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Sovereign debt sustainability scenarios based on an estimated model for Spain

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Abstract

This paper proposes a framework for sovereign debt sustainability assessment based on an estimated DSGE model. One advantage of this is that it allows taking into account feedback effects of debt ratios, spreads and fiscal measures on growth and tax bases, and thus capture the impact of changes in the composition of GDP which is pronounced during fiscal consolidation. Unsustainable debt developments may give rise to increasing interest rate spreads which could further reduce growth and tax revenue and worsen debt dynamics, while fiscal austerity measures are likely to reduce growth and lower tax revenues in the short run. Capturing the impact of risk premium on growth and public debt dynamics is crucial to understand current developments and policy trade-offs in euro area periphery countries.

JEL classification: C54; E37; E62; H68.
Keywords: public debt; sustainability; sovereign spreads; consolidation; DSGE model.

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1. Introduction

Doubts about the sustainability of peripheral European countries' public debt have heightened in the recent year, and have been reflected in significant increases in sovereign yields in these countries. As spreads on sovereign interest rates increased, large financial assistance packages from the European Union and the IMF were negotiated for the most severely affected euro area countries. In parallel, a permanent mechanism, the European Stability Mechanism (ESM), has been agreed upon to provide assistance to euro area Member States in the future. Funding to countries is under strict conditionality and, crucially, only available after a fiscal sustainability assessment shows the country to be solvent, which is also a basic requirement for any IMF loan.

This highlights the need for a framework to assess sustainability of public debt. Current gross debt levels are poor indicators of (perceptions of) long run sustainability, as has become clear in the sovereign debt crisis in Europe. Figure 1 shows a snapshot of the correlation between sovereign yields - the market's perception of sustainability - and gross debt levels in 2011. The correlation is weak, and there are clear outliers. For example, Spanish 10 year bonds are facing elevated sovereign spreads over German Bunds, while Spain's debt-to-GDP ratio is below the euro area average, and lower than in Germany. Higher primary deficit projections and problems with the banking sector can explain partly why markets are more nervous about Spain, but more generally growth perceptions also play an important role here. With pessimistic views dominating on Spain's growth potential, debt sustainability becomes a more pressing concern, and this is the reason why so much weight is given to the need to undertake structural reforms to boost growth in the medium/long run.

The standard sovereign debt sustainability assessment framework used by international organisations, like the European Commission, the ECB and the IMF, is based on an analysis of debt and debt service dynamics derived from projections of a number of indicators over a medium to long-term horizon. This paper shows how estimated structural models could be used to complement the standard approach to debt sustainability assessments and applies this to the case of Spain. The main advantage of this model-based approach is that it allows taking into account feedback effects of debt ratios, spreads and fiscal measures on growth and tax bases. For example, unsustainable debt developments may give rise to increasing interest rate spreads which could further reduce growth and tax revenue and worsen debt dynamics, while fiscal austerity measures are likely to reduce growth through reducing domestic demand and thus lower tax revenues in the short run, but can also reduce spreads if the policy is credible and thus can dampen the negative longer-term impact on growth. With estimated shock variances, a risk assessment can also be given on the basis of probabilities of (un)sustainable paths.

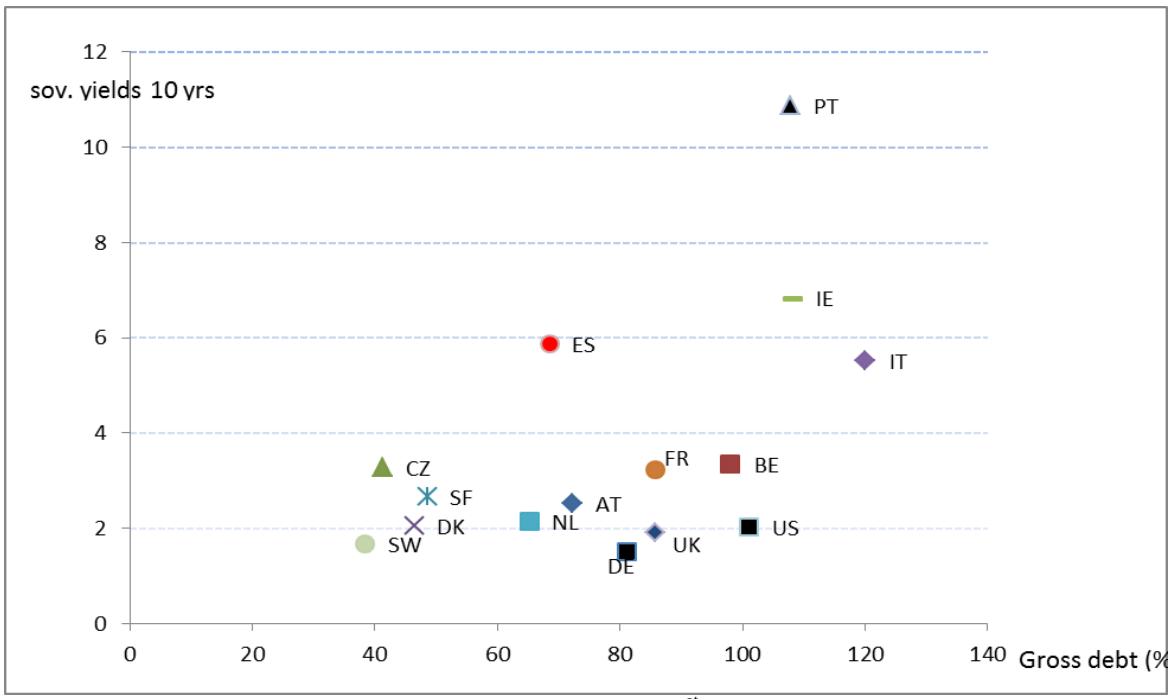
As an example, the paper takes an estimated model for Spain. At first sight Spain's public debt might not appear as pressing a problem as its external indebtedness. [1] Spain's sovereign debt was at 68% of GDP in 2011 still below the Euro area average, while its net international investment position had escalated to more than -90 per cent of GDP in 2011. In fact, Spain had recorded a surplus on its government balance in 2005-07 and managed to reduce its debt to below 40 per cent of GDP by 2007. However, it was already recognised at the time that much of this improvement was not due to permanent factors but to increases in tax revenues associated with changes in the composition of GDP,

[1] In a companion paper we use the model for an analysis of external debt sustainability (In 't Veld et al., 2012).

in particular transitory asset boom revenues (Martinez-Mongay et al., 2007). [2] With the onset of the crisis, there was a sharp reversal of this, and the deficit peaked at 11 per cent of GDP in 2009 and remained persistently high in the years after. The bursting of the bubble in the housing market also exposed deep-rooted problems in the banking sector which led to further concerns that sizeable support measures would be required to reinforce Spain's financial institutions. As a results of all this, sovereign debt sustainability has become a concern for Spain and spreads vis-à-vis German Bunds have risen. Although our analysis is limited to a direct extrapolation of the 2011 fiscal position and thus abstracts from possible interventions to support financial institutions, we are able to show how a model can be applied to assess alternative scenarios of lower growth projections, an increase in the sovereign risk premium, and frontloaded fiscal consolidations and discuss their impact on long term debt developments.

The following section describes briefly the standard debt sustainability framework used in the European Commission. The next section gives a brief overview of the estimated model, while section 4 highlights some fiscal developments in Spain in the last decade. Section 5 then describes scenarios based on the model estimates and alternative scenarios based on alternative assumptions. Section 6 concludes.

Figure 1. Sovereign debt yields and debt ratios



Note: Sovereign yields benchmark 10yr bonds (average 1st week May 2012); Gross debt in 2011 as % of GDP. Excluding Greece <165, 22>. Source: Datastream, Ameco.

[2] The standard cyclical adjustment method to budget balances does not correct for the effects of asset prices, and only captured part of the effect of the economic boom on revenues.

2. Traditional approach to debt sustainability assessments

The standard debt sustainability assessment frameworks used by international organisations like the European Commission is based on an analysis of debt and debt service dynamics derived from projections of a number of indicators over a medium to long-term horizon.

