, solid line:* Country-specific estimates of a and c, no correction factor (scenario 1). *Red, dashed line:* Growth projections 0.5 percentage points higher (scenario 5). *Blue, dashed line:* Growth projections 0.5 percentage points lower (scenario 6). *Green, dashed line:* Interest rate projections 1 percentage point higher (scenario 7).

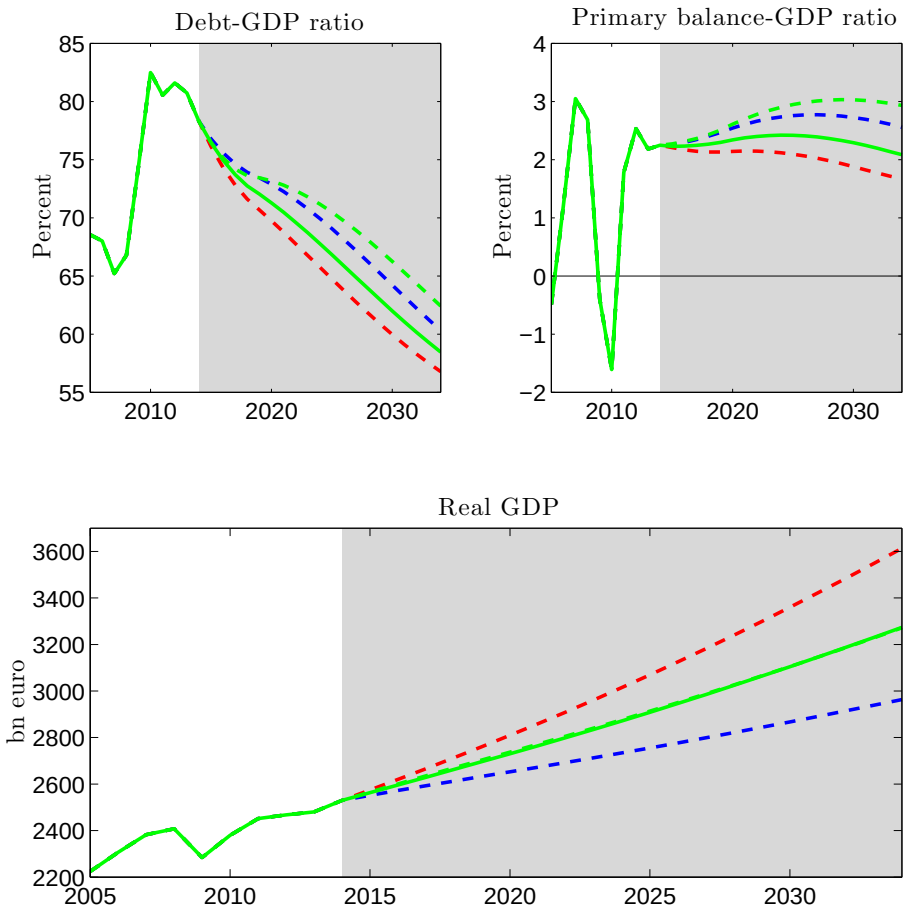

Figure 9: Projections for **Germany** under fiscal rule. Implications of different macroeconomic projections. *Green, solid line:* EA-wide estimates of a and c, $d^{CR} = 0.01$ (scenario 4). *Red, dashed line:* Growth projections 0.5 percentage points higher (scenario 8). *Blue, dashed line:* Growth projections 0.5 percentage points lower (scenario 9). *Green, dashed line:* Interest rate projections 1 percentage point higher (scenario 10).

