The Debt Dynamic of Selected Euro Area Countries and Sustainable Paths for Fiscal Consolidation

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Abstract

This paper analyses possible patterns for the debt-to-GDP ratio in France, Italy, Spain, and Ireland with a small macroeconomic model. The role of international macroeconomic variables (such as US GDP growth rate, prices of raw materials and ECB monetary policy stance) and domestic policy instruments is analyzed in the debt dynamics. We find that external conditions, together with policies aimed at stimulating growth and fulfilling Maastricht restrictions on deficit, play a fundamental role for fiscal consolidation in these countries and help to reach a debt level more in line with pre-crisis values.

Keywords: Debt to GDP Ratio, French Economy, Italian Economy, Spanish Economy, Irish Economy, International Factors, SUR.

JEL: E62, H63, H68, C30

1. Introduction

In the last days of July and August Italy, Spain and Ireland and to a lower extent France, are under speculative attack by market investors. The market considers these countries risky because their debt-to-GDP-ratio has hugely increased as consequence of the recent global economic crisis and the lack of strong fiscal discipline. This paper analyses possible patterns for the debt-to-GDP ratio in France, Italy, Ireland and Spain with a small macroeconomic model. Our approach follows earlier works of Favero (2002), Favero and Marcellino (2005), Hasko (2007), and Casadio *et al.* (2011).

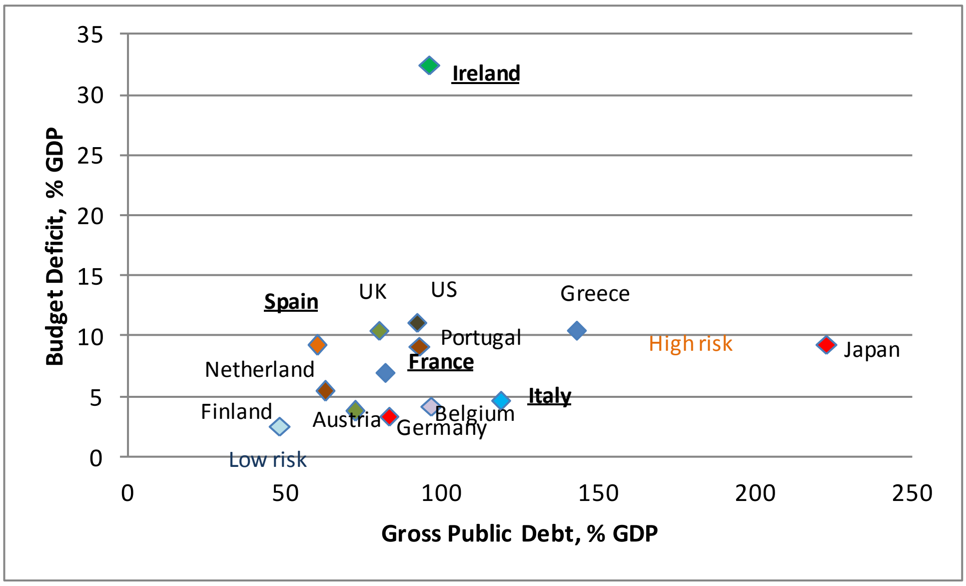
The aim of this paper is twofold. Firstly, adopting various scenarios for the exogenous variables viz. foreign GDP growth of a target country (usually USA), oil price changes and short-term interest rates, we investigate whether public debt in the next ten years will follow a sustainable pattern. Secondly, we study and quantify the policy interventions (growth and primary balance increases) aimed at reaching a debt level in line with the pre-crisis value (namely, before 2008) by 2020 in France, Italy, and Spain. A different exercise is taken for Ireland. The huge debt ratio accumulated in the last years is the result of policies aimed at saving the banking sector. Due to the high debt increase during the crisis (from 25% to almost 100%) its absorption in ten years should require an unfeasible policy-mix (additional growth over 1% every year and primary balance surplus over 10%). For the Irish case then we discuss only about a feasible policy mix aimed at reaching lower values.

The paper is organized as follows. Section 2 shows the public debt problem in Europe and in particular in France, Italy, and Spain. Section 3 presents the basic arithmetics of debt accounting. Section 4 presents a brief description of the model and its structure. Empirical results are in Section 5. Section 6 shows the debt patterns under six different scenarios. Section 7 illustrates the policies intervention needed in order to bring the debt-to-GDP ratio down to pre-crisis values or simply with lower values for Ireland. Section 8 concludes.

2. Sovereign debt problem in France, Italy, and Spain

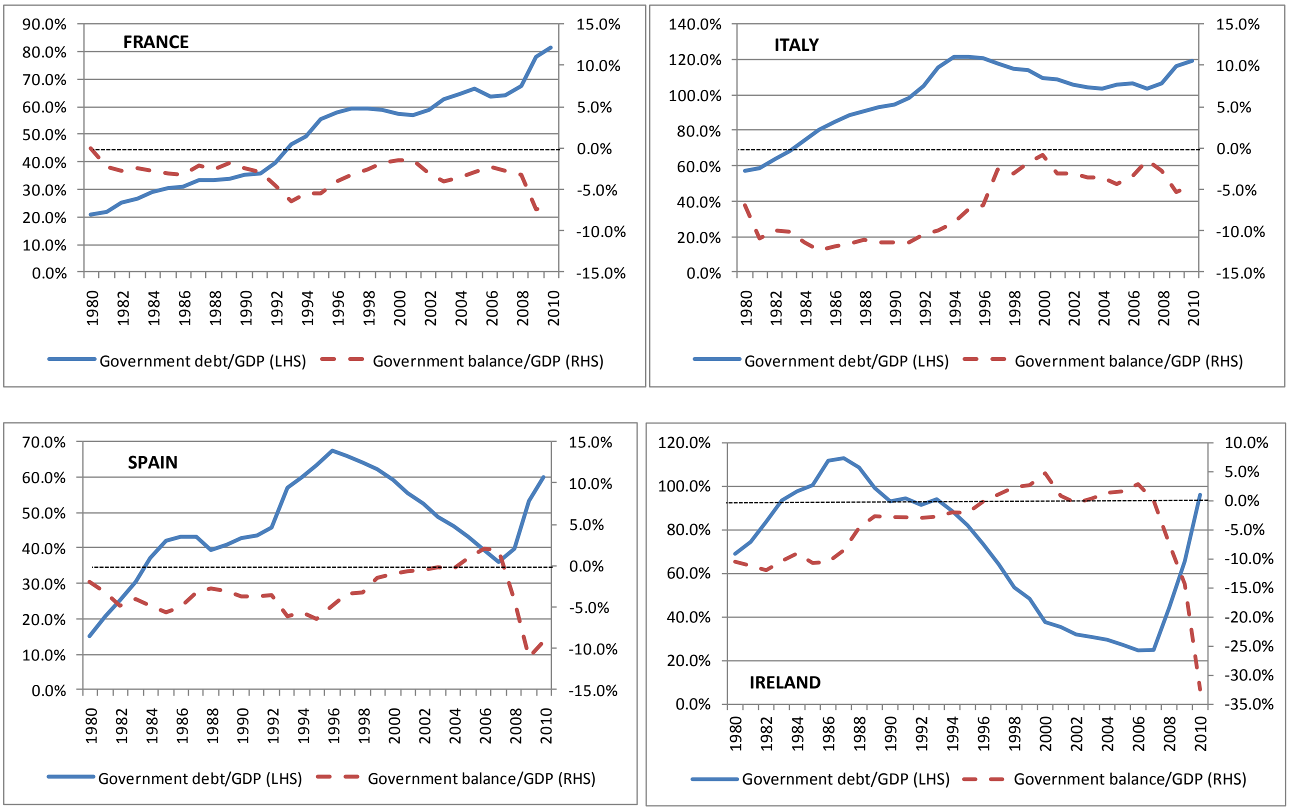
The chart below shows the sovereign debt problem in Europe and some non-Euro-Area countries. The gross public debt-to-GDP-ratio is on the horizontal axis while the budget deficit-to-GDP-ratio is on the vertical axis. Generally, the European Union Stability Pact implies a desirable debt-to-GDP ratio below the 60% and, in order to keep this stable, a budget deficit not higher than 3% of GDP in cyclically adjusted terms. Many countries are above these levels, not only as a consequence of the current global economic crisis, but also because of the lack of a strong fiscal discipline in the previous years (see Beetsma and Debrun, 2005). Italy, among the countries under investigation, has the higher debt-to-GDP-ratio (120% in 2010). This large debt is mainly the result of an historical problem as Figure 2 below shows, while its government deficit (as a ratio of GDP) was in line with those of the largest European countries. Spain, compared to other Euro Area countries, does not have a high debt-to-GDP-ratio, but it is running large budget deficits. Therefore, its debt-to-GDP ratio passed from 36% in 2007 to 60% in 2010. France does have a lower debt respect to other big countries such as Italy, USA, and Germany. Nevertheless, France shows a tangible historical upward trend in the debt dynamics, as Figure 2 shows, particularly steep in the last years because of high debt refinancing costs. Finally, Ireland is the riskier country because its debt dynamics exploded in the last few years - 27% in 2007 and 96% in 2010 (Figure 2) - and its budget deficit passed from 0 to over 30% over the same period.

