THE CHALLENGES OF PUBLIC DELEVERAGING

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(*) The opinions in this paper are those of the authors and do not necessarily represent those of the Banco de España or the Eurosystem.

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Abstract

The government debt-to-GDP ratios in the majority of euro area economies, including Spain, are at very high levels according to the available historical records. Economic research is conclusive in pointing out that bearing high levels of public debt ratios for an extended period of time can be damaging for economic growth. The economic literature also concludes that sustained high debt ratios create a source of vulnerability for the economy, in addition to lessening the stabilisation capacity of the public budget. Against this background, the reform of both the European Stability Pact and the Spanish budgetary stability law during the recent crisis strengthened the role of public debt in the budgetary framework. The simulations performed in this paper show that, under plausible macroeconomic assumptions, the public deleveraging process required by the Sustainability Pact for Spain will still imply a significant fiscal consolidation effort that has to be sustained over time.

Keywords: public debt, fiscal consolidation, macroeconomic stabilisation.

JEL classification: H63, E61, E62, H12.

Resumen

Los niveles de deuda pública sobre el PIB en una mayoría de países de la UEM, incluida España, se encuentran en niveles muy elevados de acuerdo con los registros históricos disponibles. La literatura económica es concluyente en señalar que el mantenimiento de ratios de deuda pública muy elevadas durante períodos temporales prolongados puede resultar perjudicial para el crecimiento económico y suponer una fuente de vulnerabilidad para la economía, además de reducir la capacidad estabilizadora del presupuesto público. En este contexto, las reformas del Pacto de Estabilidad y Crecimiento europeo y de la ley de estabilidad presupuestaria española acometidas durante la reciente crisis reforzaron el papel de esta variable en el marco presupuestario. Las simulaciones realizadas en el presente trabajo muestran que, bajo determinados supuestos macroeconómicos, un proceso de desapalancamiento público como el exigido por el Pacto de Estabilidad para el caso de la economía española exigirá un esfuerzo de consolidación fiscal todavía significativo y que debe perdurar en el tiempo.

Palabras clave: deuda pública, consolidación fiscal, estabilización macroeconómica.

Códigos JEL: H63, E61, E62, H12.

CONTENTS

1 Introduction

The recent economic and financial crisis has prompted a substantial increase in the European Union (EU) countries' general government debt to levels far higher than those in the period prior to 2008. In Spain's particular case, while the public debt-to-GDP ratio is on a slightly declining path, its levels remain close to 100% of GDP, the outcome of a rapid process of public deleveraging during the crisis.

The economic literature stresses the problems that high public debt poses for economic activity. First, an economy's growth capacity in the long term may be curtailed, insofar as public debt absorbs resources that might be used for more productive ends and alters the economy's aggregate financing conditions, distorting private investment decisions. Further, in the context of high public debt, fiscal policy may be affected by the need to sustain substantial primary surpluses that require higher tax levels or lower productive spending levels. At the same time, the room for countercyclical fiscal policy to tackle adverse macroeconomic shocks may be significantly reduced. Also, high indebtedness creates greater vulnerability to changes in market investor sentiment.

Against this background, this paper reviews the challenges associated with these high levels of indebtedness. Specifically, the following section describes the current levels of public debt for a broad set of advanced economies, and the determinants of recent developments in such debt. Further, past public deleveraging processes are reviewed to draw lessons for the future. The third section revisits the theoretical and empirical arguments that show the risks associated with sustained high levels of debt over extended periods of time. Also, the economic literature on the existence of limits on public debt levels above which those risks are exacerbated is summarised. The fourth section shows a set of tools that enable the vulnerability of public debt positions to be assessed, and their use for the Spanish case is illustrated.

2 Public debt from a historical perspective

2.1 Recent developments in public debt

The economic and financial crisis has prompted a substantial increase in general government debt in the main euro area countries to levels far higher than those prevailing in the period immediately prior to 2008 (see Chart 1.1). The debt-to-GDP ratio stabilised broadly only recently, at a 50-year high, standing in 2017 for the euro area as a whole at slightly below 90%. This scenario is shared by other advanced economies, such as the United States, the United Kingdom and Japan, whose respective public debt-to-GDP ratios totalled 108.1%, 86.6% and 240.3% in 2017 (see Charts 1. 3 and 1.4).[1]

Spain has likewise seen this worsening in public debt. In the case of the Spanish general government sector, the low starting level of public debt before the crisis (below 36% of GDP compared with 65% in the euro area in 2007) enabled the initial impact of the cyclical downturn and of the fiscal policy countercyclical measures to be absorbed. However, the continuing economic weakness and high budget deficits, among other factors, placed the debt-to-GDP ratio at a peak of 100.4% in 2014 (a high of 94.2% for the euro area, also in 2014), marking an increase of 65 pp from the observed level in 2007 (compared with an increase of 29 pp of GDP in the euro area in the same period). Subsequently, this ratio has dipped slightly to around 98% in 2017, a level still higher than that of the euro area.[2] As a result, the public debt-to-GDP ratio currently stands at levels not seen for over a century (see Chart 1.2).

For analytical purposes, it is worth disaggregating the change in the debt ratio as a percentage of GDP into its fundamental factors: a) the level of the primary budget deficit (the deficit excluding interest payments), which needs to be financed and, therefore, translates into an increase in debt; b) the interest charges generated by the public debt, which must also be financed; c) the so-called deficit-debt adjustment, and d) the change in nominal GDP, since an increase (decrease) in this variable automatically generates a reduction (increase) in the debt ratio, owing to the denominator effect of the ratio, in accordance with the expression that determines the dynamics of the public debt-to-GDP ratio, b, given by:

$$b_t - b_{t-1} = \left(\frac{r_t}{1+g_t}\right) b_{t-1} - \left(\frac{\pi_t + g_t}{1+g_t}\right) b_{t-1} - p_t + add_t \qquad [1]$$

which is the habitual equation of the government's budgetary constraint in a given year, t, where g denotes real GDP growth, π the inflation rate measured by the GDP deflator (such that $\gamma_t \equiv \pi_t + g_t$ is the change in nominal GDP), r the implicit nominal interest rate on debt,[3] p the primary budget deficit as a percentage of GDP, and add the deficit-debt adjustment, also as a percentage of GDP.

1 The figures for 2017 mentioned in this section draw on the European Commission's autumn 2017 projections for the European economies, and the IMF autumn projections for the United States and Japan.

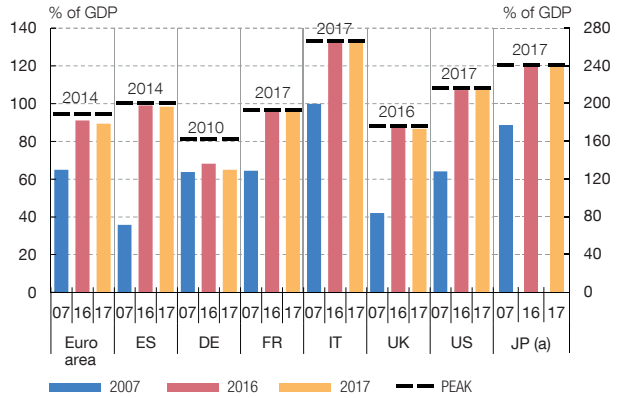
2 For a detailed description of the changes in Spanish general government finances during the crisis, see Gordo et al. (2013), Delgado-Téllez et al. (2016) and Martí and Pérez (2015).

3 The nominal interest rate is assumed to be equivalent to the weighted average of the yields on the various debt instruments at different maturities.

DEVELOPMENTS IN PUBLIC DEBT IN SPAIN AND IN THE MAIN ADVANCED ECONOMIES

CHART 1

1 PUBLIC DEBT DURING THE CRISIS



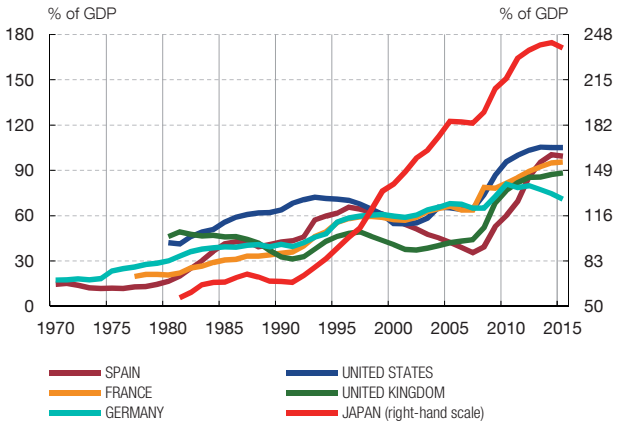
SOURCES: European Commission and IMF. The data for 2017 are the IMF's autumn projections for the United States and Japan; for the remaining economies the figures are the European Commission's.

a Right-hand axis.

2 PUBLIC DEBT IN SPAIN OVER THE LONG TERM

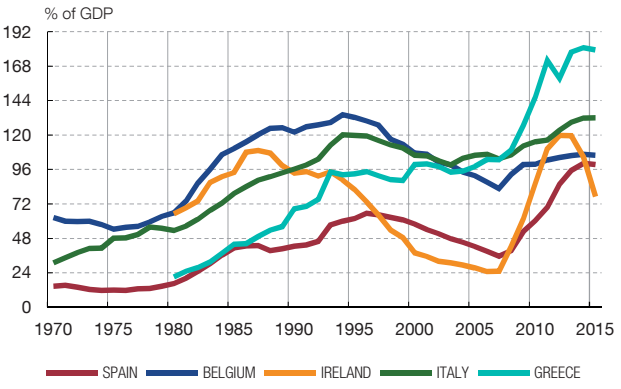
SOURCES: Reinhart and Rogoff (2011) and Comín (2016). The 2017 data correspond to the European Commission's autumn projections.

3 1970-2017: EURO AREA, UNITED STATES AND JAPAN



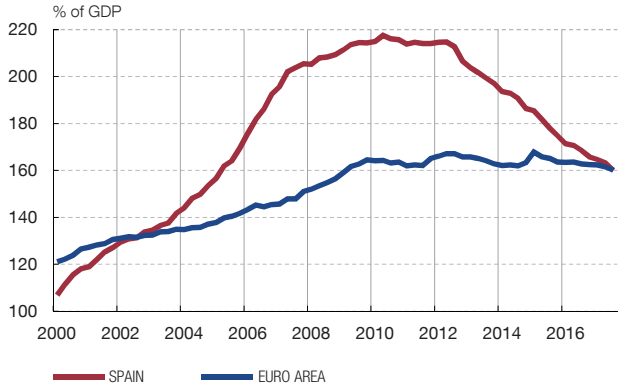
SOURCES: European Commission and IMF. The data for 2017 are the IMF's autumn projections for the United States and Japan; for the remaining economies the figures are the European Commission's.