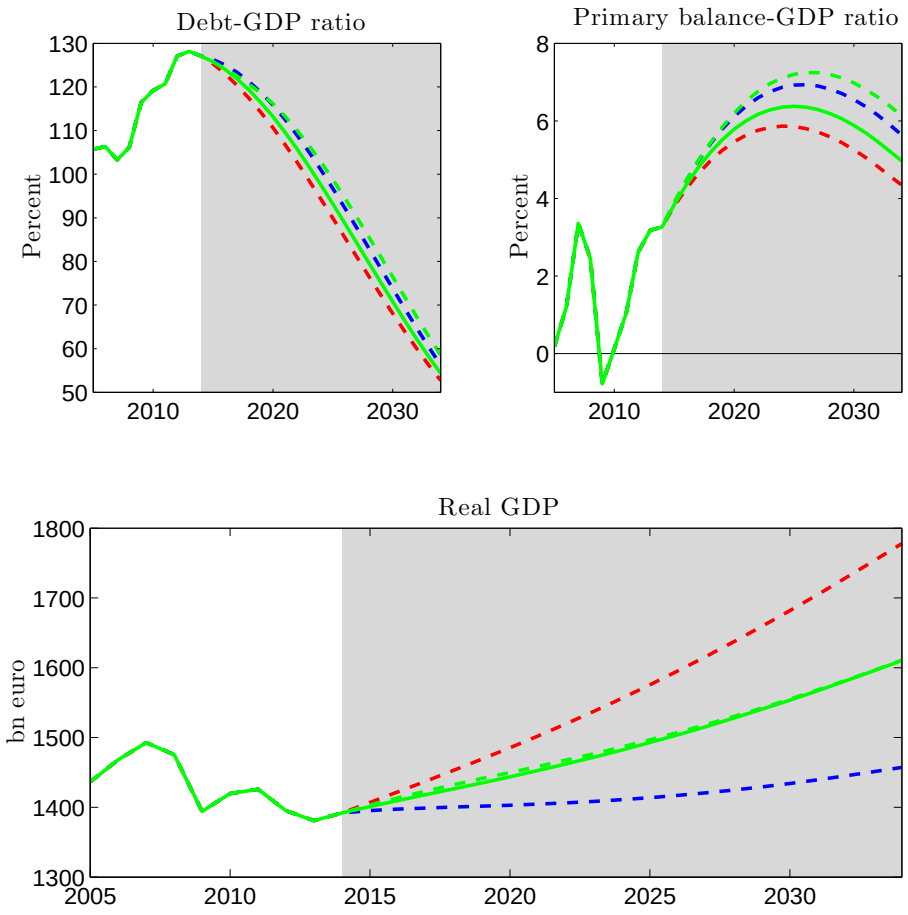

Figure 10: Projections for **Italy** under fiscal rule. Implications of different macroeconomic projections. *Green, solid line:* EA-wide estimates of a and c, $d^{CR} = 0.01$ (scenario 4). *Red, dashed line:* Growth projections 0.5 percentage points higher (scenario 8). *Blue, dashed line:* Growth projections 0.5 percentage points lower (scenario 9). *Green, dashed line:* Interest rate projections 1 percentage point higher (scenario 10).