Figure 1: The public debt problem (2010 data)



Source: EUROSTAT data.

Figure 2: France, Italy, and Spain debt-to-GDP-ratio dynamic



Source: EUROSTAT data.

As shown in Figure 1, many Euro-Area countries are close to very high risk level of debt-to-GDP-ratio. Figure 2 shows, instead, that for the countries under investigation (France, Italy, and Spain) debt dynamics has taken a dangerous positive trend in the last years, raising doubts about their capacity of solvency. In particular, this trend appears particularly accentuated for France and Ireland. The severity of the crisis has probably lowered the potential for future growth in many countries, making it very difficult for these countries to bring the debt-ratio on more sustainable pattern in the future.

3. Arithmetic of debt accounting

The dynamics of debt accumulation can be described with the identities (1) and (2) assuming that stock-flow adjustment is zero[1]:

[1] The stock-flow adjustment includes losses caused by guaranties for banks and income from the recovery of direct fiscal costs after the crisis. See note 2 for further detail.

$$B_t = B_{t-1} + i_t B_{t-1} - PB_t \qquad (1)$$

where $B_t =$ nominal general government debt at the end of year *t*, $i =$ nominal interest paid on government debt, $PB =$ primary advance, which equals tax revenues less government expenditure net of the interests paid on debt (*T* – *G*). The same relation holds if the variables are measured in real terms, assuming that inflation rate is measured with the GDP deflator. Normally the budget dynamic is written in the form of a change in the ratio of public debt-to-GDP (*b*):

$$\Delta b_t = \left(i_t - \pi_t - g_t\right) \cdot b_{t-1} - pb_t \qquad (2)$$

where $\pi =$ inflation rate and $g =$ real GDP growth; variables in lower case denote GDP ratios. According to (2), for a given *pb*, a stronger real GDP growth, a lower nominal interest rate and higher inflation rate will reduce the debt growth dynamics. The following condition is needed to guarantee the solvency and debt reduction:

$$pb^* \geq (i^* - \pi^* - g^*) \cdot b^* \qquad (3)$$

Where the variables denoted by * indicate the average value over the time span under investigation.

4. Modelling debt: A small macroeconomic model

Identity (2) can be used as a single residual equation, incorporating the scenarios for primary balance, growth, inflation, and interest rate in order to determine the debt-to-GDP dynamics. Alternatively, it can be introduced into a more complex model in order to account for interactions among the key variables. In this context, recently Favero and Marcellino (2005), Hasko (2007) and Casadio *et al*. (2011) estimated small-scale simultaneous equations models and we follow their approach. Our model consists of five equations and the endogenous variables are driven by three international variables (foreign countries GDP growth, oil price dynamics and domestic short-term Central Bank monetary policy rate). Our model is composed of the following functions expressed in linear terms[2]:

[2] We prefer to estimate the debt in the model instead of reconstructing the variable from the debt identity (1) for two reasons. Firstly, the stock flow adjustment is very difficult to predict and for this reason it is assumed to be zero in the projection exercises. A shortcoming is that in some periods ignoring this variable can cause a marked discrepancy respect to the effective debt-to-GDP ratio. Secondly, we prefer to use the long term interest rate as a proxy for the interest rate on general government debt because in this way we can see directly the effect of monetary policy changes on debt.

$$g = f\left(\overset{-}{i}, \overset{+/-}{pb}, \overset{+}{g^F}, \overset{+}{sp}, \overset{-}{\pi}\right) \qquad \text{(Output equation) (4)}$$

$$pb = f\left(\overset{+}{g}, \overset{+}{b}, \overset{+}{sp}\right) \qquad \text{(Fiscal rule) (5)}$$

$$b = f\left(\overset{-}{g}, \overset{-}{pb}, \overset{-}{\pi}, \overset{+}{i \cdot b_{-1}}, \overset{+}{sp}\right) \qquad \text{(Public debt equation) (6)}$$

$$\pi = f\left(\overset{+}{g}, \overset{+}{oil}, \overset{-}{pb}, \overset{+}{g^F}\right) \qquad \text{(Inflation equation) (7)}$$

$$i^L = f\left(\overset{+}{i^S}, \overset{+}{\pi}, \overset{+}{b}, \overset{+}{g}, \overset{-}{pb}\right) \qquad \text{(Long-term interest rate equation) (8)}$$

Where $i =$nominal interest rate, $pb =$primary balance, $g^F =$GDP growth of a foreign country (usually US GDP growth), $b =$Debt-to-GDP-ratio, $sp = i^L - i^S$ = spread between long (i^L) and short (i^S) interest rate, $\pi =$inflation, $i \cdot b_{-1} =$cost of service debt (interest paid on the stock of the debt in the previous period); $oil =$percent change in oil price expressed in euro.

The expected signs of the variables entering the various equations are indicated with on top. In the output equation, the nominal interest rate (long or short-term) enters with the negative sign. This is not a new assumption as Fuhrer and Moore (1995) showed for U.S. economy.

Inflation imposes negative externalities on the economy when it interferes with its efficiency. For example, inflation can lead to uncertainty about the future profitability of investment projects. This leads to a more conservative investment strategies leading to lower levels of investment and economic growth. In addition, inflation may interact with the tax system distorting borrowing and lending decisions. According to this view, inflation is detrimental for economic activity and we expect a negative effect on GDP growth.

Interest rate spreads (the difference between long and short-term interest rates) are considered to have a good predictive power for the business cycle, as shown for example in the studies of Stock and Watson (1989), Estrella and Hardouvelis (1991), and Estrella and Mishkin (1997). The positive correlation between spreads and economic growth results from the expectation hypothesis of term structure and the temporary influence of monetary policy (Hamilton and Kim (2002)).

A fiscal consolidation (a rise of primary balance due to an increase in government revenues or a cut in government spending) has in general a negative impact on economic growth. However, Rohn (2010) argues that the direct negative effect on aggregate demand could be potentially counterbalanced by a positive indirect effect if fiscal consolidation signals lower future public debt and taxes, as well as decreasing precautionary savings. In particular, this effect can be large if public debt is high. Then, the sign may change from a country to another depending on which kind of effect prevails. GDP growth in France, Italy, Spain, and Ireland may be also influenced (positively) by the growth of a foreign country such as US or Germany. Such countries act as leaders of Euro-zone and world economy.