4 1970-2017: EURO AREA COUNTRIES WITH FISCAL STRESS PERIODS



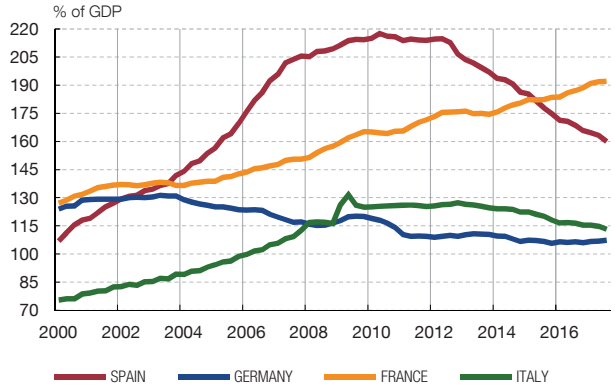
SOURCES: European Commission (AMECO) and IMF. The 2017 data correspond to the European Commission's autumn projections.

5 PRIVATE DEBT: SPAIN AND THE EURO AREA



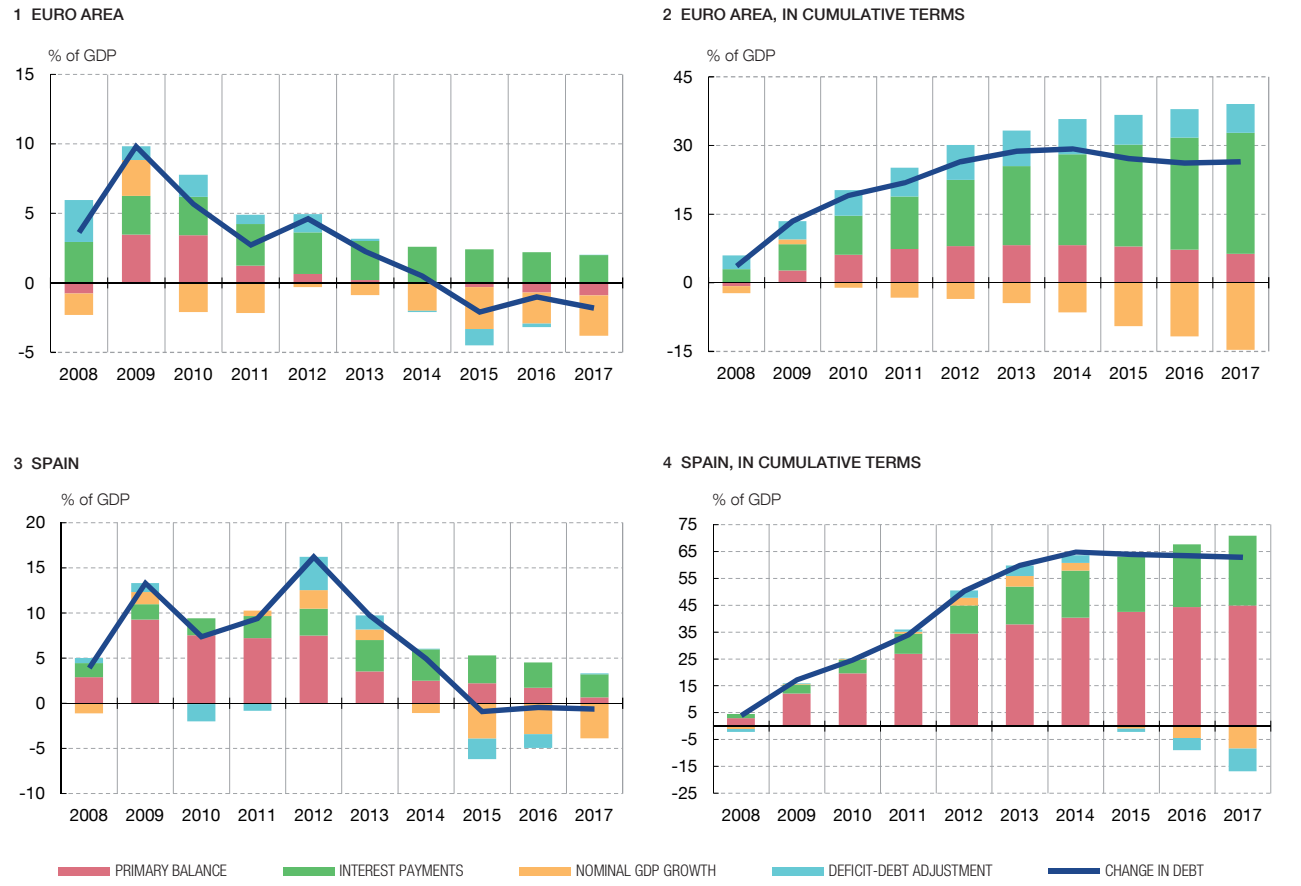
SOURCE: Banco de España.

6 PRIVATE DEBT: MAIN EURO AREA ECONOMIES



SOURCE: Banco de España.

DETERMINANTS OF THE CHANGE IN DEBT IN THE EURO AREA AND IN SPAIN CHART 2



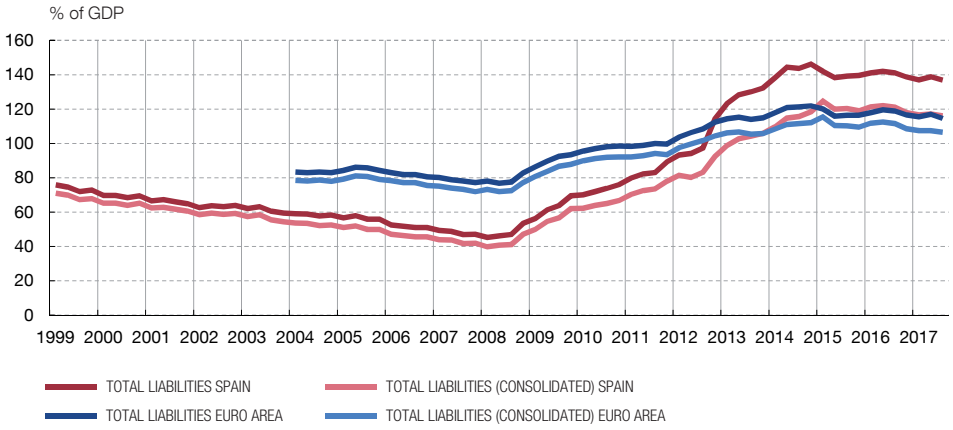
SOURCES: Banco de España and Eurostat. Public debt defined according to the Excessive Deficit Protocol (EDP). The 2017 data correspond to the European Commission's autumn projections.

For the euro area, in the period 2008-2014, the cumulative change in the debt ratio, calculated on the basis of [1], shows that the contribution of the primary balance to the increase was 8.2 pp of GDP; that of the interest burden, 19.9 pp; and that of the deficit-debt adjustment, 7.7 pp. Meantime, the nominal change in GDP reduced the ratio by 6.5 pp of GDP (see Chart 2.2). In Spain, the main determinant of the expansion of debt was the build-up of primary deficits, responsible for 40.3 pp of the increase in the debt ratio, while interest payments contributed 17.5pp, the deficit-debt adjustment 4.1 pp, and nominal growth, adverse in this case, made a negative contribution of 2.8 pp (see Chart 2.4). In the Spanish case, the recent economic recovery has enabled the public debt ratio in the 2015-2017 period to be reduced (see Chart 2.3), while for the euro area as a whole the slight decline observed in the ratio is estimated to have been underpinned both by nominal growth and by the improvement in the primary balance (see Chart 2.1).

The ongoing increase in public debt during the crisis has run in tandem with a significant reduction in private-sector debt in the Spanish case, while this latter variable is estimated to have stabilised in the euro area as a whole (see, once more, Charts 1.5 and 1.6).

During the crisis, moreover, the general government sectors in the main advanced economies have incurred other explicit liabilities, going beyond the habitual concept of public

TOTAL GENERAL GOVERNMENT LIABILITIES IN SPAIN AND IN THE EURO AREA CHART 3



SOURCES: Banco de España and Eurostat.

AGEING AND CONTINGENT LIABILIITIES TABLE 1

1 DEPENDENCY RATIO

Ratio of population aged over 65 to population aged 15-64

	2013	2025	2040	2050	Change 2013-2050
Spain	26.8	34.7	54.3	62.3	35.5
Germany	31.8	40.7	55.6	57.4	25.6
United Kingdom	26.6	31.9	39.1	40.7	14.1
Netherlands	25.9	35.5	47.1	46.4	20.5
Belgium	27.1	32.0	37.2	37.9	10.8
France	27.9	36.1	44.1	43.7	15.8
Italy	32.8	37.3	50.2	52.9	20.2
EU-28	27.8	35.5	46.1	49.5	21.7

2 SPENDING ON PENSIONS, HEALTH AND LONG-TERM CARE

% of GDP

	2013	2025	2040	2050	Change 2013-2050
Spain	18.7	19.1	20.5	21.5	2.8
Germany	19.0	20.8	22.9	23.7	4.6
United Kingdom	16.6	17.3	18.7	18.6	2.0
Netherlands	18.2	19.2	22.3	23.0	4.8
Belgium	19.9	22.1	24.3	24.5	4.6
France	24.6	25.2	25.0	24.2	-1.1
Italy	23.6	23.7	24.7	24.1	-0.4

SOURCE: Ageing Report 2015, European Commission.

debt,[4] including general government liabilities held by another general government unit and trade credits and other payables, which reflect, among other elements, the deferrals in payments owed

4 General government debt according to the excessive deficit protocol (EDP): see footnote 1.

by general government sectors to their goods and services suppliers.[5] Associated with this definition is a second concept of debt, called "consolidated liabilities", which coincides with that of total general government liabilities but in which those liabilities held by another general government unit are cancelled out. From this standpoint, consolidated general government liabilities stood, in the third quarter of 2017, in Spain and in the euro area, at 116% and 106.5% of GDP, respectively (see Chart 3).

Adding to the challenges arising from these high levels of public debt are those associated with the ongoing population ageing in the developed countries. Such challenges are expected to intensify in the coming decades and push certain public spending items such as pensions, health and care for the elderly upwards (see Table 1.1). In the European case, the European Commission regularly drafts a report in which it estimates the expected increases in various future expenditure items derived from population ageing. These estimates are based on a series of macroeconomic and demographic assumptions, taking into account the legislation in place at each point in time. According to the latest of these published reports, an increase in spending on pensions, health and long-term care of between 1.5-2 pp of annual GDP in the coming three decades is projected in Spain's case, peaking at 3 pp of GDP in 2050 (see Table 1.2) (European Commission 2015).[6]

2.2 Past experiences of public deleveraging processes

There have been many public deleveraging processes in the developed countries in the past in widely differing macroeconomic settings. Analysis of these episodes may prove worthwhile with a view to addressing the processes that the developed economies will have to undertake in the coming years.

Specifically, the economic literature has analysed the causal factors that may be associated with the onset of public deleveraging processes [see Molnar (2012)], and the references cited therein]. According to the literature, a public debt-reduction process was more likely to be set in train in the past if, on one hand, general government budgetary conditions were fragile and/or were worsening in structural terms; and, on the other hand, if the domestic economy was evidencing a favourable dynamic (positive output gap).