For this framework the change in the gross debt ratio is decomposed as follows:

$$(1) \qquad \frac{B_t}{Y_t} - \frac{B_{t-1}}{Y_{t-1}} = \frac{PD_t}{Y_t} + \left(\frac{B_{t-1}}{Y_{t-1}} * (r_t - g_t) \right) + \frac{SF_t}{Y_1}$$

where *B* indicates the stock of government debt, *PD* the primary deficit, *Y* nominal GDP and *SF* the stock-flow adjustment, and *r* and *g* represent the average real interest rate and real rate of GDP growth. The term in parentheses represents the "snow-ball" effect, measuring the combined effect of interest expenditure and economic growth on the debt ratio. This decomposition shows debt ratios can be reduced by consolidations (reductions in primary deficits) but debt dynamics also depend crucially on the interest rate-growth differential. The larger the differential *r-g* , the larger the increase in the primary balance required to stabilise a given debt ratio.

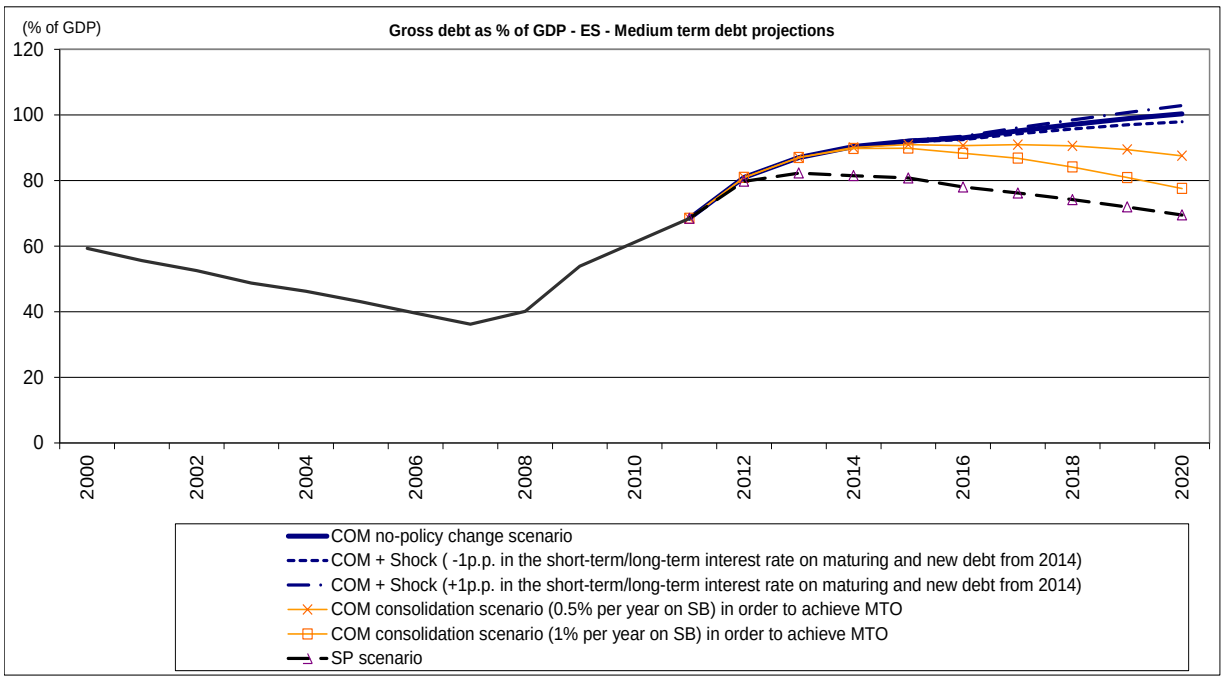
The traditional Commission approach looks at the risks to fiscal sustainability under the assumption of no-policy change in the government budget on the basis of the current structural budgetary position, but also taking into account the budgetary challenge posed by population ageing over the longer term. It compares this with projections based on data contained in the most recent Stability and Convergence Programmes submitted by Member States, reflecting planned changes in fiscal policy.[3] This assessment produces illustrative projections for the gross government debt to GDP ratio up to 2020, assuming that structural primary balances are adjusted according to the plans in the programmes and are kept constant thereafter (but taking into account changes in the cost of ageing).

As an example, Figure 2.1 shows the medium term debt projections based on this standard approach for Spain. The benchmark scenario is a no-policy change scenario, with structural primary balance/GDP ratio kept constant at 2011 estimated level. The gross debt-to-GDP ratio would rise steadily over the projection period to 100% by 2020. In order to assess the robustness of the results, projections based on risk scenarios are also presented that depart from the benchmark projection to take account of higher or lower interest rates, and stronger consolidation efforts in order to achieve the Medium Term Objectives.

One drawback of this framework is that it does not take into account second round feedback effects from spreads and fiscal measures on growth and tax revenue bases. Fiscal consolidation measures are likely to reduce growth and lower tax revenues in the short run, partly offsetting any improvement in fiscal positions. But increasing interest rate spreads could also further reduce growth and tax revenue and worsen debt dynamics. While these effects can be taken on in an ad-hoc manner, they are not incorporated in a systematic way in the traditional approach to debt sustainability assessment.

[3] For an overview of debt sustainability assessments, see European Commission (2011).

Graph 2.1: Spain medium term debt projections



Source: European Commission, 2012 Stability and Convergence Programmes

3. The model

The framework used in this paper is based on an estimated structural model for Spain. This section gives a brief overview of the model focussing on the fiscal policy block. Details of the model and the estimation can be found in In 't Veld et al. (2012).

We consider an open economy, which produces goods which are imperfect substitutes to goods produced in the RoW. Households engage in international financial markets and there is near perfect international capital mobility with a debt-elastic interest rate premium (Schmitt-Grohe and Uribe, 2003). There are three production sectors, a final goods production sector as well as an investment goods producing sector and a construction sector. We distinguish between Ricardian households which have full access to financial markets, and credit constrained households facing a collateral constraint on their borrowing. The economy is part of a monetary union and faces an exogenous interest rate. Monetary policy is modelled exogenous, with interest rates i_t^{EA} set by the ECB.

There is a fiscal authority, which follows rules-based stabilisation policies. Both government expenditure and receipts are responding to business cycle conditions. On the expenditure side we identify the systematic response of government consumption, government transfers and government investment to the annual GDP growth rate. In addition, all three expenditure components are used for stabilising the debt to GDP ratio, where b^T is the government debt target and def^T is the associated deficit target. For government consumption and government investment we specify the following rules for detrended c^G and i^G (removing trend productivity growth)

$$c_t^G - \overline{c^G} = \tau_{Lag}^{CG}(c_{t-1}^G - \overline{c^G}) + \tau^{CG}(\sum_{i=1}^{4}\Delta y_{t-i} - 4\overline{\Delta y})$$

(2)
$$- \tau^{CGB}\left(\frac{B_{t-1}}{Y_{t-1}P_{t-1}} - b^T\right) - \tau^{CGDEF}\left(\left(\frac{\Delta B_{t-1}}{Y_{t-1}P_{t-1}}\right) - def^T\right) + u_t^{CG}$$

$$i_t^G - \overline{i^G} = \tau_{Lag}^{IG}(i_{t-1}^G - \overline{i^G}) + \tau^{IG}(\sum_{i=1}^{4}\Delta y_{t-i} - 4\overline{\Delta y})$$

(3)
$$- \tau^{IGB}\left(\frac{B_{t-1}}{Y_{t-1}P_{t-1}} - b^T\right) - \tau^{IGDEF}\left(\left(\frac{\Delta B_{t-1}}{Y_{t-1}P_{t-1}}\right) - def^T\right) + u_t^{IG}$$

Government consumption and government investment can temporarily deviate from their long run targets $\overline{c^G}$ and $\overline{i^G}$ in response to fluctuations in growth rates. In addition, government expenditure is used for stabilising the debt to GDP ratio, where b^T is the government debt target and def^T is the associated deficit target. [4]

The transfer system consists of two parts, unemployment benefits *UBEN* and other transfers *TR* . The former provides income for the unemployed $(POP_t^W - POP_t^{NPART} - L_t)$. Other transfers *TR* consists of transfers to pensioners POP_t^P and other transfer payments, and is used for stabilising the debt to GDP ratio. We assume that unemployment benefits and pensions are indexed to wages with replacement rates b^U and b^R respectively.