The fiscal rule may be explained by output growth, debt-to-GDP-ratio and the interest rate spread. GDP growth in general has positive effect on government finances, boosting tax revenues and providing the government with extra money to finance spending projects. The Debt-to-GDP ratio influences positively the primary balance because higher debt implies higher government revenues (or lower government spending) to contain a further increase in the debt. The spread between long and short term interest rate is another variable that we expect to influence positively the primary balance. Higher rates on long-term government bonds imply higher costs of public debt services, forcing an increase in government revenues (or a cut in government spending) in order to contain public debt growth. We consider the long term interest rate as a proxy for the average cost of debt because the government debt duration, for all the countries considered, is getting longer and closer to the duration of long-term bonds. Figure A1 in the Appendix confirms our view as the deficit-to-GDP ratio calculated using the long-term bond interest rate as a proxy of the average cost of debt follows closely the official debt series for all the countries.

The debt-to-GDP ratio is explained by GDP growth, inflation, primary balance, and debt service payments. The expected sign in the equation are determined in accordance with our analysis in Section 3. In addition, the interest rates spread may have a positive effect on debt ratio dynamic as a spread increase is the sign of an increase in the long-term interest rates, implying a rise in debt service payments.

The inflation equation is formalized as a function of output growth, oil price growth, and international cycle, all in a positive way. The first effect is well known in literature about Phillips Curve, with the difference that output growth is used as an indicator of economic activity instead of the more common unemployment rate or output gap (Hasko, 2007). Oil prices change are included in the inflation equation according to the view that petroleum prices are not only important in production process, but also as a harbinger of inflationary pressure. Inflation may also be influenced (positively) by a rise in the international economic activity. In addition to these three variables, the primary balance could exert a negative effect on inflation. Two offsetting effects are to be accounted when considering the inflation response to the primary balances: a stimulus to inflation acting via costs (usually linked to an increase in indirect taxation) and a depressive effect due to decrease of private spending caused by the increased tax burden. We expect the latter effect to dominate.

The long-term interest rate is a positive function of the short-term interest rate, inflation, output growth and debt. High government debt, particularly if combined with uncertainties relating to the pace of economic activity, could also raise concerns about the government's ability to service its debts. This would raise credit risk-premia and government bond yield. A similar argument works for primary balance.

Obviously, the scheme presented here is in the most general form and not all the explaining variables enter the equations. Some of them, in various country estimations, are dropped because not significant.

5. Estimation results

The system of equations (4) – (8) is estimated as a simultaneous equation model using the Seemingly Unrelated Regression method (SUR) with annual data for the period 1970 – 2010. For Spain, due to data availability for the long term interest rate, the sample starts in 1980.[3] The results, which are shown in Tables 1-3, are extremely good as all the coefficients have the expected sign and are statistically significant. The residual diagnostic tests for absence of serial correlation (Portmanteau) of the residuals do not reject the null hypotheses; the normality test (Jarque-Bera), fails only for few equations: long-term interest rates for France, inflation equation for Italy and Spain, and debt and inflation equation for Ireland. The non-normality is mainly caused by outliers who produce an excessive kurtosis. Favero and Marcellino (2005) posit that the use of dummies

[3] In addition, democracy in Spain was introduced at the end of the '1970s so that excluding this decade will make the results more reliable.

could improve the diagnostic tests of the model, but it could weaken its forecasting performance. Hence, we prefer to be particularly thrifty in the use of dummies[4].

Table 1: SUR Estimates of French Debt Dynamics (1970 – 2010)								
$g_t = \alpha_1 + \alpha_2 pb_t + \alpha_3 g_t^{US} + \alpha_4 g_t^{GER} + \alpha_5 g_{t-1}^{GER} + \varepsilon_t^y$ (Output equation)								
α_1	α_2	α_3	α_4	α_5			$\bar{R}^2$	JB p-value
0.0147 (0.003) [4.273]	0.4430 (0.118) [3.741]	0.1876 (0.077) [2.424]	0.3920 (0.080) [4.907]	-0.2806 (0.083) [3.375]			0.660	0.385
$pb_t = \alpha_6 + \alpha_7 pb_{t-1} + \alpha_8 \; i_{t-1}^L - i_{t-1}^S \; + \alpha_9 g_{t-1} + \alpha_{10} DUM09 + \varepsilon_t^{pribal}$ (Fiscal rule)								
α_6	α_7	α_8	α_9	α_{10}			$\bar{R}^2$	JB p-value
-1.5159 (0.236) [6.424]	0.3647 (0.094) [3.869]	0.2332 (0.082) [2.849]	0.4911 (0.084) [5.813]	-3.190 (0.529) [6.031]			0.849	0.832
$b_t = \alpha_{11} + \alpha_{12} b_{t-1} + \alpha_{13} g_t + \alpha_{14} pb_{t-1} + \alpha_{15} \pi_t + \alpha_{16} g_t^{GER} + \varepsilon_t^b$ (Public debt equation)								
α_{11}	α_{12}	α_{13}	α_{14}	α_{15}	α_{16}		$\bar{R}^2$	JB p-value
7.7448 (1.172) [6.609]	0.9438 (0.018) [52.846]	-0.8448 (0.190) [4.495]	-0.7064 (0.156) [4.483]	-0.2664 (0.077) [3.450]	-0.500 (0.140) [3.547]		0.993	0.156
$\pi_t = \alpha_{17} + \alpha_{18} \pi_{t-1} + \alpha_{19} \pi_{t-2} + \alpha_{20} g_{t-1} + \alpha_{21} oil_t + \alpha_{22} oil_{t-1} + \varepsilon_t^{\pi}$ (Inflation equation)								
α_{17}	α_{18}	α_{19}	α_{20}	α_{21}	α_{22}		$\bar{R}^2$	JB p-value
-0.3983 (0.251) [1.590]	1.2255 (0.137) [8.910]	0.3010 (0.127) [2.377]	0.2391 (0.076) [3.160]	0.0272 (0.003) [8.051]	-0.0165 (0.010) [2.951]		0.963	0.925
$i_t^L = \alpha_{23} + \alpha_{24} i_{t-1}^L + \alpha_{25} i_t^S + \alpha_{26} \pi_{t-1} + \alpha_{27} g_t + \varepsilon_t^i$ (Long-term interest rate equation)								
α_{23}	α_{24}	α_{25}	α_{26}	α_{27}			$\bar{R}^2$	JB p-value
0.8003 (0.277) [2.888]	0.4123 (0.062) [6.645]	0.4070 (0.048) [8.383]	0.1840 (0.038) [4.887]	0.0643 (0.048) [1.326]			0.972	0.000
System residual Portmanteau tests for autocorrelations								
Q-Stat (Lag 1) (Prob. value)		Q-Stat (Lag 2) (Prob. value)		Q-Stat (Lag 4) (Prob. value)		Q-Stat (Lag 6) (Prob. value)		
0.727		0.436		0.248		0.180		
Notes: Standard errors and t-ratios are in parentheses and brackets respectively								

Table 2: SUR Estimates of Italian Debt Dynamics (1970 – 2010)								
$g_t = \alpha_1 + \alpha_2 pb_{t-1} + \alpha_3 g_t^{US} + \alpha_4 i_t^S + \alpha_5 i_{t-1}^S + \varepsilon_t^y$ (Output equation)								
α_1	α_2	α_3	α_4	α_5			$\bar{R}^2$	JB p-value
0.0049 (0.005)	-0.2098 (0.080)	0.6228 (0.085)	0.5387 (0.093)	-0.5674 (0.082)			0.715	0.608

[4] The only dummy used is for inflation equation of France due to a huge outlier encountered.