Similarly, the international evidence available on the most recent episodes of a reduction in high debt levels in the advanced economies since the 1980s [see Abbas et al. (2013)] shows that, firstly, such episodes were more effective when they took place in economic upturns (see Chart 4). By comparison, other determinants of public debt dynamics, such as inflation, lower interest rates or deficit-debt adjustments, reflected, for example, in privatisation processes or in the disposal of significant financial assets, contributed to the stabilisation and reduction of debt but played a secondary role.

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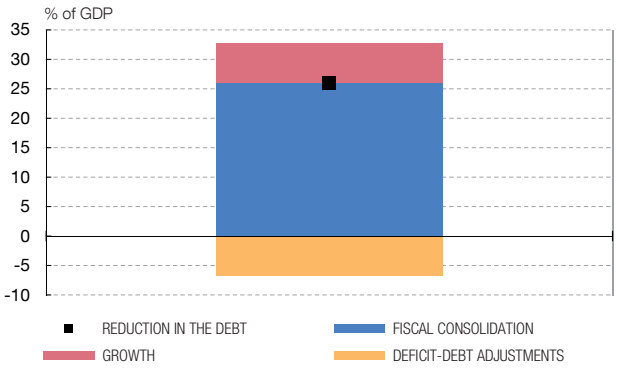
5 This is the broadest possible concept of debt, reflected in the Spanish case in the *Financial Accounts of the Spanish Economy (FASE),* given that it encompasses all liabilities incurred by general government, irrespective of their nature. These liabilities are coined money, securities other than shares, investments, short- and long-term loans, in euro and in currencies other than the euro, trade credit and other accounts payable. For further methodological details, see Gordo et al. (2013).

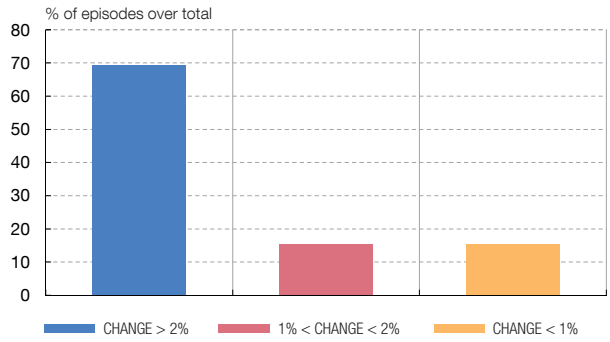
6 See too, for the Spanish case, Ramos (2014) and Hernández de Cos et al. (2017).

INTERNATIONAL EVIDENCE ON PUBLIC DEBT REDUCTION EPISODES (a) CHART 4

1 DECOMPOSITION OF THE REDUCTION IN PUBLIC DEBT



2 CHANGE IN PRIMARY BALANCE



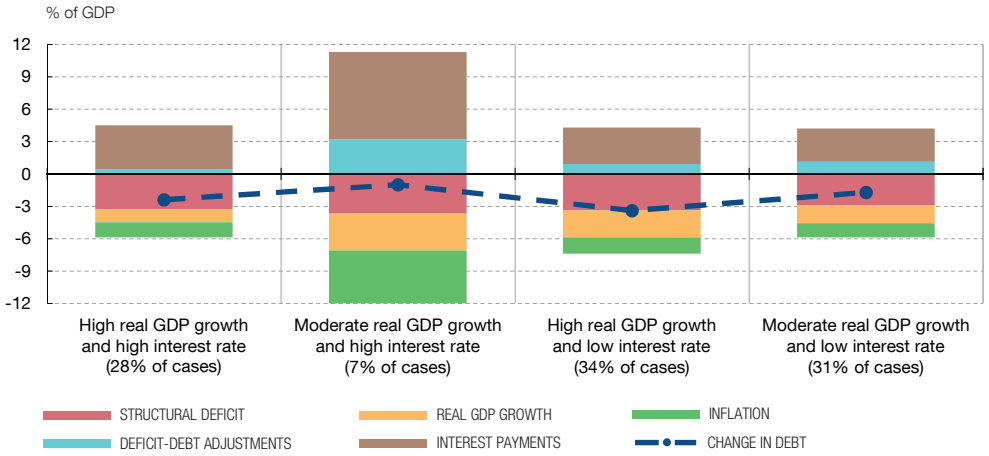
SOURCE: Abbas et al. (2013).

a Average changes in 26 past episodes of public debt reduction.

Nonetheless, although the contribution of macroeconomic fundamentals has been significant and has marked the setting in which successful episodes of public deleveraging have tended to take place, the main factor for the success of such processes has generally proven to be the unfolding of a process of persistent reduction in the budget deficit. Specifically, in 70% of the episodes analysed by Abbas et al. (2013), the average change in the primary balance during the debt-reduction process was 2% of GDP (see Chart 4).

In the Spanish economy there is a relatively recent precedent of a public debt-reduction process, namely that relating to the emergence from the crisis in the 1990s. Specifically, from its 1996 peak of 65.6%, the public debt-to-GDP ratio embarked on a reduction that saw a decline of 30 pp of GDP in the period to 2007. This process occurred in a very favourable macroeconomic setting that was conducive to fiscal consolidation, with average real growth between 1996 and 2007 of 3.8%, average inflation (measured by the GDP deflator) of 3.6% in this period, and implicit rates on public debt which, though they stood on average over those years at 6%, fell during that period from 8% in 1996 to around 4% in 2007. If the accounting breakdown provided by the general government budgetary constraint [1] is used, 70% of the reduction in cumulative GDP terms in public debt net of flow-stock adjustments was due in that episode to the improvement in the primary budget balance, while the remaining 30% was on account of nominal growth higher than that of the interest burden (see Chart 6). In part, this improvement in the primary balance was due, in turn, to high nominal growth. As regards the improvement in the interest burden, of the 3.6 pp of GDP reduction in interest payments relative to GDP from 1996 to 2007 (from 5.2% to 1.9% of GDP), 2 pp were due to the effect of the reduction in implicit rates and 1.6 pp to the reduction in the volume of debt.

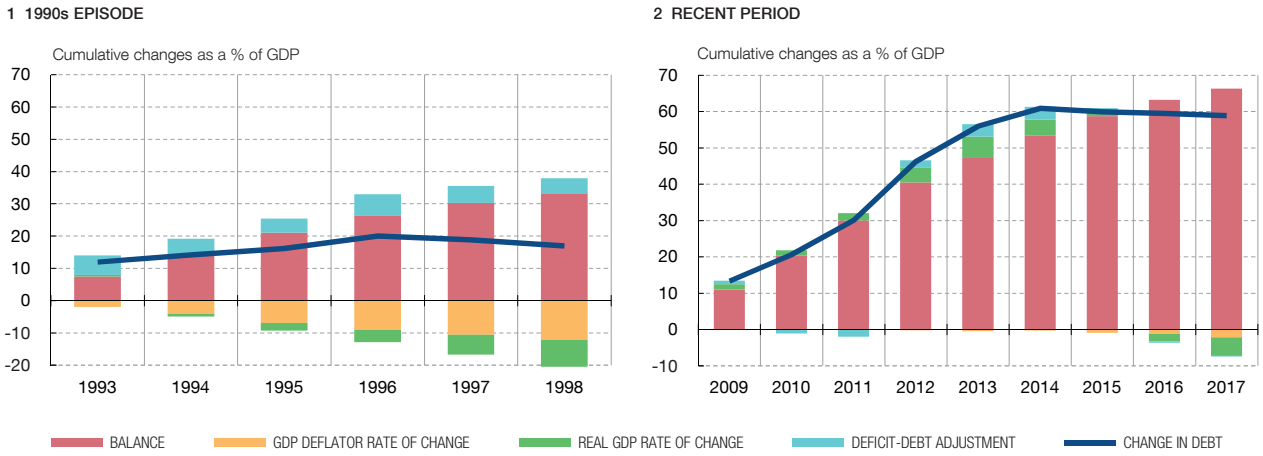
INTERNATIONAL EVIDENCE ON PUBLIC DEBT REDUCTION EPISODES (a) CHART 5



SOURCE: Abbas et al. (2013).

a Average values from four years for a sample of 30 countries in the 1980-2011 period. High (moderate) growth: real GDP growth of over 2% (between 0% and 2%) over four consecutive years (allowing the exception of one year). High (low) interest rate: rate higher (lower) than the median for each country (1980-2011 sample).

THE PUBLIC DEBT STABILISATION PROCESS IN SPAIN (a) CHART 6



SOURCE: Banco de España. The 2017 data correspond to the European Commission's autumn projections.

a Average inflation (GDP deflator): 3.6% in the 1993-1998 period, and 0.3% in the 2009-2017 period.

3 Economic effects of high public debt

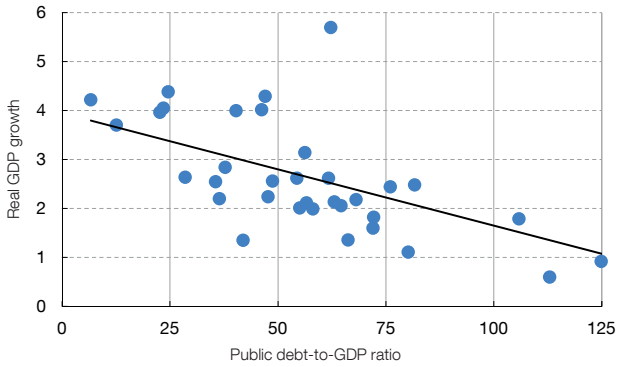
3.1 The costs of high public debt

The economic –principally empirical– literature shows that sustaining high levels of public debt over extensive periods is usually associated with lower economic growth[7] (see, by way of illustration, Chart 7.1). This negative effect, according to the literature, would operate as from specific public

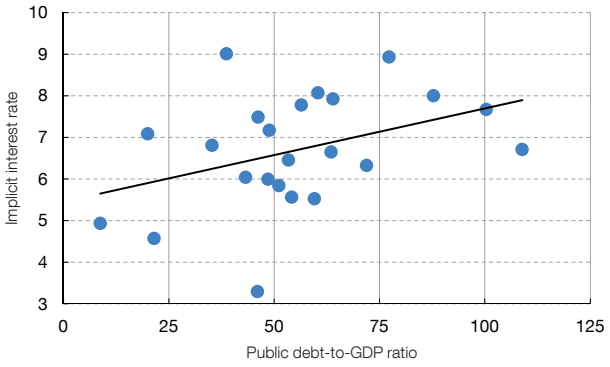
7 See, inter alia, Reinhart et al. (2009), Abbas et al., (2013), Checherita-Westphal and Rother (2012), Eberhardt and Presbitero (2015), Sutherland et al. (2012), Afonso and Alves (2015) or Doménech and González-Páramo (2017).