$$tr_t = b^U w_t(POP_t^W - POP_t^{NPART} - L_t) + b^R w_t POP_t^P$$

(4)
$$- \tau^{TRB}\left(\frac{B_{t-1}}{Y_{t-1}P_{t-1}} - b^T\right) - \tau^{TRDEF}\left(\left(\frac{\Delta B_{t-1}}{Y_{t-1}P_{t-1}}\right) - def^T\right) + u_t^{TR}$$

Government revenues R_t^G consists of taxes on labour income (social security contributions and personal income taxes), on consumption (and residential investment) and corporate profits, as well as lump-sum taxes T_t^{LS}

(5) $$R_t^G = \left(ssc_t + t_t^w\right)W_t\ L_t + t_t^c P_t^c C_t + t_t^c P_t^H I_t^H + t_t^K[(Y_t\text{-}W_t L_t)\text{-}\delta K_t P_t^I] + T_t^{LS}$$

We assume consumption and capital income tax to follow a linear scheme, but a progressive labour income tax schedule

(6) $$t_t^w = \tau_0^w Y_t^{\tau_1^w} U_t^{TW}$$

[4] Alternatively, the fiscal closure rule could be imposed on other instruments, like lump-sum taxes or distortionary labour taxes. Different instruments may lead to different dynamic outcomes (Bryant and Zhang, 1996, Michel et al., 2010).

where τ_0^w measures the average tax rate, and τ_1^w the degree of progressivity. A simple first-order Taylor expansion around a steady state growth rate yields

(6b) $$t_t^w = \tau_0^w + \tau_0^w \tau_1^w (\sum_{i=0}^{3} \Delta y_{t-i} - 4\overline{\Delta y})_t$$

Government debt (B_t) evolves according to

(7) $$B_t = (1+i_t^B)B_{t-1} + P_t^C C_t^G + P_t^C I_t^G + TR_t - R_t^G - T_t^{LS}.$$

where i_t^B is the implicit interest rate the government pays on its debt, which depends on the average maturity structure of sovereign debt ($1/(1-\rho^B)$) and the policy rate augmented by a mark-up made up of a sovereign risk premium dependent on the government debt-to-GDP ratio and an autoregressive term

(8) $$i_t^B = \rho^B i_{t-1}^B + (1-\rho^B)\left[i_t + mup^B + rprem^B (B_t / Y_t - \overline{B/Y}) + \varepsilon_t^{rpb}\right]$$

This model is estimated on quarterly data for Spain over the period 1995 to 2011, using Bayesian estimation methods. The model is set up for estimation by calibrating a subset of parameters according to long-run (steady-state) restrictions and by estimating other structural parameters (elasticities, adjustment cost parameters, etc.) and the persistency and standard deviation of exogenous shocks based on quarterly macroeconomic and fiscal data. Model estimation was performed using the DYNARE toolbox for MATLAB (Adjemian *et al*., 2011). A detailed description of the estimation and model fit can be found in In 't Veld *et al.* (2012).

Based on the whole estimation sample, the quarterly GDP trend growth rate was set to 0.56% (approximately 2.2% per annum), the inflation trend growth rate was set at 0.5% (2% p.a), while openness is calibrated at 0.25. Concerning the government debt ratio, we impose the debt target of 60% of GDP, which is close to the sample average. The debt target implies, given the nominal growth rate in the steady state, a deficit target of 2.5% of GDP. Tax rates are calibrated on sample averages, while government transfers to households are set to 12.5% of GDP, and benefit and pension indexation are set to match this. Fiscal policy reactions are generally counter cyclical, while also containing debt- and deficit stabilising responses. The average maturity structure of sovereign debt is set at 20 quarters (5 years), at the lower end of estimates based on Bloomberg data. The the elasticity of the sovereign risk premium w.r.t. the government debt-to-GDP ratio implies an increase in the risk premium of 12 bps. for a 10 pps. increase in the debt ratio. This is at the lower end of the range estimated by Laubach (2009) and may partly reflect the favourable debt developments in Spain over the estimation sample, or at least up to 2007, but may also be indicative of the general underpricing of risk over this period.

Table 3.1 Selected calibrated and estimated fiscal parameters

Structural parameter				Calibrated value			
Target government debt to GDP				0.60			
Target government deficit to GDP				-0.0252			
ssc				0.14			
τ_0^W				0.13			
τ_1^W				0.8			
τ^K				0.2962			
τ^C				0.15			
b^R				0.24613			
ρ^B				0.95			
$\tau^{B,TR}$				0.05			
$1-s^M$				0.75			
	Prior distribution	Prior mean	Prior s.d.	Posterior mean	Posterior s.d.	HPD inf	HPD sup
$\tau^{CG}{}_1$	beta	-0.1	0.04	-0.0310	0.0148	-0.0532	-0.0073
$\tau^{CG}{}_{lag}$	beta	0.5	0.2	0.8997	0.0225	0.8640	0.9365
$\tau^{IG}{}_1$	beta	-0.1	0.04	-0.0825	0.0303	-0.1306	-0.0314
$\tau^{IG}{}_{lag}$	beta	0.5	0.2	0.3244	0.1512	0.0737	0.5580
b^U	beta	0.3	0.1	0.2852	0.0726	0.1640	0.4036
τ^B	beta	0.02	0.01	0.0271	0.0052	0.0187	0.0355
τ^{DEF}	beta	0.02	0.01	0.0160	0.0073	0.0040	0.0269
$\tau^{B,IG}$	beta	0.02	0.01	0.0187	0.0067	0.0078	0.0294
$\tau^{DEF,IG}$	beta	0.02	0.01	0.0230	0.0102	0.0064	0.0392
$\tau^{DEF,TR}$	beta	0.02	0.01	0.0207	0.0103	0.00422	0.0364
$rprem^B$	beta	0.003	0.0012	0.0030	0.0012	0.0010	0.0049

Note: HPDinf and HPDsup denote the bounds of the 90% Highest Probability Density interval. The prior distributions used and posterior estimates of all parameters can be found in the In 't Veld et al. (2012).

4. Fiscal developments in Spain

The Spanish economy has experienced a significant build-up of internal and external imbalances since its accession to the euro area, which manifested itself in an excessive allocation of resources to the construction sector and persistent current account deficits leading to a rapid escalation of external debt. A correction started in 2007, accelerated by the financial crisis, and the Spanish economy has since gone through a sharp adjustment, with unemployment soaring to above 20%. The share of construction investment in GDP has fallen back to pre-boom levels and a deleveraging process for households has started with an adjustment to consumption. As a result there has been some improvement in the trade balance. But further corrections are needed as Spain's external indebtedness remains at highly elevated levels.

Public debt was not a pressing problem before the crisis but the crisis had dire consequences for the fiscal position. In the boom years transitory composition effects had boosted tax revenues, and the government balance was in surplus in 2007. Much of this improvement was not due to permanent factors but to increases in tax revenues associated with changes in the composition of GDP, in particular transitory asset boom revenues (Martinez-Mongay *et al*., 2007). The fiscal position deteriorated dramatically when revenues related to housing and wealth declined and spending increased. The government balance, which had reached a surplus in the pre-boom years, deteriorated dramatically when revenues related to housing and wealth declined and spending increased. Government debt had been reduced to below 40% of GDP before the crisis, but has since risen and exceeded the 60% threshold in 2010. While this is still below the euro area average, it is projected to rise fast given that government's net borrowing exceeded 8% of GDP in 2011 and there is uncertainty how quickly this can be reduced. As a result, Spain has also become subject to financial market pressure in the euro area sovereign debt crisis. Sovereign spreads of Spanish bonds over German bunds have risen over the recent two years from less than 100 bps. to more than 400 bps. by the end of our estimation period in December 2011, and have risen further since. Over the estimation period, not much of this increase has been reflected in the implicit interest rate the government pays on its debt, which was by 2011 only 75 bps. above German rates. But it is obvious that if the spreads currently observed in the markets would persist for longer, it would lead to a gradual increase in the average government interest rate, as debt matures and has to be renewed at these higher rates.