[0.922]	[2.625]	[7.308]	[5.817]	[6.884]				
$pb_t = \alpha_6 + \alpha_7 pb_{t-1} + \alpha_8 g_t + \alpha_9 b_{t-1} + \varepsilon_t^{pribal}$ (Fiscal rule)								
α_6	α_7	α_8	α_9				$\bar{R}^2$	JB p-value
-5.4144 (1.058) [5.117]	0.6763 (0.089) [7.564]	0.3455 (0.087) [3.976]	0.0531 (0.011) [4.624]				0.889	0.361
$b_t = \alpha_{10} + \alpha_{11} b_{t-1} + \alpha_{12} b_{t-2} + \alpha_{13} g_t + \alpha_{14} b_{t-2} \cdot i_{t-1}^L + \alpha_{15} \pi_t + \varepsilon_t^b$ (Public debt equation)								
α_{10}	α_{11}	α_{12}	α_{13}	α_{14}	α_{15}		$\bar{R}^2$	JB p-value
15.7100 (2.180) [7.206]	1.3579 (0.082) [16.515]	-0.5067 (0.073) [6.904]	-1.0593 (0.119) [8.917]	0.4159 (0.092) [4.532]	-0.3537 (0.078) [4.560]		0.956	0.251
$\pi_t = \alpha_{16} + \alpha_{17} \pi_{t-1} + \alpha_{18} g_{t-1} + \alpha_{19} pb_{t-1} + \alpha_{20} oil_t + \varepsilon_t^{\pi}$ (Inflation equation)								
α_{16}	α_{17}	α_{18}	α_{19}	α_{20}	$\bar{R}^2$	JB p-value		
0.0019 (0.005) [0.356]	0.7906 (0.058) [13.632]	0.2978 (0.118) [2.518]	-0.1921 (0.106) [1.805]	0.0422 (0.007) [6.147]	0.926	0.021		
$i_t^L = \alpha_{21} + \alpha_{22} i_{t-1}^L + \alpha_{23} i_{t-2}^L + \alpha_{24} i_t^S + \alpha_{25} \pi_t + \alpha_{26} b_t + \varepsilon_t^i$ (Long-term interest rate equation)								
α_{21}	α_{22}	α_{23}	α_{24}	α_{25}	α_{26}		$\bar{R}^2$	JB p-value
-0.0186 (0.012) [1.600]	0.8929 (0.109) [8.185]	-0.3259 (0.090) [3.637]	0.2152 (0.054) [3.948]	0.2102 (0.052) [4.022]	0.0268 (0.010) [2.618]		0.966	0.214
System residual Portmanteau tests for autocorrelations								
Q-Stat (Lag 1) (Prob. value)	Q-Stat (Lag 2) (Prob. value)	Q-Stat (Lag 4) (Prob. value)	Q-Stat (Lag 6) (Prob. value)					
0.186	0.351	0.470	0.105					
Notes: Standard errors and t-ratios are in the parentheses and square brackets respectively								

Table 3: SUR Estimates of Spain Debt Dynamics (1980 – 2010)

$g_t = \alpha_1 + \alpha_2 g_{t-1} + \alpha_3 i_t^L + \alpha_4 i_{t-1}^L + \alpha_5 pb_t + \alpha_6 pb_{t-1} + \alpha_7 g_t^{FR} + \alpha_8 g_{t-1}^{US} + \varepsilon_t^y$ (Output equation)									
α_1	α_2	α_3	α_4	α_5	α_6	α_7	α_8	$\bar{R}^2$	JB p-value
0.0086 (0.003) [3.190]	0.2052 (0.077) [2.656]	0.0014 (0.001) [1.746]	-0.0015 (0.001) [1.962]	0.4208 (0.057) [7.429]	-0.3002 (0.071) [4.230]	0.6214 (0.095) [6.565]	0.1553 (0.054) [2.896]	0.911	0.932
$pb_t = \alpha_9 + \alpha_{10} pb_{t-1} + \alpha_{11} pb_{t-2} + \alpha_{12} \; i_{t-1}^L - i_{t-1}^S \; + \alpha_{13} b_{t-1} + \alpha_{14} g_t + \varepsilon_t^{pribal}$ (Fiscal rule)									
α_9	α_{10}	α_{11}	α_{12}	α_{13}	α_{14}		$\bar{R}^2$		JB p-value
-3.6934 (0.853) [4.332]	0.7491 (0.144) [5.198]	-0.1980 (0.162) [1.216]	0.1491 (0.149) [1.001]	0.0300 (0.018) [1.625]	0.6778 (0.148) [4.579]		0.852		0.254
$b_t = \alpha_{15} + \alpha_{16} b_{t-1} + \alpha_{17} g_t + \alpha_{18} pb_{t-1} + \alpha_{19} \pi_{t-1} + \alpha_{20} \pi_{t-2} + \alpha_{21} b_{t-2} \cdot i_{t-1}^L + \varepsilon_t^b$ (Public debt equation)									
α_{15}	α_{16}	α_{17}	α_{18}	α_{19}	α_{20}	α_{21}	$\bar{R}^2$		JB

								JB p-value
6.153 (2.275) [2.704]	0.9479 (0.043) [22.257]	-1.6383 (0.173) [9.458]	-0.5341 (0.142) [3.756]	0.3416 (0.229) [1.489]	-0.4519 (0.239) [1.890]	0.0065 (0.002) [3.069]	0.979	0.637

$$\pi_t = \alpha_{22} + \alpha_{23}\pi_{t-1} + \alpha_{24}g_{t-1} + \alpha_{25}oil_t + \alpha_{26}oil_{t-1} + \varepsilon_t^{\pi}$$ (Inflation equation)

α_{22}	α_{23}	α_{24}	α_{25}	α_{26}			$\bar{R}^2$	JB p-value
-0.0038 (0.005) [0.769]	0.8904 (0.050) [17.650]	0.0016 (0.001) [1.510]	0.0163 (0.007) [2.263]	0.0029 (0.007) [0.385]			0.904	0.000

$$i_t^L = \alpha_{27} + \alpha_{28}i_{t-1}^L + \alpha_{29}i_{t-2}^L + \alpha_{30}i_t^S + \alpha_{31}\pi_t + \alpha_{32}b_t + \varepsilon_t^i$$ (Long-term interest rate equation)

α_{27}	α_{28}	α_{29}	α_{30}	α_{31}	α_{32}		$\bar{R}^2$	JB p-value
-0.3955 (0.984) [0.402]	0.4984 (0.116) [4.280]	-0.1894 (0.100) [1.890]	0.4842 (0.064) [7.508]	0.1894 (0.087) [2.171]	0.0300 (0.018) [1.664]		0.974	0.201

System residual Portmanteau tests for autocorrelations				
Q-Stat (Lag 1) (Prob. value)	Q-Stat (Lag 2) (Prob. value)	Q-Stat (Lag 4) (Prob. value)	Q-Stat (Lag 6) (Prob. value)	
0.089	0.122	0.595	0.433	

Notes: Standard errors and t-ratios are in the parentheses and square brackets respectively

Table 4: SUR Estimates of Ireland Debt Dynamics (1970 – 2010)

$$g_t = \alpha_1 + \alpha_2 g_{t-1} + \alpha_3 g_{t-2} + \alpha_4 g_t^{US} + \alpha_5 \;\; i_t^L - i_t^S \;\; + \alpha_6 \pi_{t-1} + \alpha_7 \pi_{t-2} + \varepsilon_t^y$$ (Output equation)

α_1	α_2	α_3	α_4	α_5	α_6	α_7		$\bar{R}^2$	JB p-value
-0.0058 (0.010) [0.553]	0.4567 (0.133) [3.439]	0.1480 (0.136) [1.087]	1.0287 (0.206) [4.999]	0.5754 (0.188) [3.056]	0.1811 (0.145) [1.246]	-0.3677 (0.162) [2.276]		0.573	0.494

$$pb_t = \alpha_8 + \alpha_9 \Delta pb_{t-1} + \alpha_{10}\Delta pb_{t-2} + \alpha_{11} g_t + \alpha_{12} b_{t-1} + \alpha_{13} b_{t-2} + \varepsilon_t^{pribal}$$ (Fiscal rule)