PUBLIC DEBT, ECONOMIC GROWTH AND FISCAL POLICY (a) CHART 7

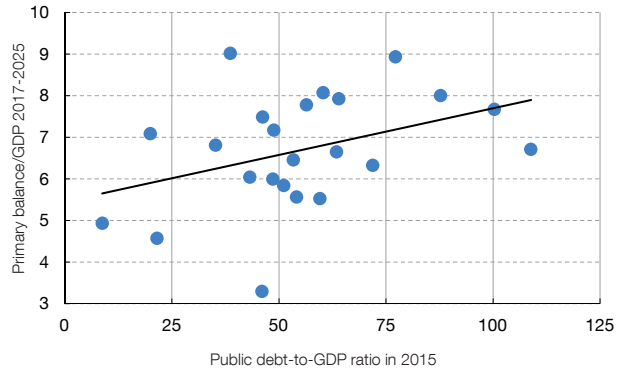
1 PUBLIC DEBT AND GDP GROWTH



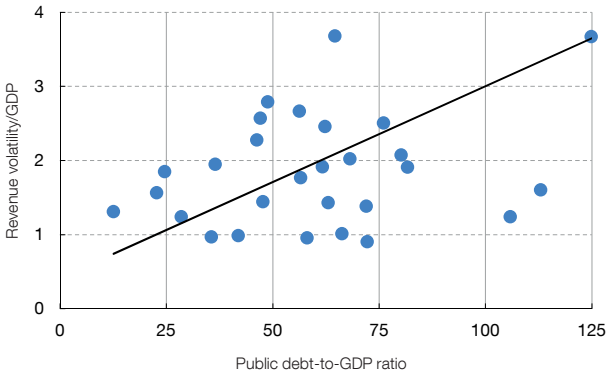
2 PUBLIC DEBT AND INTEREST RATE



3 PUBLIC DEBT AND EXPECTED PRIMARY BALANCE



4 PUBLIC DEBT AND REVENUE VOLATILITY



SOURCES: Eurostat, OECD and Banco de España.

a Regression with average values for the EU and OECD countries in the 1995-2015 period. Chart 7.3 shows, for the euro area countries, the correlation between their public debt ratio in 2015 and their primary balance commitments to 2025, in accordance with the criteria laid down in the European Stability and Growth Pact and their medium-term macroeconomic projections.

debt ratios, of around 70%-90% of GDP, on average, for broad sets of countries. However, these studies offer an extensive variety of results, depending on the characteristics of the design of the empirical exercise, on the time period, or on whether emerging or developing countries are involved, among other factors [see, in particular, Reinhart and Rogoff (2011); Checherita-Westphal and Rother (2012); Afonso and Alves (2015)].

Furthermore, this literature suggests that the effects on economic growth are determined not only by the level of debt but also by its attendant dynamics, meaning that the negative impact of a high level of public debt would be smaller in a context of debt reduction. At the same time, the evidence shows that the interaction of public debt levels and developments with national institutions and other idiosyncratic factors of the countries are significant [see Pescatori, Sandri and Simon (2014); Chudik et al. (2017); Masuch, Moshammer and Pierluigi (2016); or Mendoza (2017)].

The main channels through which high public debt, or an adverse public debt dynamic, negatively affects economic growth operate through lower private investment and through the

distortionary effects of fiscal policy. As regards investment, high public debt exerts upward pressure on long-term interest rates (see Chart 7.2), increasing private-sector financing costs and absorbing part of the financing capacity generated by the economy (the crowding-out effect). That is to say, high public debt financing needs might displace private-sector project financing possibilities [Demirci et al. (2017)].

As to fiscal policy, in settings of moderate economic growth, maintaining a high level of public debt requires running high primary budget surpluses over extensive periods (see Chart 7.3). Attaining these primary surpluses might affect the economy's potential growth insofar as they may come about at the cost of distortionary taxes or by cutting productive public spending. In addition, the debt burden associated with high debt drains resources persistently, giving rise to an opportunity cost in terms of economic growth in the use of the public budget.

Higher levels of public debt entail greater financing needs in the short term, which increases the vulnerability of the economy to adverse reactions by the financial markets [see Borensztein et al. (2004); and Arellano and Ramanarayanan (2012)]. This degree of vulnerability will depend not only on the level but also on the structure of public debt and on the magnitude of the budget deficit, and overall this will determine financing needs at a specific point in time [Missale (1997)].[8]

The existence of high debt levels reduces the capacity to implement countercyclical fiscal policies. In this respect, there is evidence linking high public debt levels with the greater volatility of public revenues (see Chart 7.4), which might be associated with this diminished fiscal policy room. Furthermore, having less room to finance budgetary stimulus policies with a charge to public debt limits the capacity of fiscal policy to pursue discretionary measures needed at times of economic weakness. It should be borne in mind that the stabilising role of fiscal policy is particularly valuable for the euro area countries, which are part of a monetary union and whose monetary conditions and exchange rate cannot be adjusted to the idiosyncratic needs of each economy. Past experience shows that countries with lower debt levels, on average, evidenced higher degrees of automatic stabilisation of the budget, enabling them to soften the effects of economic fluctuations on activity. Also, in the case of the EU countries, there appears to be a positive correlation between the intensity of debt-reduction processes in the post-Maastricht period and the degree of automatic stabilisation of budgets,[9] which appears to suggest that healthier debt positions are usually associated with a higher degree of automatic fiscal policy responsiveness.

Finally, public debt, insofar as it may be considered a low-risk asset, provides an alternative with a high degree of safety for the diversification of agents' saving. These two functions are more likely to be able to be exercised if, firstly, the level of public debt is such that it is perceived to be sustainable by national and international private agents alike, who will

8 For the Spanish case see Pérez and Prieto (2015).

9 The degree of automatic stabilisation is habitually proxied by the sensitivity (elasticity) of the budget deficit to changes in the output gap.

retain their appetite to acquire the debt of the country in question; and, secondly, if there is room such that at times of crisis the debt may be increased without jeopardising the country's public finances.[10]

3.2 Public debt thresholds in practice and "debt limits"

The arguments set out in the foregoing section are the basis for justifying the imposition of legal reference values or limits on the level of debt in both the national framework and, in the European case, in the context of the Stability and Growth Pact (SGP). Indeed, the review of the EU economic governance framework during the crisis included a reform of the SGP,[11] one of the main objectives of which was precisely to reinforce the disciplining role of the defined limit on public debt, namely 60% of GDP, assigning greater relevance to this variable in the corrective arm of the SGP throughout the budgetary oversight process, and defining more precisely the conditions under which situations of excessive debt, i.e. above the aforementioned ceiling, had to be corrected. Hence, following this reform, countries evidencing a debt ratio in excess of 60% of GDP shall be subject to the corrective mechanism of the SGP, unless the ratio is slowing at a satisfactory pace, which requires that, in the three years prior to the assessment, the debt must decrease by one-twentieth with respect to the amount by which it exceeds the reference value of 60% of GDP. The aim of this reform is to correct the fact that, despite the central role given in the initial design of the SGP to public debt as a key variable for measuring the sustainability of public finances, the limit thereon was largely ignored in the decades prior to the economic crisis, partly as a result of the absence of clear quantitative criteria for assessing the pace at which it should be reduced.

In this same respect, the changes to the Spanish budgetary framework, initiated in September 2011 with the reform of the Constitution and its subsequent implementation in April 2012 through the Organic Law on Budgetary Stability and Financial Sustainability (LOEPSF by its Spanish abbreviation), assigned greater importance to this variable. In particular, an explicit limit was established that was not envisaged in previous stability laws, whereby its weight in GDP may not exceed 60%, with a transitory period to 2020 being set for the application of this criterion.[12] In this connection the legislation requires that the public debt-to-GDP ratio for each tier of government should be reduced at the necessary pace in annual average terms so as to attain this limit and, moreover, the path of reduction of the volume of debt should fulfil the following requirements: 1) the change in the non-financial expenditure of each tier of government may not exceed the Spanish economy's real GDP growth rate; 2) when the national economy attains a real growth rate of at least 2% per annum or generates net employment with growth of at least 2% per annum, the public debt ratio shall annually be reduced, at least, by 2 pp of GDP. Further, the rule gives absolute priority to the payment of public debt interest and capital expenses over other budgetary commitments, which may prove especially important for dispelling potential doubts over the state of public finances at times of financial instability or deteriorating confidence.

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10 See Hiebert et al. (2009).

11 Part of the so-called "Six Pack". For further details on the SGP reforms implemented during the crisis, see Gordo and García Perea (2016), and Hernández de Cos and Pérez (2015).

12 See Hernández de Cos and Pérez (2013) for a discussion of the reform of the 2012 Budgetary Stability Law.

The setting of an explicit numerical limit on the public debt ratio is not trivial. In Europe's case, it should be recalled that the rationale behind the calibration of the legal reference limit of 60% of GDP defined in the SGP was that, in accordance with the macroeconomic situation prevailing in the early 1990s, this was the equilibrium level consistent with a situation of real GDP growth of 3%, an inflation rate of 2% (the ECB's medium-term objective) and a budget deficit of 3% of GDP. If the equation [1] is taken as a starting point, with $g = 3\%$, $\pi = 2\%$ and $d \equiv (r\ b - p) = 3\%$ del PIB, the stationary solution in which $b_t = b_{t-1} = b$ is such that $b = 60\%$ of GDP. In this respect, although this criterion is applied wholesale to all the EU countries, it is immediately apparent that a different macro-fiscal situation in one country might influence the selection of the reference value. In this simple example, to be able to maintain a debt reference level of 60% in a situation of real long-term growth of the economy below what was previously the case (e.g. 1%), the public balance consistent with the stationary solution would be –2% of GDP, instead of –3% as in the SGP, according to the expression $d = -b\ \gamma / (1 + \gamma)$, where $\gamma \equiv g + \pi$ is the nominal GDP growth rate.

Such a simple, static and deterministic exercise illustrates a key element that has been highlighted in the literature addressing the question of what the "public debt limit" acting as a reference for a country should be. And this limit depends on the country's economic fundamentals. In the example, an economy with lower-than-average real growth would have to show a lower budget deficit, on average, to maintain the same stationary level of public debt. This observation is consistent with international evidence showing high heterogeneity across different experiences: some countries have been capable of sustaining high levels of public debt relative to their output over time, retaining normal access to international markets in order to obtain funding, while others have had restrictively to hold these levels at lower values, to avoid liquidity or fiscal solvency problems, and to reduce the risks of having to make drastic budgetary adjustments in crisis situations.

From this standpoint, the theoretical literature, in line with the previously reviewed empirical literature, suggests that, beyond the levels demanded by different budgetary frameworks, there are "prudent" public debt levels for each country above which that country would become more vulnerable and be subject to greater scrutiny by the financial markets.[13] Should lenders be able to analyse the current and future strength of an economy, the status of their public finances or the quality of national institutions, they would be in a position to impose stricter debt limits on countries with weaker and/or more volatile macroeconomic fundamentals.[14] One set of papers, in particular, studies the determinants of the maximum level of debt that a country can allow itself without resorting to a default thereon, and the emergence of non-linear reactions to the proximity

13 See, for example, Fall and Fournier (2015) and the references cited in this paper. This literature is different, but also related, to that which studies the "optimal" level of public debt. See Woodford (1990), Aiyagari and McGrattan (1998), Floden (2001) or Desbonnet and Kankamge (2007).