Figure 4.1 Government deficit

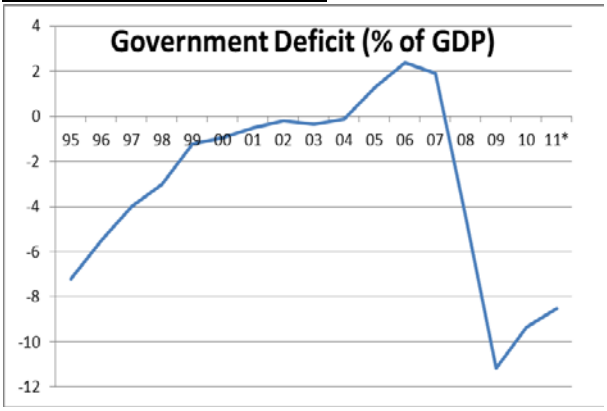


Figure 4.2 Government debt

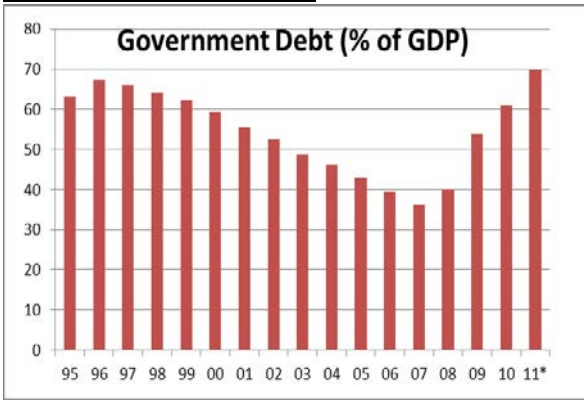


Figure 4.3 Gov. bond yields (10yr) Spain and Germany

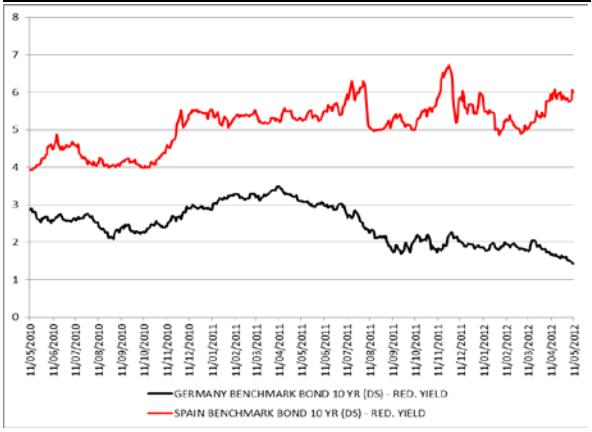
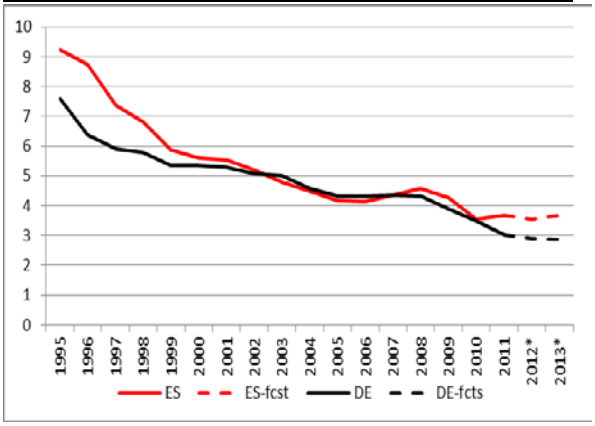


Figure 4.4 Implicit government interest rate (ES, DE)



Source: Ameco; Government benchmark bonds 10 years: Datastream.

5. Debt sustainability assessment

We now illustrate how this model can be used in debt sustainability assessments. As stated in the introduction, our analysis is limited to a direct extrapolation of the 2011 fiscal position and thus abstracts from possible interventions to support financial institutions. The benchmark scenario shown in Fig.5.1 presents the projections based on the estimated model parameters and persistence of shocks. It shows the adjustment to the fiscal and external imbalances as implied by the model, with the speed at which growth rates and nominal demand shares return to steady state levels determined by the persistence of the identified shocks. The projections in Fig. 5.1 also include the 90% confidence bands based on the estimated magnitude of all the structural shocks that are present in the model.

The benchmark scenario is characterised by a current account adjustment that relies heavily on expenditure reduction. Net foreign liabilities have risen from around 20 per cent of GDP in 1995 to more than 90 per cent of GDP by 2011. In the benchmark model projections shown here the increase in net foreign liabilities comes to a halt, thanks to an improvement in the trade balance. [5] This expenditure switching adjustment from domestic demand to net exports is not without costs. Households and firms face ever higher interest rates due to the debt-dependent interest rate premium, and this depresses consumption and (corporate and residential) investment. Domestic demand falls further from its already subdued levels reached by the end of the sample period. This is accompanied by below trend inflation and below trend growth in unit labour costs. This export led growth profile implies an adjustment that is not particularly tax rich. In this scenario the government deficit only gradually returns to its 2.5% steady state level, and government debt continues to grow to reach almost 100% of GDP by 2020 and only returns then gradually to its 60% target. [6]

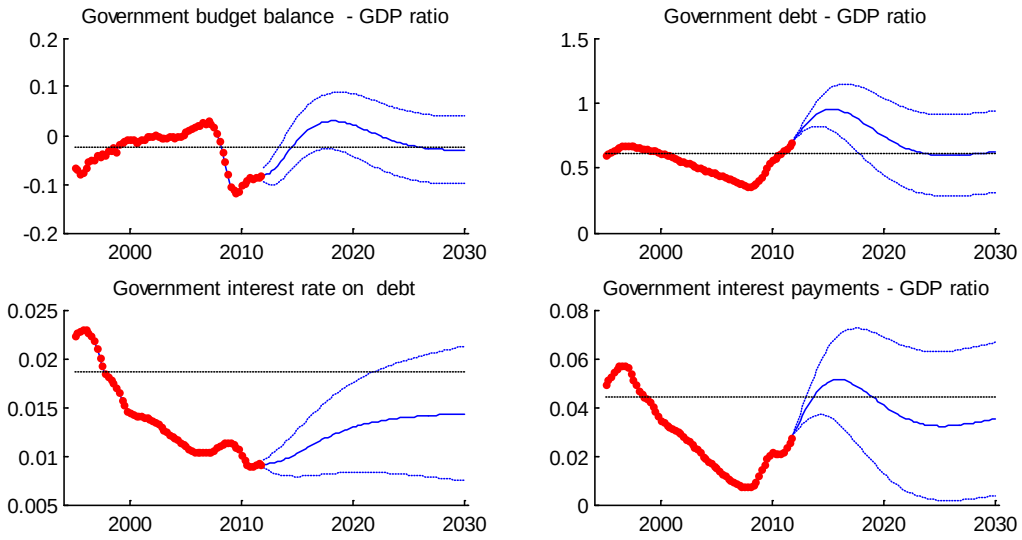
Fiscal balance is restored in this benchmark scenario through an adjustment in government consumption, but this occurs very gradually. The government consumption share in GDP has risen above its average over the estimation period and in the projections it falls back to its steady state level by the end of 2015, a decline of more than 2 pps., and has to undershoot in the second half of the decade in order to reduce the debt-to-GDP ratio. The government investment share had gradually risen up to 2009 but fallen below its long run steady state level by 2011, and rises in the projections back to this level with some light countercyclical behaviour. Transfers to households are at much elevated levels, and are kept high as unemployment remains high, but are gradually reduced over the projection in response to the above-target debt-to-GDP ratio. The effective labour tax rate has fallen below trend given the estimated progressivity in labour taxes, and gradually increases as the output gap closes. The estimated debt and deficit corrections are extremely protracted. Without any further consolidation measures in these projections, government deficits remain well above target till the end of the decade.