α_8	α_9	α_{10}	α_{11}	α_{12}	α_{13}		$\bar{R}^2$	JB p-value
-3.8300 (1.923) [1.992]	0.4803 (0.309) [1.556]	0.4711 (0.311) [1.513]	0.3217 (0.215) [1.500]	-0.3954 (0.109) [3.619]	0.4329 (0.115) [3.776]		0.656	0.000

$$b_t = \alpha_{14} + \alpha_{15} b_{t-1} + \alpha_{16} g_{t-1} + \alpha_{17} pb_{t-1} + \alpha_{18}\pi_{t-1} + \alpha_{19} i_t^L + \alpha_{20} \;\; i_{t-1}^L - i_{t-1}^S \;\; + \varepsilon_t^b$$ (Public debt equation)

α_{14}	α_{15}	α_{16}	α_{17}	α_{18}	α_{19}	α_{20}	$\bar{R}^2$	JB p-value
10.893 (1.894) [5.753]	0.9334 (0.031) [30.167]	-1.6441 (0.197) [8.339]	-0.5529 (0.241) [2.294]	-0.4681 (0.191) [2.453]	0.5295 (0.344) [1.539]	0.3613 (0.312) [1.159]	0.979	0.000

$$\pi_t = \alpha_{21} + \alpha_{22}\pi_{t-1} + \alpha_{23}\pi_{t-2} + \alpha_{24}\pi_{t-3} + \alpha_{25}oil_t + \alpha_{26}oil_{t-1} + \alpha_{27} g_t^{GER} + \alpha_{28} pb_t + \varepsilon_t^{\pi}$$ (Inflation equation)

α_{21}	α_{22}	α_{23}	α_{24}	α_{25}	α_{26}	α_{27}	α_{28}	$\bar{R}^2$	JB p-value
-0.0088 (0.008) [1.060]	0.9928 (0.148) [6.684]	-0.2936 (0.209) [1.404]	0.0419 (0.124) [0.338]	0.0376 (0.009) [4.341]	0.0234 (0.010) [2.268]	0.5095 (0.180) [2.827]	-0.1769 (0.073) [2.406]	0.864	0.000

$i_t^L = \alpha_{29} + \alpha_{30} i_{t-1}^L + \alpha_{31} i_{t-2}^L + \alpha_{32} i_{t-3}^L + \alpha_{33} i_t^S + \alpha_{34} \pi_{t-1} + \alpha_{35} pb_t + \varepsilon_t^i$ (Long-term interest rate equation)								
α_{29}	α_{30}	α_{31}	α_{32}	α_{33}	α_{34}	α_{35}	$\bar{R}^2$	JB p-value
0.0121 (0.003) [3.507]	0.3620 (0.137) [2.593]	-0.1883 (0.146) [1.286]	0.2305 (0.125) [1.847]	0.3789 (0.056) [6.745]	0.1667 (0.042) [3.932]	-0.1164 (0.023) [5.099]	0.955	0.171
System residual Portmanteau tests for autocorrelations								
Q-Stat (Lag 1) (Prob. value)	Q-Stat (Lag 2) (Prob. value)	Q-Stat (Lag 4) (Prob. value)	Q-Stat (Lag 6) (Prob. value)					
0.075	0.147	0.203	0.509					
Notes: Standard errors and t-ratios are in the parentheses and square brackets respectively								

As we aim at studying the future pattern of debt dynamic with respect to international exogenous variables, we are not interested in whether the SUR models estimated above are better than other econometric forecasting models. We are interested in evaluating the debt pattern with respect to different exogenous variables scenarios. In any case, we checked whether our model tend to predict the debt-GDP-ratio in a satisfying way by running an out of sample forecast for the period 2000-2010. The results are satisfying and are available upon request.

6. Scenarios and debt-to-GDP dynamic forecasts

Six scenarios are simulated for the period 2011-2020 using the results of estimations in Section 4. Each scenario is characterized by different patterns assumed for the exogenous variables. In our simulations we change the pattern for g^F and i^S because we are interested in understanding the pattern of debt with respect to changes in both world economy growth and monetary policy by European Central Bank. For this reason in all scenarios we maintain the oil price change fixed, assuming that in 2020 it reaches a value of 247$ (equal to 186€ assuming an exchange rate identical to the last value observed)[5]. All scenarios and results for France, Italy, and Spain are presented in Table 2-4 and Figure 4.

Table 4: Scenarios and Macroeconomic Analysis for France (2011 – 2020)						
Scenario	**1**	**2**	**3**	**4**	**5**	**6**
Nominal short-term interest rate	4%	3%	5%	4%	4%	4%

[5] Charles Maxwell of Weeden and Co., a renowned expert in the energy markets, predicts an oil price at US$300 in 2020. This value could be too high, but if the world economy will recover from the recession and economies such as India and China will continue to experience near double-digit growth, then a value well above US$200 is feasible.

2020 Oil price in US dollar and Euro	Nominal 247$ (186€)	Nominal 247$ (186€)	Nominal 247$ (186€)	Nominal 247$ (186€)	Nominal 247$ (186€)	Nominal 247$ (186€)
	Real 202$ (152€)	Real 202$ (152€)	Real 202$ (152€)	Real 202$ (152€)	Real 202$ (152€)	Real 202$ (152€)
Real US GDP growth	1.8%	1.8%	1.8%	2.0%	2.2%	3.0%
Real GER GDP growth	1.8%	1.8%	1.8%	2.0%	2.2%	3.0%
2020 Public Debt (% of GDP)	95%	93%	96%	93%	91%	83%
Primary balance (% of GDP) *	-1.15%	-1.01%	-1.30%	-1.09%	-1.02%	-0.76%
Nominal long-term interest rate*	4.42%	3.87%	4.98%	4.45%	4.44%	4.61%
Inflation*	1.31%	1.37%	1.26%	1.41%	1.50%	1.89%
Real GDP growth*	1.46%	1.52%	1.40%	1.55%	1.64%	2.0%
General Government balance in % of GDP*	5.04% (5.20%)	4.31% (4.36%)	5.71% (6.05%)	4.96% (5.07%)	4.87% (4.93%)	4.52% (4.38%)
$pb^{*} - \ i^{*} - \pi^{*} - g^{*} \ d^{*} \geq 0$	-2.66	-1.89	-3.44	-2.44	-2.21	-1.26

Note: Real values for Oil price change are calculated assuming an international average inflation of 2.2% for period 2011 – 2020. * Average values over the period. In parentheses the last value of government balances in 2020.

Table 5: Scenarios and Macroeconomic Analysis for Italy (2011 – 2020)

Scenario	**1**	**2**	**3**	**4**	**5**	**6**
Nominal short-term interest rate	4%	3%	5%	4%	4%	4%
2020 Oil price in US dollar and Euro	Nominal 247$ (186€)	Nominal 247$ (186€)	Nominal 247$ (186€)	Nominal 247$ (186€)	Nominal 247$ (186€)	Nominal 247$ (186€)
	Real 202$ (152€)	Real 202$ (152€)	Real 202$ (152€)	Real 202$ (152€)	Real 202$ (152€)	Real 202$ (152€)
Real US GDP growth	1.8%	1.8%	1.8%	2.0%	2.2%	3.0%
2020 Public Debt (% of GDP)	109%	107%	111%	108%	106%	101%
Primary balance (% of GDP) *	2.30%	2.25%	2.34%	2.32%	2.34%	2.44%
Nominal long-term interest rate*	5.63%	6.08%	6.08%	5.61%	5.60%	5.55%
Inflation*	2.82%	2.80%	2.84%	2.89%	2.96%	3.26%
Real GDP growth*	1.26%	1.24%	1.28%	1.38%	1.50%	1.97%
General Government balance in % of GDP*	3.70% (3.80%)	3.25% (3.21%)	4.15% (4.40%)	3.61% (3.73%)	3.53% (3.67%)	3.19% (3.42%)
$pb^{*} - \ i^{*} - \pi^{*} - g^{*} \ d^{*} \geq 0$	0.59	0.99	0.18	0.85	1.11	2.11