14 See, for example, Mendoza and Oviedo (2009) or Hiebert et al. (2009). Within this literature, in the particular case of developing countries, Reinhart et al. (2009) present the concept of "debt intolerance", which becomes manifest in situations in which certain countries, despite posting moderate sovereign (external, in general) debt by developed countries' standards, undergo episodes of extreme pressure. According to these authors, the "safe" thresholds for the external debt-to-GNP ratio for countries experiencing this intolerance phenomenon are low, at around 15% in some cases. These thresholds depend on the trajectory of each country's (recurrent) arrears and inflation.

of that level, which may ultimately prompt explosive increases in the cost of debt.[15] The idea of a "prudent" public debt-to-GDP ratio level has also been addressed in the literature that focuses on the development of indicators for the analysis of the sustainability of such debt.[16]

However, no consensus has been reached on how to measure, in quantitative terms, these "prudent" levels or "debt limits", largely because very few sovereign default episodes have been observed in the past, and those that did come about, moreover, were typically confined to emerging economies.[17] According to the studies available, fiscal policy tended to react to the level of debt, more sharply so at times of serious budgetary stress, bordering on a situation of debt default. Hence, on the basis of this consideration, some authors have calculated the implicit debt limits that give rise to a vigorous reaction (see section 3.3), given that they would reveal the times at which governments were at the limit and reacted to prevent default [see Ghosh et al. (2013); and Fall and Fournier (2015)]. However, the heterogeneity of the values estimated in the different papers, and the very high values that are found,[18] detract for the moment from the operational capacity of the prescriptions set out in this literature.

As indicated in section 3.1, one of the adverse effects of sustaining a high level of public debt arises from the reduction in budgetary headroom for enabling fiscal policy to perform its stabilising function. In this respect, in the face of a high level of public debt, a trade-off may arise between debt reduction and automatic stabilisation. Specifically, though it might be optimal for an economy to reduce the level of public debt so as to allow greater cyclical sensitivity by the budget, the debt-reduction cost needed to attain this objective poses a problem of inter-generational distribution. The current generation ought to assume the transitory cost of convergence towards a new situation of low debt and greater cyclical insurance, with lasting benefits for other, future generations [see Hiebert et al. (2009)].

3.3 Fiscal policy reaction to the level of debt

The evidence available shows that the fiscal authorities tend to react to the economic costs of high public debt and to the need to prevent unsustainable debt dynamics. Indeed, the empirical papers available, for a broad set of developed and emerging countries, find evidence that fiscal policy has tended to react –drastically on occasions– at times of budgetary stress to high public debt values and/or slippage from the medium-term reference values for public debt. This reaction would thus have cancelled out the potential risks of non-sustainability associated with a significant deterioration in macroeconomic and fiscal fundamentals, in the form of persistent and potentially explosive or unsustainable slippage from that reference level.

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15 Situated along these lines would be the papers that focus on the so-called "fiscal limit" (Bi, 2012; Bi and Leeper, 2013; Ghosh et al., 2013; Daniel and Shiamptanis, 2013), and those that define a "maximum sustainable level of the public debt ratio" (Collard, Habib and Rochet, 2015).

16 See García and Rigobon (2004) and Polito and Wickens (2011), who combine "Value at Risk" methodologies with the estimation of type [2] models such as those described in the text to develop indicators of the probability that debt will stand above a certain level in the future. Andrés et al. Rojas (2017), for their part, use this approach in order subsequently to calculate the "prudent" level of debt that maximises the correlation of these indicators with the sovereign debt spread between Spain and Germany, the benchmark measure of market sentiment. See also Berrittella and Zhang (2015).

17 The debt was, in many cases, denominated in foreign currency.

18 For example, Fall and Fournier (2015) show that Italy's debt limit would stand at between 170% and 180% of GDP, that of Spain at 175%, and that of Ireland at 184%.

The starting point for the formalisation of the "reaction function" is the acknowledgement that debt sustainability is a forward-looking concept. That is to say, in order to judge whether the current level of debt is sustainable requires making an assumption about the future behaviour of debt determinants. Specifically, on the basis of equation [1], it is obtained that the level of the debt ratio at time t should be covered by a future path, discounting primary balances such that:

$$b_t = \sum_{i=0}^{\infty} \Lambda_i \, p_{t+1+i} + \lim_{h \to \infty} \Lambda_h b_{t+1+h} \qquad [2]$$

where $\Lambda_i = \prod_{j=0}^{i} \left(\frac{1 + g_{t+1+j}}{1 + r_{t+1+j} - \pi_{t+1+j}} \right)$. This expression is a standard one, obtained by iterating on equation [1], assuming for the sake of simplicity that the future deficit-debt adjustments are zero. Moreover, debt sustainability at t requires that the net discounted present value of future public debt should converge on zero. That is to say, the level of debt may not grow at a greater pace than the discount rate, Λ, which incorporates the cumulative real growth of GDP in relation to the course of the real interest rate. In formal terms, this latter condition of transversality requires the second term on the right-hand side of expression [2] to converge on zero. The usual means of imposing the condition of transversality and excluding unsustainable debt paths involves postulating that the authority responsible for fiscal policy should react by altering one of the instruments at its disposal (whether public revenue or spending) to prevent explosive paths from materialising ex post. The reaction by the budgetary authority would come about in response to increases in the debt level. The canonical fiscal reaction function in the literature is formulated in terms of the changes that would be made to the primary budget balance (whether the actual or the cyclically adjusted balance) in response to changes in the level of public debt when the latter were to exceed a reference value or at specific times of fiscal stress:

$$p_t = \phi_0 + \phi_1 \, b_{t-1} + \beta X_t + \varepsilon_t \qquad [3]$$

where X captures a set of control variables, in particular the output gap, which determines the cyclical component of the public budget, and ϕ_1 measures the intensity of the reaction, which should be such that $\phi_1 > 0$ so that fulfilment of the transversality condition is ensured. According to [3], the authorities would alter their primary balance in a discretionary manner to bound slippage by the debt level from the reference level. In practice, the authorities do not explicitly express the fact that they are adjusting to [3]-type rules. However, de facto, as earlier mentioned the literature has found that most authorities have implicitly behaved in such a way that an approximation can be made through expressions such as those described [see, for example, Bohn (1998); Checherita and Ždárek (2017); Plödt and Reicher (2015)].[19]

For the euro area (country panel), the papers available estimate values for the parameter ϕ_1 in the range of 0.02-0.10, depending on the assumptions of the estimated type-[3] model and on the sample used [see Berti et al. (2016)], i.e. an increase of 10 pp of GDP in public debt

19 Drawing on the analysis of the stability of debt in macroeconomic models with fiscal rules of the type discussed in the text, different functional forms can be extracted that ensure debt sustainability [see Pérez and Hiebert (2004) for a discussion on this matter].

would lead the authorities to implement policies that brought about an improvement in the euro area primary balance of between 0.2 pp and 1 pp of GDP.

For the case of Spain, Legrenzia and Milas (2013) estimate a statistically significant coefficient of ϕ_1 = 0.02, using a sample of annual data for 1970-2012. Lukkezen and Rojas Romagosa (2012), also with annual data, obtain values in the range between 0.02 (1946-2010 sample) and 0.10 (1975-2010 sample), and Mauro et al. (2013), move in a similar range (0.03, 0.05 and 0.07, respectively, for the 1950-2011, 1950-2007 and 1919-2011 samples of annual data)[20] for different specifications. The literature evidences some dependence on the values estimated with respect to the sample period used and the empirical specification. The estimates made with homogenous samples and quarterly data provide values in the lower part of the range discussed for the Spanish case (see Chart 8.1). Taking the last four decades as a reference, for which more homogenous macroeconomic data are available, the fiscal policy reaction would have been more vigorous in the data samples commencing in 1986 compared with those using data from 1970 (an average of 0.03 against 0.02), and would have increased during the recent crisis (comparison of the samples ending in 2007 set against those including the latest years). As a result, it is estimated that in Spain's case, on average, the reaction by the authorities to an increase in public debt of 10 pp of GDP leads to an increase of 0.2-0.3 pp in the primary balance.

Some papers [see Ghosh et al. (2013)] find that this reaction by the authorities to the level of debt may be particularly vigorous at times of serious budgetary stress, close to a situation of debt default, although it would be subject to certain restrictions derived from "fiscal fatigue", as from a certain high level of debt, while in normal periods the build-up of budgetary imbalances is not perceived as a first-order problem for economic policy; accordingly, the fiscal policy reaction to such imbalances would be milder or even non-existent. These authors, therefore, argue that expression [3] would be non-linear in the level of debt, of the type:

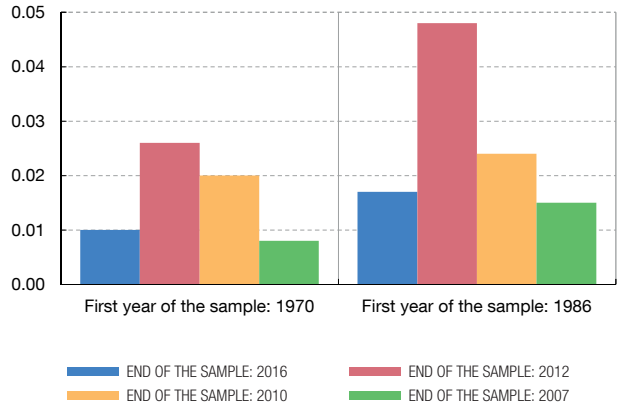
$$p_t = \phi_0 + \phi_1 b_{t-1} + \phi_2 (b_{t-1})^2 + \phi_3 (b_{t-1})^3 + \beta X_t + \varepsilon_t \qquad [4]$$

For a panel of 23 advanced countries in the 1970-2008 period, and a relevant set of control variables (X), Ghosh et al. (2013) show that the coefficients of the cubic functional form ϕ_1, ϕ_2 y ϕ_3 are significantly different from zero, with the expected signs $\phi_1 < 0$, $\phi_2 > 0$ and $\phi_3 < 0$, thereby validating the hypothesis that there is a reaction by the primary balance to past debt values, as from high levels of debt (quadratic term), but which slows as from very high values of the level of debt (cubic term), reflecting what these papers call "fiscal fatigue", derived both from policy restrictions (reduction in the support of the population to protracted processes of adjustment) and technical restrictions (exhaustion of the policy instruments available to achieve consolidation). Specifically, these authors find that, for the set of countries in their sample, the marginal response by the primary balance to the lagged debt level falls in levels of around 90%-100% of GDP, and turns negative when the debt ratio draws close to 150%. These findings support the hypothesis of Mendoza and Ostry, (2008) whereunder the risks

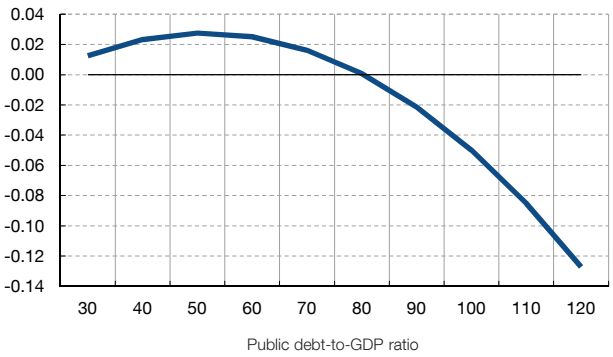
20 See Mussons-Olivella (2018) for the analysis of regional government reaction functions in Spain.