This benchmark scenario shown here may be overly-optimistic for two reasons. First, the underlying trend growth assumptions are based on 1995-2011 growth averages, and at 2.2%, they are much higher than what is now generally perceived as the potential growth rate for Spain. For example, the European Commission's medium term growth projections for Spain suggest potential growth is around 1-1.2%. Debt dynamics depends crucially on the interest rate-growth differential $r - g$ and a lower

[5] Alternative scenarios reported in In 't Veld et al (2012) show a much sharper contraction in domestic demand in case of a higher external debt risk premium and stabilisation to a lower net foreign liabilities position of 35%.
[6] These scenarios exclude the effects of measures to support the fragile banking sector that have become important in 2012.

growth effect implies a less favourable debt profile. Second, and not unrelated to this, in line with the more general repricing of risks financial markets have revised their risk assessments for Spain. As a result, sovereign risk spreads have soared in the last year, as shown in the previous section. This is only to a small extent reflected in the data so far as the implicit government interest rate for Spain has not risen much yet but this is likely to change as long as sovereign spreads persist.[7] The two following scenarios illustrate the effects of this on the projections.

Figure 5.1: Benchmark scenario based on estimated model



[7] The pass-through of sovereign spreads into the implicit interest rate a country pays on its debt depends among other things on the average debt maturity, which is more than 5 years for Spain.

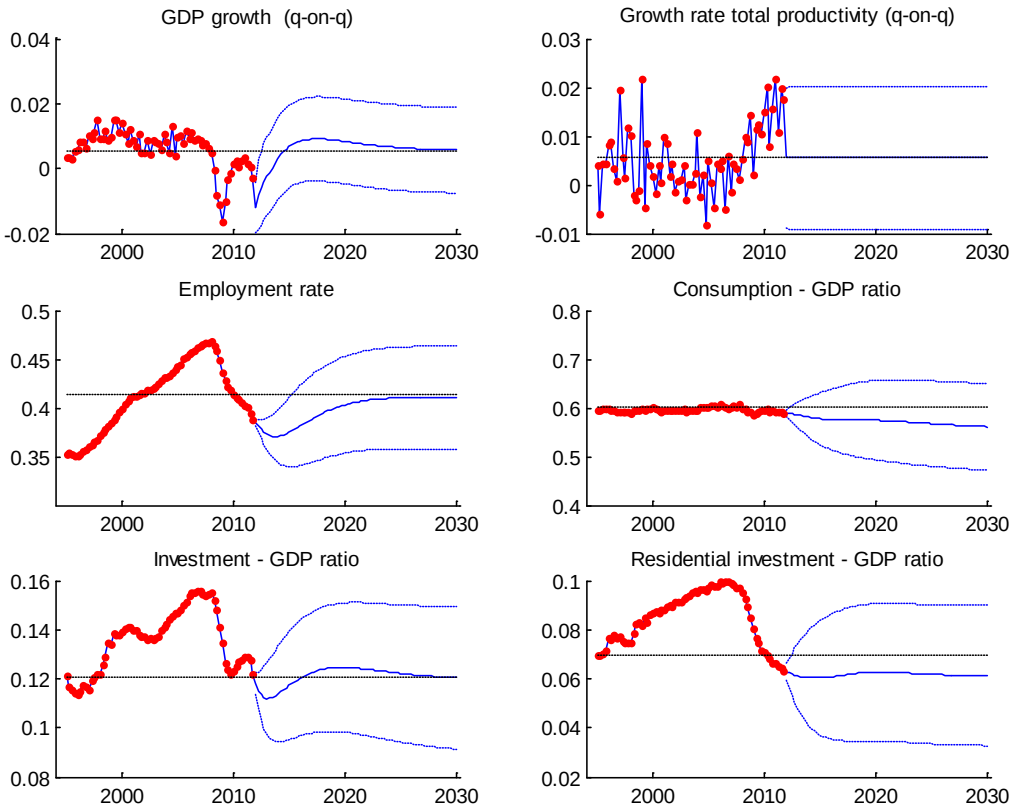
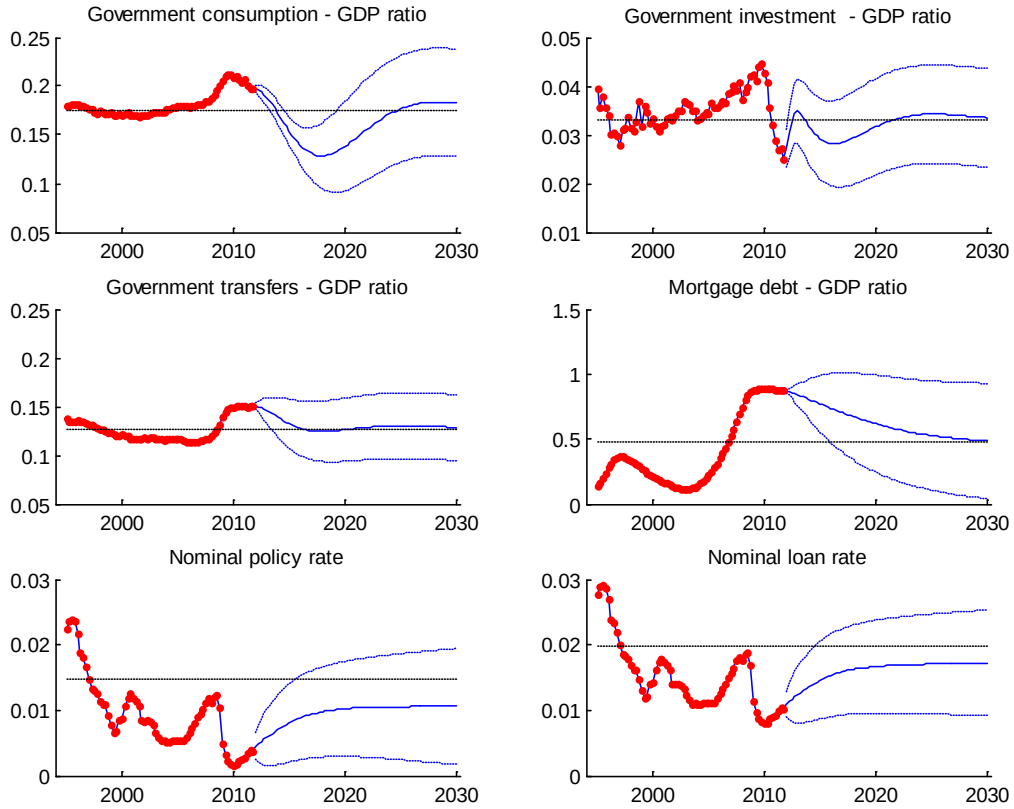
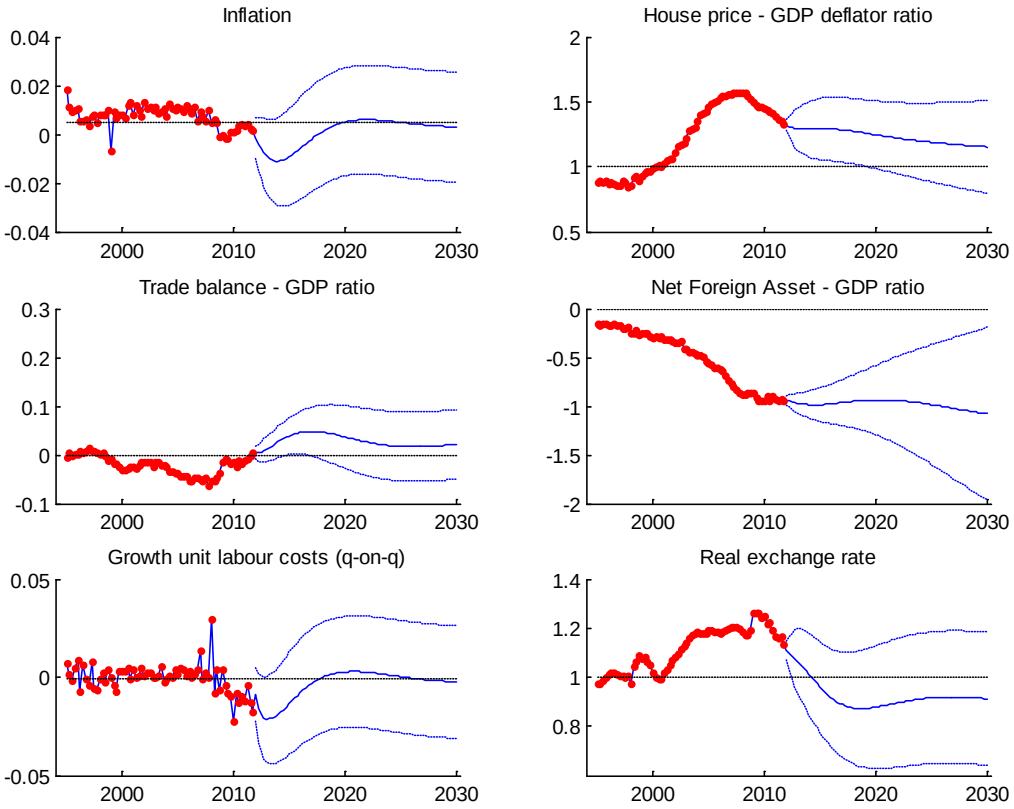