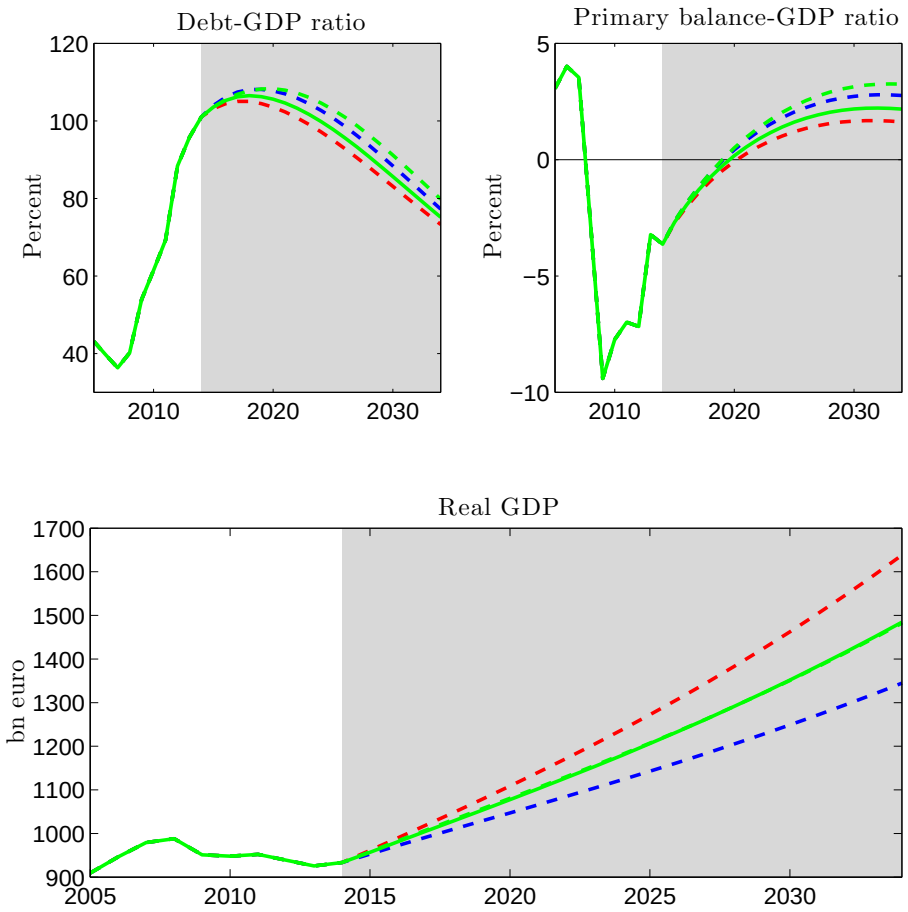

Figure 11: Projections for **Spain** under fiscal rule. Implications of different macroeconomic projections. *Green, solid line:* EA-wide estimates of a and c, $d^{CR} = 0.01$ (scenario 4). *Red, dashed line:* Growth projections 0.5 percentage points higher (scenario 8). *Blue, dashed line:* Growth projections 0.5 percentage points lower (scenario 9). *Green, dashed line:* Interest rate projections 1 percentage point higher (scenario 10).

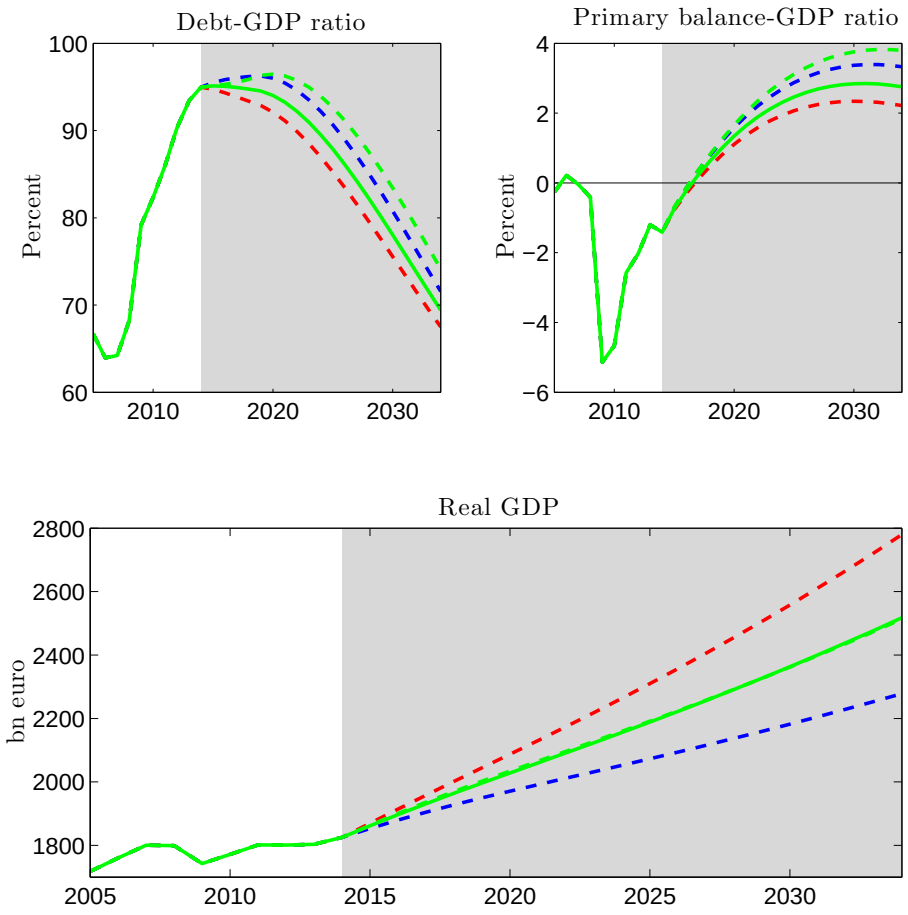

Figure 12: Projections for **France** under fiscal rule. Implications of different macroeconomic projections. *Green, solid line:* EA-wide estimates of a and c, $d^{CR} = 0.01$ (scenario 4). *Red, dashed line:* Growth projections 0.5 percentage points higher (scenario 8). *Blue, dashed line:* Growth projections 0.5 percentage points lower (scenario 9). *Green, dashed line:* Interest rate projections 1 percentage point higher (scenario 10).