FISCAL POLICY REACTION FUNCTIONS FOR THE CASE OF SPAIN CHART 8

1 LINEAR MODEL: RESPONSE BY THE PRIMARY BALANCE TO LAGGED DEBT (a)



2 NON-LINEAR MODEL: MARGINAL RESPONSE BY THE PRIMARY BALANCE TO THE LEVEL OF PUBLIC DEBT (b)



SOURCE: Banco de España.

a A standard fiscal reaction function (of type [3] in the main body of the text) is estimated in which the fiscal primary balance as a percentage of GDP is made to depend on the lagged public debt ratio, the lagged dependent variable, real GDP growth, the inflation rate, the implicit interest rate on public debt and cyclical public spending (the difference between the public spending-to-GDP ratio and a trend calculated with the HP filter, with a smoothing parameter of 1600). The regressions are estimated by ordinary least squares and are adjusted for the presence of autocorrelation in the regression residuals. Unlike the literature, which uses annual data, these estimates use quarterly data, taken from De Castro et al. (2018). The sample commencing in 1986 is prepared with a greater wealth of statistical sources than the sample commencing in 1970, which has some shortcomings that are discussed in the article cited.

b A reaction function is estimated with linear, quadratic and cubic terms at the level of lagged debt (equation [4] in the main body of the text). The parameters used are those obtained from the estimation of the model using the 1970-2016 sample, with quarterly data.

of sustainability increase as from very high levels of debt, given that the aforementioned "fiscal fatigue" phenomenon appears.

For the Spanish case, the estimation of type-[4] reaction functions, for different quarterly samples, does not generally provide precise results from the statistical standpoint. In the particular case of the 1970Q1 2016Q4 sample, the coefficients obtained show the expected signs and are as follows: $\phi_1 = -0.006$, $\phi_2 = 0.170$, $\phi_3 = -0{,}00001$, with ϕ_3 being significantly different from zero at the 5% significance level, while ϕ_1 and ϕ_2 show signs of statistical significance on the edge of the usual levels. If these coefficients are taken as a reference, in the Spanish case the marginal response of the primary balance to the lagged debt level is an increasing one up to levels around 60%-70% of GDP, and diminishes in intensity as from those levels (see Chart 8.2).

4 Analysis of public debt sustainability

Given the risks associated with a high level of debt, it is important to have analytical tools enabling the sustainability of budgetary positions and the risks associated therewith to be assessed. The economic literature has developed various methodologies for making this assessment. In most cases, these methodologies seek to anticipate the dynamic of public debt in the future on the basis of a series of assumptions about their basic determinants. Three such methodologies are presented below and illustrated for the Spanish case.[21, 22]

4.1 Stochastic scenarios of developments in public debt

An initial approach to the question of public debt sustainability can be made through the construction of probabilistic scenarios of the future course of public debt, devised on the basis of the estimated empirical relationship between the main determinants of public debt in the past. In particular, this stochastic analysis estimates a probability distribution of multiple macroeconomic scenarios subject to a high number of random shocks. This distribution enables a probabilistic analysis of potential public debt scenarios to be conducted. With this information it is possible subsequently to calculate the probability of public debt standing below a specific value throughout a simulation horizon and, as a result, to assign a risk to the probability distribution associated with the public debt dynamic. Specifically, using these statistical models, it is possible to calculate the probability of the debt-to-GDP ratio (b) standing, within a given number of years (T), above a reference value (θ), given the information available (I_{t-1}) in the current quarter (t).

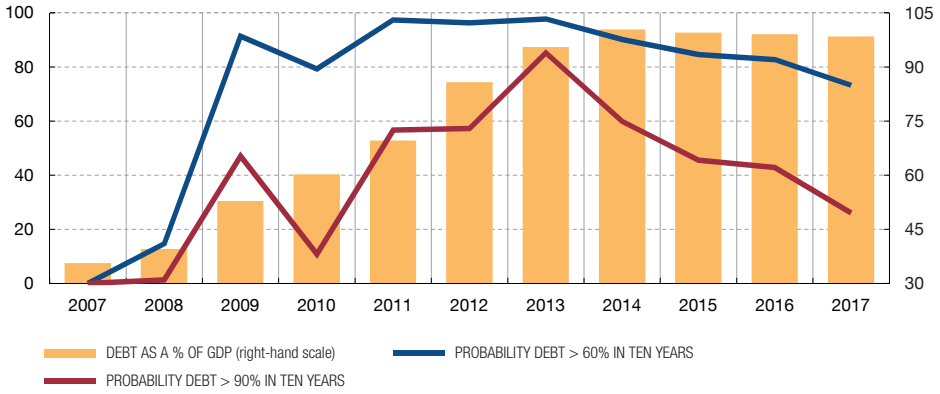
We denote this probability as $P^{T}_{t/t-1}(\theta)$. The procedure followed for its calculation is, after Andrés et al. (2017), as follows. First, a vector auto-regressive (VAR) model is recursively estimated, $Y_t = \mu_y + \beta\, t + B(L)\, Y_{t-1} + u_t$, where Y_t is a vector with the determining variables of the debt ratio, i.e. real GDP growth, inflation measured with the GDP deflator, the implicit nominal interest rate on the debt, and the primary budget deficit as a percentage of GDP, excluding the deficit-debt adjustment which is an erratic and unpredictable component. μ_y and t are deterministic terms (constant and trend), and u_t is the vector of reduced-form residuals which are assumed to be distributed according to a multinomial distribution with zero mean and variance and covariance matrix Ω. In our case, the model is initially estimated on a sample for the 1970Q1-2007Q4 period, with a quarter being recursively added until completing the estimate with the 1970Q1-2017Q4 sample.

21 Leading international institutions in the fiscal policy area usually translate sets of indicators similar to those presented in the various sub-sections of section 4, along with additional ones, onto a numerical scale of risks, habitually summarised on a colour palette, running from least to most risky. The aggregation of the signals extracted from each indicator provides the so-called "indicator of risk to public debt sustainability" (DSA). In this respect, see, for example, European Commission (2014), International Monetary Fund (2011) and Bouabdallah et al. (2017). While clearly of use for explaining and monitoring fiscal sustainability risks, the preparation of these synthetic risk indicators is, nonetheless, not free from methodological problems and largely arbitrary assumptions, in particular regarding the selection of the thresholds that define the risk categories for the different indicators, and in the translation of very different indicators to a homogenous numerical scale, which is moreover then aggregated.

22 Another type of commonly used tool to anticipate public finances unsustainability risks are the so-called "fiscal stress early warning systems" [see Schadler (2016), or Hernández de Cos et al. (2014)]. These systems draw on a tradition of models used to anticipate foreign exchange and banking crises, and employ historical data from crisis episodes to identify variables with leading-indicator properties as far as the identification of imminent crises are concerned.

SPANISH GENERAL GOVERNMENT DEBT SCENARIOS: STOCHASTIC ANALYSIS CHART 9

PROBABILITY OF DEBT HIGHER THAN 60% OF GDP IN TEN YEARS AND DEBT RATIO IN THE BASE YEAR



SOURCE: Banco de España, using the model of Andrés et al. (2017). The chart shows the probability calculated in the fourth quarter of each year.

Second, once the parameters of the foregoing model have been estimated (including the variance and covariance matrix), a high number of Montecarlo simulations (5,000) are performed at horizon T, and the corresponding realisations of the debt-to-GDP ratio are calculated on the basis of expression [1], assuming that the deficit-debt adjustment takes a zero value in each year of the forecasting horizon. The sequential estimation of the VAR models and the calculation of the simulated paths for public debt [1] generate, for each point in time, a distribution function of debt levels, which depends on the simulation horizon T, and is denoted as $F_t^T (b / I_{t-1})$. Hence $P_{t/t-1}^T (\theta) = P_t^T (b > \theta / I_{t-1}) = 1 - F_t^T (\theta / I_{t-1})$.

The results of applying this methodology to Spain and to the euro area are discussed below.[23] Chart 9 shows for Spain the probabilities of the debt ratio, b, exceeding the value of 60% over a 10-year horizon, calculated with the samples that take as the last year (source of the forecast), recursively, 2007Q4, 2008Q1, …, up to 2017Q4, i.e. the sequence of probabilities $\{P_{t=\tau/\tau-1}^{10\ años} (60)\}_{\tau=IVTR2017}^{IVTR2017}$. In the Spanish case, the probability calculated in the fourth quarter of 2007 whereby public debt would stand below 60% of GDP in the following decade (2017) was zero. At that point in time, the context was supposedly favourable from the standpoint of public finances, with a debt level of 35.6% of GDP, fiscal accounts that were posting a primary surplus of 3.5% of GDP, and real (year-on-year) GDP growth of 3.8%. This probability increased to 15% in just one year, in 2008, and stood slightly above 90% at end-2009. The brighter macroeconomic outlook associated with the recovery phase that began in 2013 has progressively reduced the probability, despite the fact that the public debt-to-GDP ratio has fallen only marginally. However, on the information available to 2017 Q4, the probability was still at high levels, of around 75%, meaning that only in 25% of the simulations performed would debt stand below the threshold of 60% of GDP at the end of the coming decade. When this exercise is conducted for the probability that debt will stand below the 90% threshold in 10 years, this probability falls to 25%, i.e. in three out of each four simulations debt stands below that value in 2027.

23 The data for the euro area aggregate are taken from the European Central Bank's AWM database (macroeconomic variables) and Paredes et al. (2014) (fiscal policy variables), and Spanish data from the National Accounts (INE) and from De Castro et al. (2018).

For the case of the euro area, despite recording a debt level that is lower by almost 10 pp of GDP in 2017, currently a far higher probability is calculated, between 90% and 100%, owing to the recent worse relative behaviour of the macroeconomic fundamentals compared with the Spanish case. From a backward-looking standpoint, the probability for the euro area of public debt standing above 60% of GDP in 2017, which is calculated taking the fourth quarter of 2007 as the starting point, was lower than 30%. This probability increased to 15% in only one year, in 2008, and stood practically at 100% as from end-2009. On the information available to 2017Q4, debt would not be expected to be lower than its reference value (60%) in the coming decade.

In any event, the limitations of this type of stochastic analysis should be stressed, arising essentially as they do from the fact that the probabilistic scenarios are constructed on the basis of the past empirical relationships between the relevant variables. Insofar as these empirical relationships are modified in the projection scenario, as a result, for instance, of a reaction by the authorities to the increase in public debt being different from the reaction in the past, the paths traced by these scenarios would also be affected.