Figure 5.1 (cont'd)





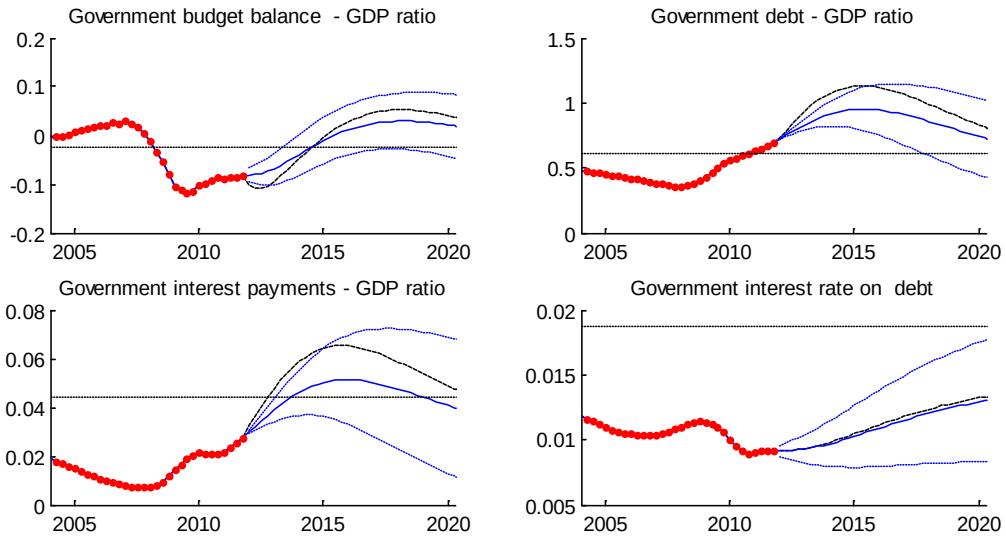
Note: blue line = baseline scenario (with 90% confidence interval bands);

5.2 Lower growth

The first scenario shows the impact of changes in assumptions on the long term growth rate for Spain. To illustrate the effects of this, a negative permanent shock is given to productivity in this scenario that reduces growth by 0.8 pp., from 2.2% to 1.4% in the steady state. The negative TFP shock leads to a sharp immediate contraction and leaves growth permanently lower.

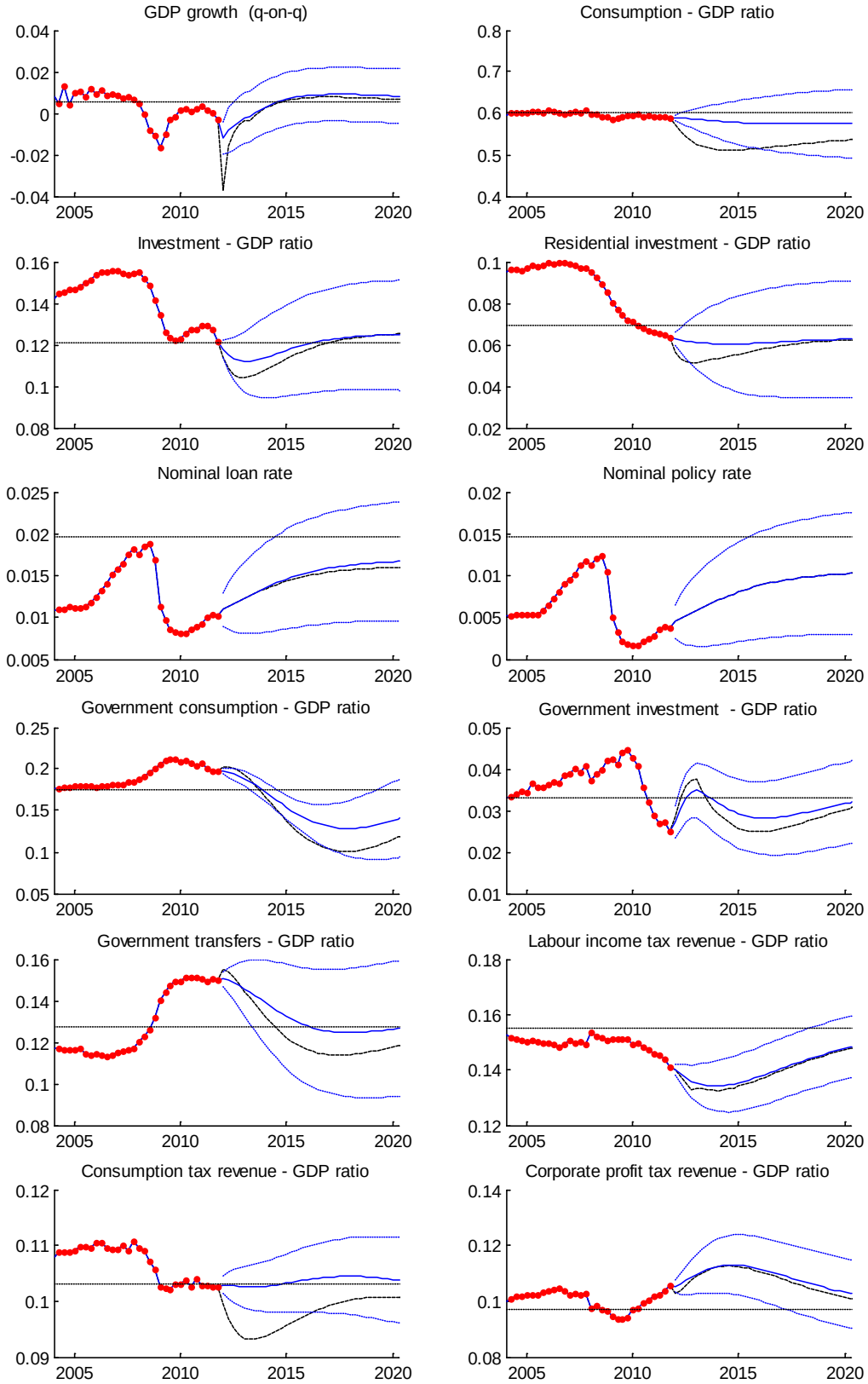
The effects of this on deficit and debt developments are presented in Fig. 5.2. Lower growth leads to lower tax revenues and a sharp increase in the government deficit, and the larger interest rate – growth differential leads to a worsening of the debt position. The deficit increases by more than 2pp and the debt ratio by an additional 17 pps.. The increase in debt raises government interest payments directly, and indirectly via the endogenous increase in the sovereign spread as a result of the higher debt ratio. The share of government interest payments in GDP rises by more than 1 pp., There are two opposing effects on government consumption. On the one hand there is the countercyclical response to the fall in growth which leads to an increase in government spending. On the other hand there is the debt stabilising response which stabilises debt in the long run. The second effect dominates in the medium run. Debt can be stabilised in the medium/long term but only through sharp declines in spending, in particular in government consumption and transfers to households. This has profound effects on domestic demand, with a fall in the consumption-GDP share of about 6 pps..