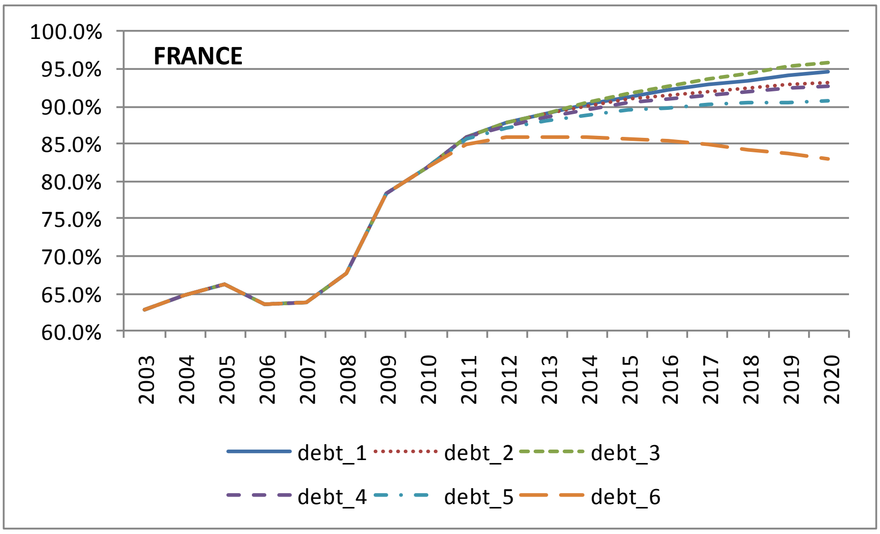
Note: Real values for Oil price change are calculated assuming an international average inflation of 2.2% for period 2011 – 2020. * Average values over the period. In parentheses the last value of government balances in 2020.

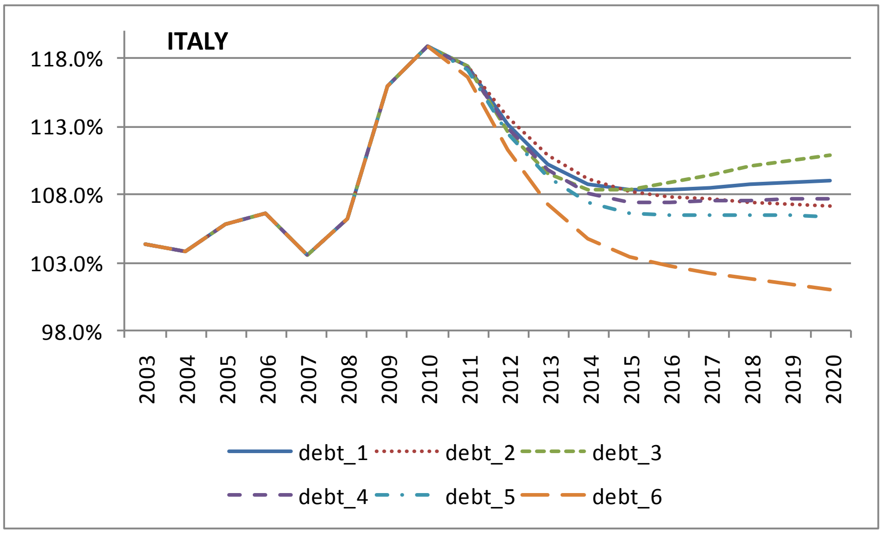
Table 6: Scenarios and Macroeconomic Analysis for Spain (2011 – 2020)						
Scenario	**1**	**2**	**3**	**4**	**5**	**6**
Nominal short-term interest rate	4%	3%	5%	4%	4%	4%
2020 Oil price in US dollar and Euro	Nominal 247$ (186€)	Nominal 247$ (186€)	Nominal 247$ (186€)	Nominal 247$ (186€)	Nominal 247$ (186€)	Nominal 247$ (186€)
	Real 202$ (152€)	Real 202$ (152€)	Real 202$ (152€)	Real 202$ (152€)	Real 202$ (152€)	Real 202$ (152€)
Real US GDP growth	1.8%	1.8%	1.8%	2.0%	2.2%	3.0%
Real FRA GDP growth	1.8%	1.8%	1.8%	2.0%	2.2%	3.0%
2020 Public Debt (% of GDP)	60%	58%	62%	56%	52%	35%
Primary balance (% of GDP) *	0.54%	0.57%	0.51%	0.71%	0.89%	1.58%
Nominal long-term interest rate*	5.36%	4.70%	6.02%	5.30%	5.24%	4.99%
Inflation*	2.55%	2.54%	2.55%	2.69%	2.84%	3.41%
Real GDP growth*	3.08%	3.09%	3.07%	3.30%	3.51%	4.36%
General Government balance in % of GDP*	2.53% (2.65%)	2.09% (2.16%)	2.98% (3.18%)	2.22% (2.37%)	1.90% (2.09%)	0.67% (1.09%)
$pb^{*} - \; i^{*} - \pi^{*} - g^{*} \; d^{*} \geq 0$	0.71	1.12	0.27	1.11	1.50	2.86
Note: Real values for Oil price change are calculated assuming an international average inflation of 2.2% for period 2011 – 2020. * Average values over the period. In parentheses the last value of government balances in 2020.						

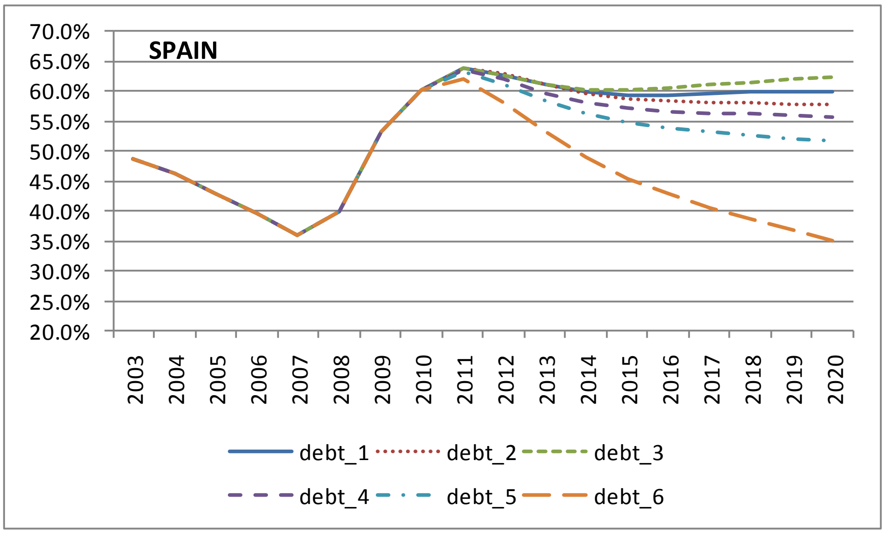
Table 7: Scenarios and Macroeconomic Analysis for Ireland (2011 – 2020)						
Scenario	**1**	**2**	**3**	**4**	**5**	**6**
Nominal short-term interest rate	4%	3%	5%	4%	4%	4%
2020 Oil price in US dollar and Euro	Nominal 247$ (186€)	Nominal 247$ (186€)	Nominal 247$ (186€)	Nominal 247$ (186€)	Nominal 247$ (186€)	Nominal 247$ (186€)
	Real 202$ (152€)	Real 202$ (152€)	Real 202$ (152€)	Real 202$ (152€)	Real 202$ (152€)	Real 202$ (152€)