4.2 Deterministic scenarios for debt: with exogenous assumptions

An alternative for analysing the sustainability of a specific public debt situation involves constructing deterministic scenarios for public debt developments based on ad hoc assumptions about the course of the main macroeconomic and fiscal variables determining such developments. Specifically, assumptions about the expected course of fiscal policy (budget deficit), the economic growth path, prices and the economy's financial conditions in the simulation horizon are required.

It is usual in this type of exercise to construct a baseline scenario, which is subjected to a sensitivity analysis modifying the assumptions about the expected course of the main magnitudes that determine developments in public debt. The assessment of the sustainability of public debt on the basis of these projections can be made by calculating, for example, the fiscal adjustment that would be needed to reduce public debt to a specific reference level over a given time horizon, or simply by analysing the dynamics of the projected public debt and comparing its level at the end of the projection horizon with a reference (e.g. the SGP's 60% of GDP). Specifically, starting with the basic framework that provides the government budgetary constraint (equation [1] above), if it is assumed, for instance, that GDP growth and the interest rate hold constant over a specific horizon and that the deficit-debt adjustments are zero, the constant primary budget deficit, $\bar{p}$, needed to reduce public debt in N years, from the current level, b_T, to a reference level, $\bar{b}_{T+N}$, would be given by the standard expression [see Escolano (2010):

$$\bar{p} = \frac{\frac{r-\gamma}{1+\gamma}}{\left[\left(1+\frac{r-\gamma}{1+\gamma}\right)^{-N}-1\right]}\left[\left(1+\frac{r-\gamma}{1+\gamma}\right)^{-N}\bar{b}_{T+N}-b_T\right] \qquad [5]$$

The necessary primary balance depends, therefore, on the average nominal interest rate assumed for the period and on the nominal growth of the economy (real and prices), which determine the differential $r - \gamma$, of the starting level of public debt, and of the number of years considered for attaining a specific reference value.

CONSTANT FISCAL EFFORT NEEDED TO ATTAIN A DEBT RATIO OF 60% OF GDP IN A SET NUMBER OF YEARS TABLE 2

%	Public debt in 2017 (% of GDP) (e)	Assumptions on macroeconomic determinants				Primary balance by year needed to reduce debt to 60% of GDP			Memorandum item		
		Real GDP (a)	Inflation (a)	Nominal GDP (a)	Nominal interest rate (b) bp	In the year 2027	In the year 2030	In the year 2037	Historical average primary balance		
		Change (pp)				% of GDP			2017	1995-2017	1995-2007
Euro area	89.3	1.5	1.6	3.1	2.6	2.6	1.9	1.1	0.9	0.4	1.2
Belgium	103.8	1.8	1.6	3.4	2.9	4.0	3.0	1.8	1.1	2.9	5.0
Germany	64.8	1.4	1.1	2.4	2.2	0.3	0.2	0.1	2.1	0.6	0.0
Ireland	69.9	4.7	2.3	6.9	3.4	-1.2	-1.4	-1.6	1.6	-0.6	3.4
Greece	179.6	0.8	2.5	3.3	2.0	10.4	7.7	4.5	2.0	-1.5	0.0
Spain	98.4	2.1	2.2	4.4	3.0	2.9	2.0	1.0	-0.6	-1.0	1.7
France	96.9	1.6	1.4	2.9	2.1	3.1	2.2	1.2	-1.1	-1.0	0.0
Italy	132.1	0.5	2.0	2.6	3.2	7.8	6.2	4.2	1.7	2,3	3.1
Netherlands	57.7	1.9	1.8	3.7	1.9	-1.3	-1.2	-1.1	1.7	0.7	1.9
Austria	78.6	1.8	1.6	3.3	2.7	1.5	1.0	0.5	0.9	0.5	0.7
Portugal	126.4	1.2	2.4	3.6	3.5	6.6	5.0	3.2	2.5	-1.3	-1.1
Finland	62.7	2.1	1.7	3.8	1.8	-0.9	-1.0	-1.0	-0.4	2.4	4.5
Memorandum item											
Euro area, higher rates (c)	89.3	1.5	1.6	3.1	3.9	3.5	2.8	2.0	0.9	0.4	1.2
Euro area in 2017 (d)	89.3	3.6	2.2	5.7	2.3	0.4	-0.2	-1.0	0.9	0.4	1.2

SOURCES: European Commission (AMECO) and Banco de España.

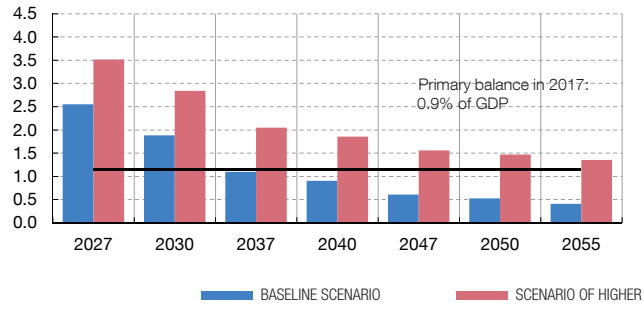
a Average values for the period 1995-2017.
b Implicit nominal interest rate on public debt. Average value for 2014-2017.
c Implicit nominal interest rates 50% higher than the baseline scenario are assumed.
d Real GDP growth, the inflation rate and the nominal interest rate are assumed to hold at the values observed in 2016.
e European Commission's November 2017 projections.

By way of illustration, Table 2 presents the results of calculating the primary balance (as a percentage of GDP) that certain euro area countries would have to maintain to place the public debt-to-GDP ratio at 60% in 10 years, under the assumption that the nominal GDP growth rate will stand at the average for the past decades (average for 1995-2017) and the implicit rate on debt at the average for the most recent period of expansionary unconventional monetary policy (the average for 2014-2017).[24] In the case of the euro area, the reduction in the next 10 years in the public debt-to-GDP ratio from the 2017 level of 89.3% to 60% would be attained by maintaining a primary surplus of 2.6% of GDP, on average, in 2018-27, under the assumption that the nominal GDP growth rate will stand, on average, at 3.1% (average for 1995-2017) and the implicit rate on debt at 2.6% (average for 2014-2017) (see Table 2). This primary fiscal surplus is significantly higher than that observed in the recent past (0.4% of GDP in the 1995-2017 period, 1.2% in 1995-2007) and that estimated for 2017 (0.9% of GDP). In Spain's case, the reduction in the public debt ratio from the European Commission's forecast last autumn for 2017 of 98.4% to 60% in the next decade would require, under the above-mentioned macro-fiscal assumptions (see Table 2 once more), that a constant primary surplus of 2.9% of GDP be maintained,

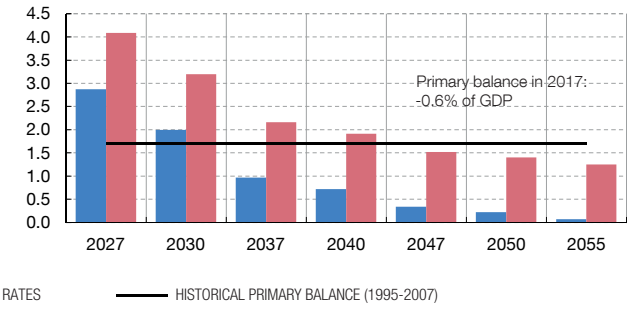
24 The data for 2017 are taken from the European Commission's November 2017 estimates.

PRIMARY BALANCE NEEDED TO REDUCE THE PUBLIC DEBT RATIO FROM ITS LEVEL IN 2017 TO 60% CHART 10

1 EURO AREA: THE ROLE OF THE CONSOLIDATION HORIZON (a)

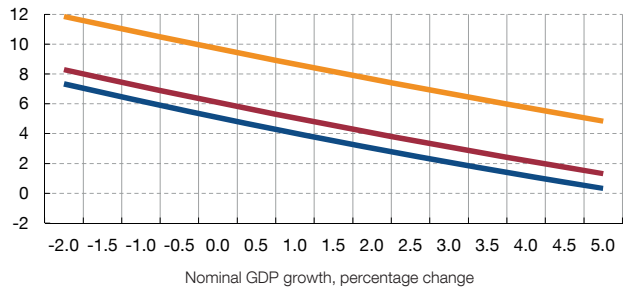


2 SPAIN: THE ROLE OF THE CONSOLIDATION HORIZON (a)

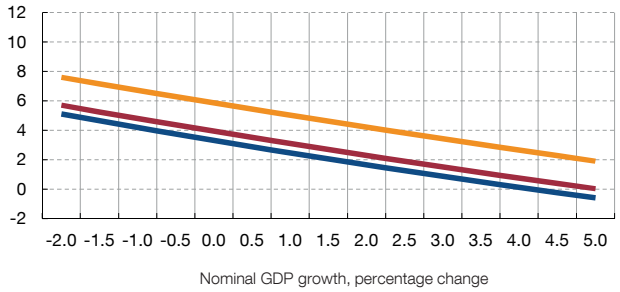


BASELINE SCENARIO SCENARIO OF HIGHER RATES HISTORICAL PRIMARY BALANCE (1995-2007)

3 ITALY: THE ROLE OF NOMINAL GROWTH (b)



4 SPAIN: THE ROLE OF NOMINAL GROWTH (b)



60% IN 2047 60% IN 2037 60% IN 2027

SOURCES: European Commission (AMECO) and Banco de España.

a Primary balance needed on average in each period to reduce public debt to 60% of GDP from its level in 2017, in the time horizon referred to. The baseline scenario assumens that nominal GDP growth stands in the debt reduction period at the average value for the 1995-2017 period, while the nominal interest rate is assumed to be equal to the average for 2014-2017. The scenario of higher rates entails a 50% increase on the baseline scenario figure. The 2017 data are the European Commission's Novermber 2017 projections.
b The nominal implicit interest rate holds in all the scenarios on average in the 2014-2017 period.

which is a more demanding value than the historical figure for the pre-crisis period (1.7% in 1995-2007), and substantially higher than that estimated by the European Commission for 2017, namely –0.6% (a primary deficit).

In the foregoing exercise the term over which the simulated reduction in the public debt ratio is considered is crucial, given that it conditions the effort needed, which in turn depends on the macro-financial situation in the fiscal adjustment period. For example, in the case of the euro area, under the assumptions of real GDP growth, inflation and interest rate described in the previous paragraph, a sustained primary balance similar to the historical pre-crisis balance, of 1.2% of GDP (average 1995-2007), would allow debt to be reduced to 60% in two decades, towards 2037 (see Chart 10.1). In Spain's case, with assumptions about better macroeconomic fundamentals than in the euro area on average (i.e. with a lower $r - \gamma$ differential), despite the starting point in 2017 being a debt-to-GDP ratio that is 9 pp higher, the maintenance from 2017 to 2030 of a primary balance similar to that observed, on average, in the previous expansionary period (1.7% of GDP, higher than that for the euro area) would enable the debt reference value to be attained, approximately, in the latter year (see Chart 10.2).