Figure 5.2 Lower growth scenario



Note: blue line = baseline scenario (with 90% confidence interval bands); black dashed line = lower growth scenario

Fig 5.2. (cont'd)



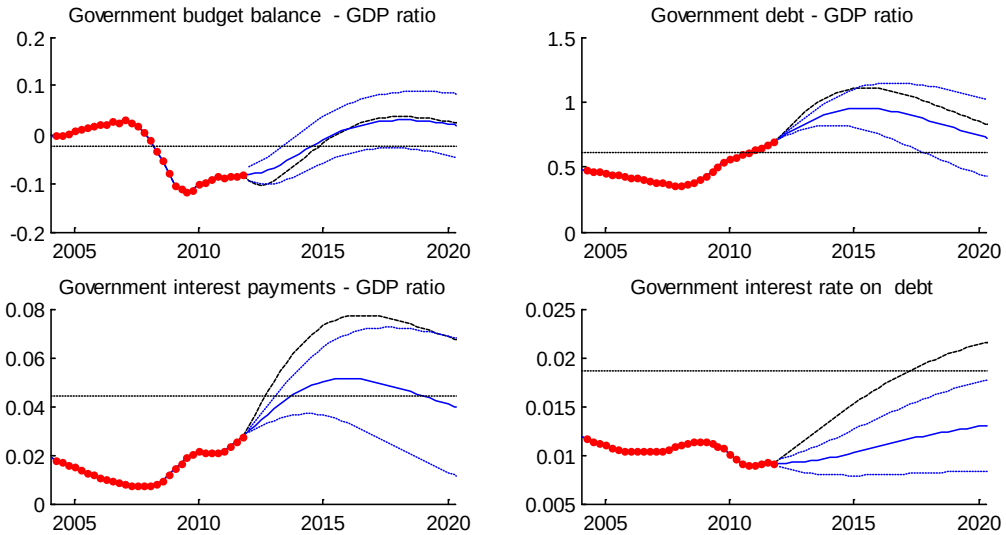
Note: blue line = baseline scenario (with 90% confidence interval bands); black dashed line = lower growth scenario;

5.3 Higher risk premia

The second scenario, shown in Fig. 5.3, shows the effects of an increase in sovereign spreads that raise borrowing costs for the Spanish government. As described in the previous section, sovereign spreads of Spanish bonds over German bunds have risen over the recent two years from less than 100 bps. to more than 400 bps. in the beginning of December 2011. In our model the sovereign risk premium is determined by the debt-to-GDP ratio and an exogenous risk premium term ε_t^{rpb} (see eq. 8). Our estimation period is dominated by the pre-crisis period, and higher sovereign spreads are not (yet) reflected in the implicit government interest rate on debt. But if current spreads were to persist for longer, it would lead to a gradual increase in the average government interest rate, as debt matures and has to be renewed at these higher rates. The simulated scenario illustrates the effects of this for an increase of 400 bps. Crucially, it is assumed this risk premium is not confined to the government alone but also partly spills over into higher private sector borrowing costs. [8]

As Fig. 5.3 shows, the sovereign risk premium shock is gradually feeding through into a higher government interest rate on its debt (assuming 5-years average maturity). A larger share of the budget has to be spent on higher government interest payments, around 2% of GDP more. It leads to a rapid increase in the deficit by about 2 pps. and an increase in the debt ratio of 15 pps.. Again, the stabilising response in government consumption and transfers will eventually stabilise debt, but at the cost of a sharp reductions in these spending components. This, and the effects of higher borrowing costs across the economy, lead to declines in consumption and investment. These risk premia shocks result into generating a second dip recession in the model, with a fall in growth even larger than observed in 2009.

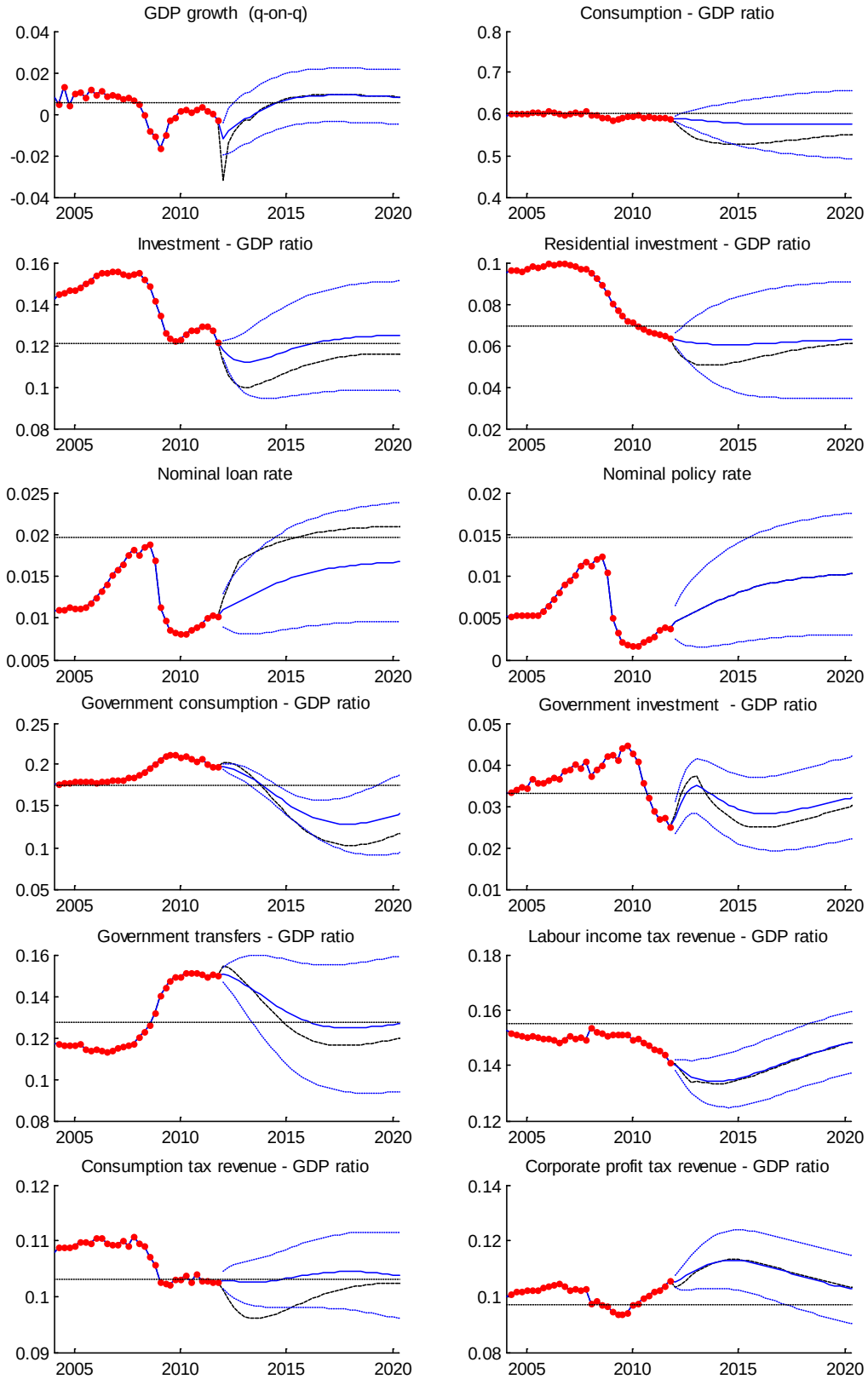
Figure 5.3 Higher risk premia



Note: blue line = baseline scenario (with 90% confidence interval bands); black dashed line = higher risk premium scenario

[8] The assumed 50% spillover to private financing costs is informed by Corsetti et al. (2012) and the empirical evidence cited therein.