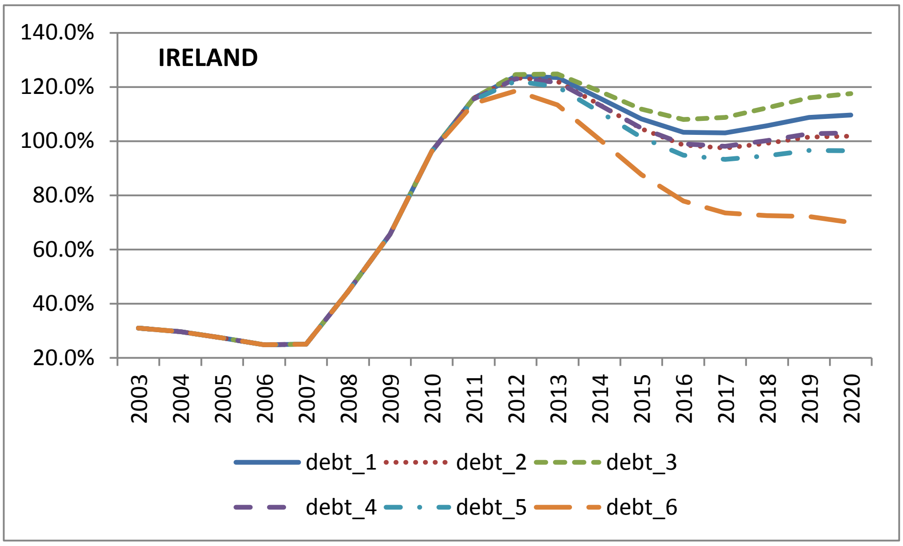
Real US GDP growth	1.8%	1.8%	1.8%	2.0%	2.2%	3.0%
Real GER GDP growth	1.8%	1.8%	1.8%	2.0%	2.2%	3.0%
2020 Public Debt (% of GDP)	110%	102%	117%	103%	96%	70%
Primary balance (% of GDP) *	-0.26%	0.08%	-0.59%	0.02%	0.30%	1.41%
Nominal long-term interest rate *	5.30%	4.71%	5.88%	5.30%	5.30%	5.29%
Inflation *	3.77%	3.70%	3.85%	4.03%	4.30%	5.35%
Real GDP growth *	3.52%	3.92%	3.11%	3.88%	4.26%	5.73%
General Government balance in % of GDP *	5.65% (7.99%)	4.56% (6.94%)	6.78% (9.13%)	5.20% (7.61%)	4.75% (7.23%)	4.52% (5.68%)
$pb^* - \ i^* - \pi^* - g^* \ d^* \geq 0$	1.97	3.20	0.66	2.86	3.70	6.62
Note: Real values for Oil price change are calculated assuming an international average inflation of 2.2% for period 2011 – 2020. * Average values over the period. In parentheses the last value of government balances in 2020.						

Figure 4: Debt-to-GDP-ratio simulation in correspondence of different scenarios









It is interesting to note that Italy and Ireland show a more stable pattern over the period 2011-2020. Even in most pessimistic scenario (debt 3) public debt increases only by 3 percentage points. In any case, it is also interesting to note that in all scenarios, excluding the most optimistic (*debt 6* with $g^F = 3\%$), the debt never goes under 100% of GDP. Spain shows a similar situation as all scenarios are stable ,but there is a difficulty in bringing debt levels below 50% of GDP (with the exception of *debt 6* scenario). France shows the most problematic case. All scenarios (including the most optimistic *debt 6*) produce an unstable path for debt. According to our analysis, France seems to be the riskier among the three countries studied. In conclusion, we can say that without a direct policy intervention, Italy and Spain show a sustainable pattern for the next 10 years – but with difficulties to bring the debt under pre-crisis values (that is, before 2008) – whereas France follows non-sustainable patterns. In this situation, ad-hoc measures to facilitate the back-in of the sovereign debt are needed, especially for France.

7. Debt-to-GDP dynamic forecasts in presence of policies mix

In this section two kinds of exercise are taken. We simulate policy interventions needed to bring the debt of France, Italy, and Spain in line with before crisis values (that is, values of 2007). For Ireland, instead, we discuss only about a feasible policy mix aimed at reaching lower values. The reason is that the huge Irish debt ratio accumulated in the last years is a result of policy aimed at saving the banking sector. Absorbing the accumulated debt in ten years in order to reach the 2007 level (25%) require – according to our simulations - an infeasible policy-mix (additional growth over 1% every year and a primary balance surplus over 10% for all periods 2011-2020).

In our exercises we assume that monetary policy is equal to 4%, oil price changes follow the usual pattern and that international growth (g^F) rises at a rate of 2% per annum. In this scenario we assume that the only two policy interventions are steers aimed at increasing internal growth and the primary balance (a rise in government revenues or a cut in the government spending). These are exactly the mix policies discussed in these days in the Euro Commission. The results are shown in Table 5.

Table 7: Scenarios and policy intervention simulation (2011-2020)

Scenario	**France**	**Italy**	**Spain**	**Ireland**
Nominal short-term interest rate	4%	4%	4%	4%
2020 Oil price in US dollar and Euro	Nominal 247$ (186€)	Nominal 247$ (186€)	Nominal 247$ (186€)	Nominal 247$ (186€)
	Real	Real	Real	Real

	202$ (152€)	202$ (152€)	202$ (152€)	202$ (152€)
Real US GDP growth	2.0%	2.0%	2.0%	2.0%
Real GER GDP growth	2.0%	-	-	2.0%
Real FRA GDP growth	-	-	2.0%	-
2020 Public Debt (% of GDP)	64%	103%	36%	87%
Primary balance policy intervention (% of GDP)	+ 0.5%	+ 0.05%	+ 0.07%	1%
Primary balance (% of GDP) *	1.04%	2.54%	1.65%	1.70%
Nominal long-term interest rate*	5.07%	5.53%	4.99%	4.83%
Inflation*	3.39%	3.12%	3.38%	3.28%
Real GDP growth policy intervention	+ 1%	+ 0.5%	+ 0.75%	0.5%
Real GDP growth*	3.49%	1.83%	4.30%	4.56%
General Government balance in % of GDP*	2.64% (1.64%)	3.14% (3.31%)	0.61% (1.04%)	2.75% (5.02%)
$pb^* - \ i^* - \pi^* - g^* \ \ d^* \geq 0$	2.42	1.91	2.89	4.70
Note: Real values for Oil price change are calculated assuming an international average inflation of 2.2% for period 2011 – 2020. * Average values over the period. In parentheses the last value of government balances in 2020.				

In order to bring the debt in line with the values of 2007, France, Italy, and Spain have to implement a policy mix of growth and primary balance stimulus. For Italy an additional half percentage point for both GDP growth and primary balance is sufficient to reach the debt target. Spain is in a similar situation, with a required increase of 0.7% for both variables. France is the country needing the higher effort in order to bring the sovereign debt in line with the 2007 value (64% in percent of GDP). For France, a policy mix of an additional 1% GDP growth and 5% primary balance increase over the whole period 2011-2020 is needed. The necessity to strongly increase the primary balance further indicates that French debt levels are very unlikely to turn back to pre-crisis levels.

Ireland, instead, with a reasonable policy mix is able to reach a debt-ratio under 90%. This means that it will require more than 10 years to reach the 2007 values.[6]

[6] Our results (available upon request) show that only in 2030 the debt-ratio will be in line with the 60% target.

8. Conclusions

In this paper we used a small-scale econometric model for France, Italy, Spain, and Ireland in order to study possible patterns of debt-to-GDP-ratio in the next ten years. Our results showed that, even in presence of positive external scenarios, the debt-to-GDP ratios are unlikely to reach the pre-crisis levels for all countries. In addition, French debt follows an unsustainable pattern for the period 2011-2020. Our simulation showed that a policy intervention aimed at both pushing up GDP growth and primary balance are needed to bring the debt in line with lower values. For France, Italy, and Spain, we conducted an exercise aimed at bringing the debt ratio down to pre-crisis levels. France is the country which needs major efforts in order to bring the sovereign debt down to the 2007 level (64% in percent of GDP): a policy mix of an additional 1% of growth and additional 5 percentage points in the primary balance are needed for the whole 2011-2020 period. Considering the recent events, with increasing instability in Greece and Italy, this result indicates that France can potentially suffer from a crisis of similar entity, posing additional risks to the stability of the Euro Area. A different exercise is taken for Ireland because the particular origin of its debt. The huge Irish debt ratio accumulated in the last years (from 2007 onward) is a result of policy aimed at saving the banking sector. Reaching the pre-crisis level is unfeasible because it will require a policy mix of growth and fiscal interventions not realizable (additional growth over 1% and additional primary balance surplus over 10% for all period 2011-2020). A feasible policy mix (0.5% growth and 1% primary surplus interventions for 2011-2020) shows that Irish economy can reach a debt-ratio value below 90%.