Figure 5.3 (cont'd)



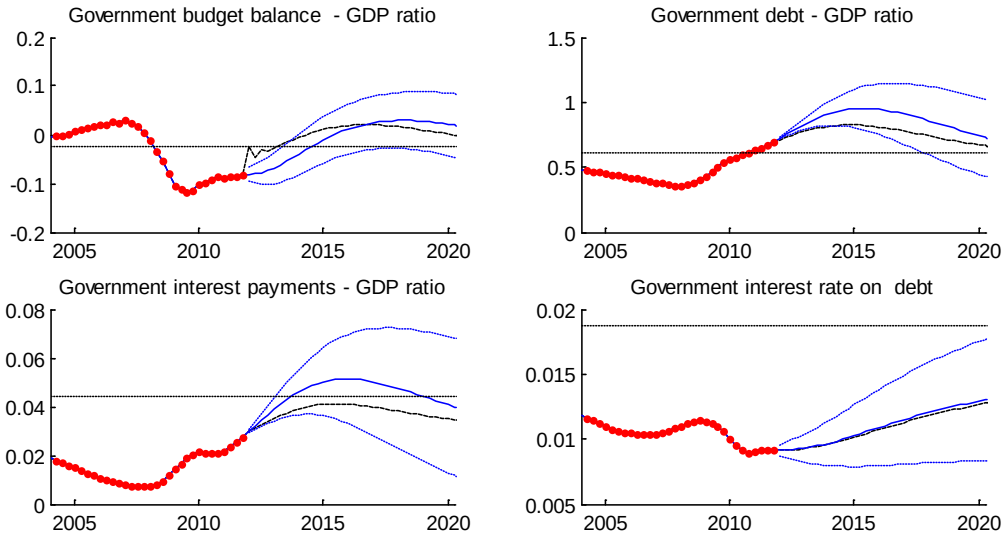
Note: blue line = baseline scenario (with 90% confidence interval bands); black dashed line = higher risk premium scenario ;

5.4 Frontloaded fiscal consolidation

The model can also be used to simulate alternative consolidation scenarios that front load the required fiscal adjustment and avoids the rise in debt by returning the deficit to target with a year. Frontloading fiscal consolidations can help to restore market confidence and reduce risk premia, but at a cost of GDP losses in the short and medium run. The scenario shown here assumes the adjustment takes place through an increase in personal income taxes, such that the share of labour taxes in GDP rises to around 21% of GDP, above the levels observed in the late 1990s. As can be seen in Fig. 5.4, the increase in labour taxes brings the deficit back to target with a year and avoids the debt-GDP ratio rising much above 80%. This helps to reduce the increase in the share of government interest payments directly, and the endogenous effect of a more favourable debt profile on the sovereign spreads adds to this further. But these consolidation measures have significant negative growth consequences, resulting into lower growth in the short to medium term, with growth below benchmark for up to 4 years.

The short term negative growth effects of fiscal consolidations depend crucially on the instrument used to reduce the deficit. It is generally advocated to consolidate through reductions in spending, rather than increases in taxes, as the latter increases the distortions associated with these taxes.[9] However, the short run GDP multipliers of tax changes are generally smaller than those for expenditure changes and therefore increasing taxes in the short run may be a strategy that is advisable if the objective is to minimise short term output losses and maximise the impact on the debt-to-GDP ratio. [10] Moreover, if, as argued above, the risk-pricing behaviour of investors has indeed changed, the balance between the negative effect of fiscal contraction on domestic demand and its positive effect on risk premium may further change, making the case for frontloaded fiscal consolidation stronger in countries with fragile fiscal fundamentals.

Figure 5.4 Frontloaded consolidation

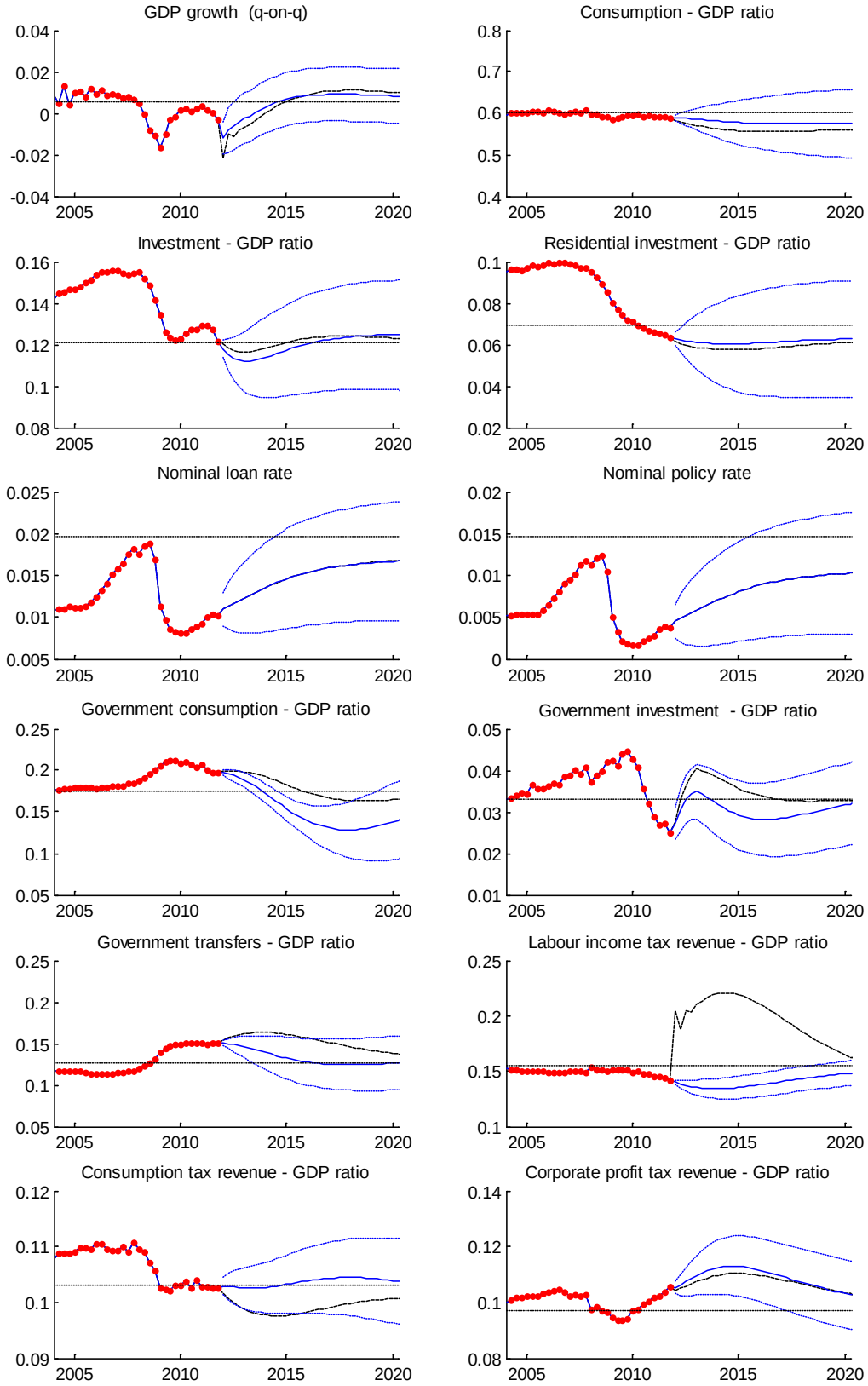


Note: blue line = baseline scenario (with 90% confidence interval bands); black dashed line = frontloaded consolidation scenario

[9] In Roeger and in 't Veld (2010) , we compare consolidations for different policy instruments.

[10] For this strategy to work, one would have to start consolidating with tax increases and switch in the medium term to expenditure cuts. See also Erceg and Linde (2012).

Figure 5.4 (cont'd)



Note: blue line = baseline scenario (with 90% confidence interval bands); black dashed line = frontloaded consolidation scenario ;

6. Conclusions

This paper has illustrated how an estimated structural model can be used to complement standard debt sustainability assessment frameworks. The perception of long run debt sustainability depends crucially on fiscal policy and long term growth projections, and the interaction between these and the financial markets responses in terms of spreads are of fundamental importance. The advantage of a model-based approach is that it allows taking into account feedback effects of debt ratios, changes in the composition of GDP, spreads and fiscal measures on growth and tax bases. Although our analysis abstracts from possible interventions to support financial institutions, and may therefore paint too rosy a picture of Spain's fiscal position, this would not be difficult to include this in the assessment.

It is shown how lower growth projections can have significant negative impact on debt projections. This underlines the need for structural reforms to raise the growth potential of the economy. Fiscal consolidation measures that reduce debt and deficits faster towards sustainable targets may have short term costs in terms of lower growth, but can avoid the costs associated with permanently higher risk premia. The speed of fiscal consolidation is a major and rather controversial policy choice in European countries with high public debt and weak structural fiscal position. Model-based analysis as illustrated in this paper can help to choose the least harmful ways of keeping public debt on a sustainable path.

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