Data Appendix

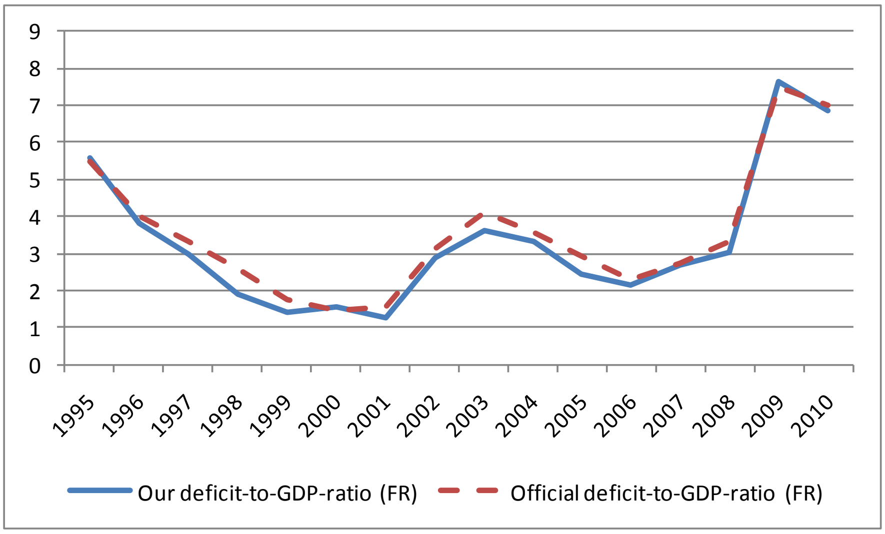
Definitions and Data Source for all countries

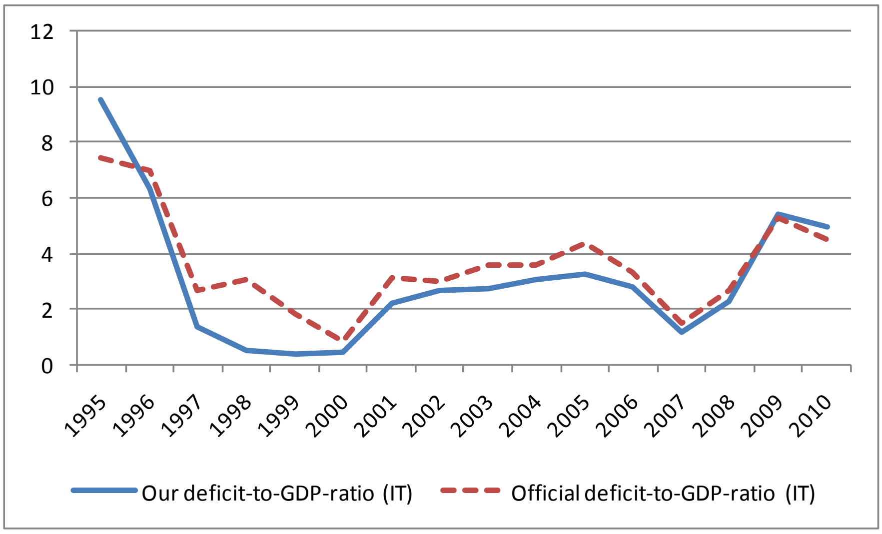
Variable	Definition	Source
b	Debt-to GDP ratio	AMECO - EUROSTAT (A-E)
π	Percentage change of Consumer Price Index	OECD Statistics (OCED-S)
g	Real GDP growth	A-E
g^{US}	Real France GDP growth	Federal Reserve Economic DATA

		(FRED)
pb	Primary balance (Total government revenues minus government spending excluding interest payments).	A-E
i^S	Nominal short-term interest rate	OCED-S
i^L	Nominal long-term interest rate	OECD-S
oil	Oil price (WTI - expressed in Euro) percentage change	FRED

Appendix A

Figure A1: Official deficit-to-GDP-ratio versus our calculated deficit-to-GDP-ratio




12
10
8
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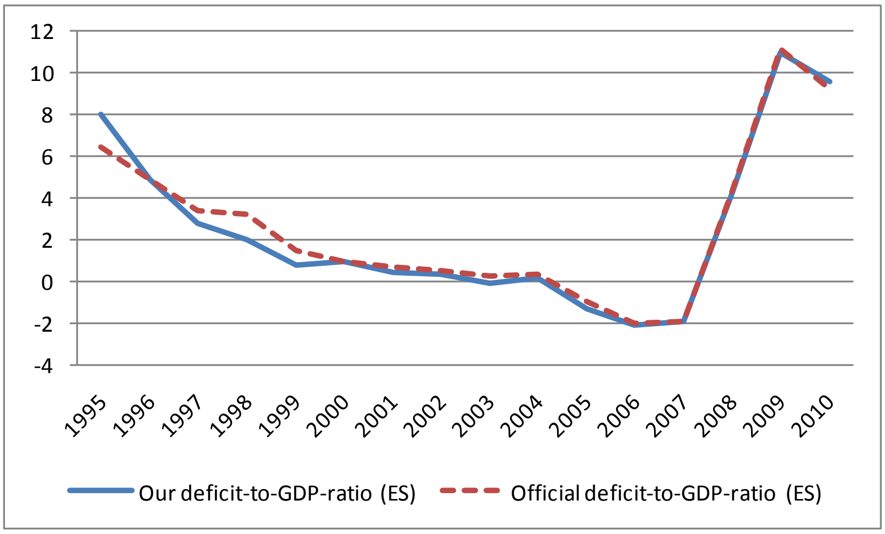
1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010
Our deficit-to-GDP-ratio (IT)
Official deficit-to-GDP-ratio (IT)


12
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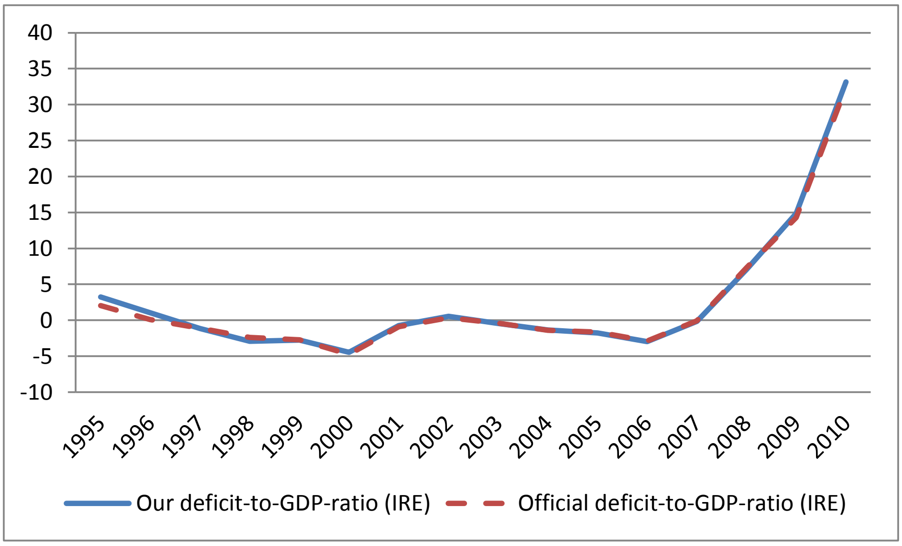
1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010
Our deficit-to-GDP-ratio (ES)
Official deficit-to-GDP-ratio (ES)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0
-5
-10
1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010
Our deficit-to-GDP-ratio (IRE)
Official deficit-to-GDP-ratio (IRE)

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