The changes in the macroeconomic assumptions also significantly alter the results of the simulations. Better (worse) macro-financial assumptions would require a smaller (bigger) primary surplus to achieve the same debt reduction objective. For example, in the case of the euro area aggregate, an implicit interest rate 50% higher than that assumed in the baseline case (3.9%, the average for 1999-2017) would involve having to maintain a primary surplus 38% higher (3.5 pp of GDP compared with 2.6 pp) in order to achieve the same debt goal of 60% in a decade. In the Spanish case, higher (by 50%) interest rates than those assumed in the foregoing baseline scenario, with the remaining assumptions holding constant, would delay convergence by the public debt ratio on the 60% level by a decade (see Chart 10.2 once more).

The results are also very sensitive to the assumptions about the economy's nominal growth rate. For instance, in the case of Italy, which posts a very high debt-to-GDP ratio (132% of GDP in 2017), sustaining a primary surplus equal to the historical one (3.1% of GDP) would, if the implicit nominal rates on debt are held at 2.5%, allow 60% to be attained in one decade, two decades or three decades, with nominal GDP growth of 7%, 3% and 2%, respectively (see Chart 10.3). That is to say, nominal growth that is higher by 1 pp over two decades would enable the consolidation time to be reduced by one decade, with the same budgetary effort.

The illustrative exercises discussed do not take into consideration the effects on economic growth and inflation that would be brought about, first, by the maintenance of these primary surpluses over a prolonged period and, on the other, the effects that the deleveraging process would have on interest rates. Nor do they show the real degree of effort required to attain a specific budgetary position, because no distinction is drawn between the cyclical component of the budget deficit, which would be corrected by macroeconomic developments, and the structural component, whose correction requires discretionary measures. These considerations can be incorporated into the analysis by broadening the analytical framework, which is what is done in the following section.

4.3 Deterministic scenarios for debt: with a behaviour model

This section broadens the foregoing simple framework of analysis, based on the equations [1] and [5], with an additional set of behavioural relationships. The first, equation [6], captures the effect of changes in the fiscal policy stance, measured on the basis of the change in the primary structural balance, Δd_t^E, as a percentage of nominal potential GDP ($P_t \bar{Y}_t$), on real economic growth, g, given by the fiscal multiplier β_1 [see, inter alia, Warmedinger et al. (2015)]:

$$g_t = \rho\, g_{t-1} + (1-\rho)\, \bar{g}_{t-1} - \beta_1\, \Delta d_t^E - \beta_2 O_t - \beta_3 (r_t - r_{t-1}) \qquad [6]$$

where ρ measures the persistence of the growth in real output, which in turn is found anchored to the growth of real potential output, $\bar{g}$. Furthermore, the situation of the output gap, O_t, conditions the rate of expansion of output, meaning that in each period a fraction β_2 of the gap closes. Equation [6], finally, includes an inverse standard relationship between the changes in the interest rate, r, and growth. To complete the notation, the output gap is defined as:

$$O_t \equiv (Y_t - \bar{Y}_t) / Y_t \qquad [7]$$

where $Y_t = (1 + g_t)\, Y_{t-1}$ denotes the level of real output, and $\bar{Y}_t = (1 + \bar{g}_t)\, \bar{Y}_{t-1}$ that of potential real output, while the budget balance as a percentage of nominal GDP, $P_t Y_t$, is defined as the sum of the structural balance and the cyclical balance, d_t^C,

$$d_t \equiv d_t^E (\bar{Y}_t / Y_t) + d_t^C \qquad [8]$$

where the cyclical balance is defined as a proportion (elasticity, ϵ) of the output gap

$$d_t^C \equiv \epsilon\, O_t \qquad [9]$$

The second basic equation of the extended model is a Phillips curve, which links the course of the inflation rate with the degree of slack in the economy, measured by the output gap, and inflation expectations, which weight the recent past and the ECB's medium-term objective, π^0,

$$\pi_t = \vartheta_0\, \pi^0 + (1 - \vartheta_0)\, ¼\, (\pi_{t-1} + \pi_{t-2} + \pi_{t-3} + \pi_{t-4}) + \vartheta_1\, O_t \qquad [10]$$

Finally, some persistence is incorporated into the nominal interest rate, given by φ_r, which reflects the hysteresis that is introduced into the dynamic of the implicit rate on public debt by its term structure, and a term that measures the impact of new long-term issues, with the rate r_t^L, and short-term issues, with the rate r_t^C:

$$r_t = \varphi_r\, r_{t-1} + (1 - \varphi_r)\{(1 - \varphi_r^C)\, r_t^L + \varphi_r^C r_t^C\} \qquad [11]$$

where the long-term rate is affected by the situation of the country's public finances, measured by the distance between the balance and public debt with respect to their medium-term references:

$$r_t^L = r_{t-1}^L - \tau_d\, \{d_{t-1} - \bar{d}_t\} + \tau_b\, \{b_{t-1} - \bar{b}_t\} \qquad [12]$$

while the short-type rate is determined taking as a reference the long-term rate:

$$r_t^C = r_t^L + ¼\, \sum_{i=1}^{4} \{r_{t-1}^C - r_{t-1}^L\} \qquad [13]$$

Hence, the improved public finances situation leads to an improvement in the interest rate at which the debt is financed and, therefore, in the payment of interest thereon.

The basic calibration of the model's parameters given by [1]) and [6] to [13] is taken from Warmedinger et al. (2015), Laubach (2009), Balducci and Kumar (2010), Álvarez and Urtasun (2013), Broussard et al. (2012), Bouabdallah et al. (2017), and own calculations based on the data for the Spanish economy: $\rho = 0.5$ (persistence of output); $\beta_1 = 0.55$ (average fiscal multiplier of a combination of instruments on the revenue and expenditure side); $\beta_2 = 0.20$ (closing of the output gap); $\beta_3 = 0.5$ (elasticity of the change in rates on growth); $\bar{g}_t = 1.5\%$ (constant in the simulation horizon); $\epsilon = 0.45$ (elasticity); $\vartheta_0 = 0.3$ (anchoring of inflation to its medium-term objective); $\vartheta_1 = 0.1$ (inflation response to cyclical slack); $\tau_d = 0.15$ (impact of a 1% of GDP increase

DETERMINISTIC SCENARIOS: PACE OF REDUCTION OF PUBLIC DEBT UNDER ALTERNATIVE ASSUMPTIONS (PARAMETERISATION FOR SPAIN) TABLE 3

%

Constant fiscal adjustment needed to reduce the public debt to 60% of GDP in ten years	Fiscal effort needed (a) (annual average)	Primary balance (annual average, pp of GDP)		Public debt (pp of GDP)		
	2018-2027	2017	2018-2027	2017	2018	2027
No reaction of macro variables	0.83	-0.6	2.9	98.4	97.0	60.0
Reaction of GDP: multiplier 0.55	1.14	-0.6	3.6	98.4	97.6	60.0
Higher potential GDP (b)	0.97	-0.6	2.7	98.4	97.5	60.0

SOURCE: Banco de España. The values for 2017 are European Commission estimates (November 2017).

a Change in the structural balance per annum, in percentage points of potential GDP.
b Growth in potential GDP of 2.5% in 2017-2026 (1.5% in baseline scenario).

in the deficit-to-GDP ratio on the long-term interest rate of government debt); $\tau_b = 0.02$ (impact of a 1% of GDP increase in the debt-to-GDP ratio on the long-term interest rate of government debt); $\varphi_r = 0.8$ (persistence of the implicit rate, whereby 20% of the debt is rolled over each year); $\varphi_r^c = 0.2$ (weight of short-term debt, with a residual maturity of less than one year). So as to be able to calculate the backward-looking component of inflation, the increasing path of prices forecast by the Eurosystem in the December 2017 projections exercise is assumed for 2017-2019. Also taken for these years are the paths of short-and long-term interest rates forecast in that exercise.

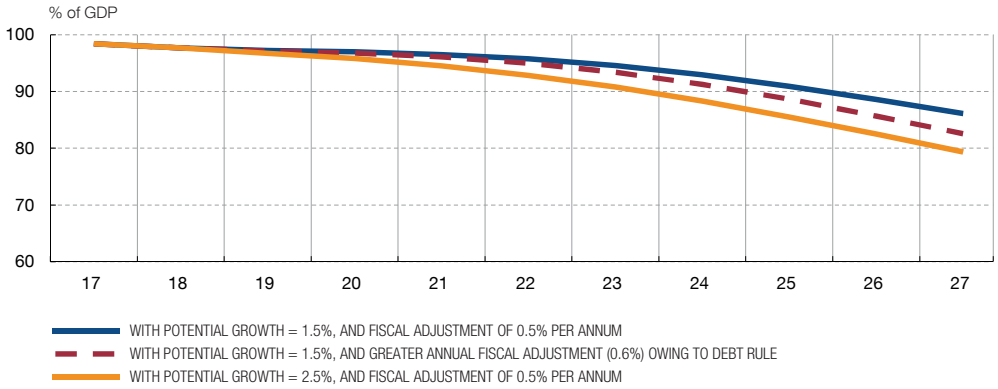
With this model and given the calibration set out, some of the simulations of the previous section can be performed again and the results compared. Specifically, in a similar way to the beginning of this section, the constant fiscal effort (per annum) needed to reduce the public debt ratio from the level of 98.4% of GDP forecast by the European Commission for 2017 (the case of Spain) to 60% in 10 years (2027) is calculated, but taking into account moreover the costs in terms of GDP growth of this fiscal consolidation strategy. The main conclusions of the analysis are as follows (see Table 3).

First, in line with the beginning of this section, the reduction in public debt towards the 60% reference in the next 10 years would require a significant, constant, annual structural effort of 0.83 pp of GDP in 2018-2027, with a fiscal multiplier $\beta_1 = 0$, consistent with maintaining on average a primary balance in 2018-2027 of 2.9% of GDP, with mild convergence towards that value by the primary balance derived from the model, from –0.6% in the base year 2017. In cumulative terms, general government interest payments would fall by 0.9 pp of GDP, which provides budgetary headroom that could be used to mitigate the structural effort needed.

If the channel comprising the macroeconomic impact of the consolidation given by a multiplier[25] with a standard value, $\beta_1 = 0{,}55$, is activated, the fiscal effort needed to attain the same debt target in 2027, namely 60%, is 0.3 pp higher in terms of additional structural effort

25 The fiscal multipliers depend on the time at which the adjustment is made or the composition thereof, among other factors. For example, they are higher at times of economic recession or high unemployment, and they are lower at times of budgetary or financial stress [see Hernández de Cos and Moral Benito (2016); Lamo et al. (2016)].

SIMULATED PUBLIC DEBT PATHS IN A SCENARIO OF CONVERGENCE ON THE MEDIUM-TERM STRUCTURAL BALANCE OBJECTIVE (a) CHART 11



SOURCE: Banco de España, using the model described in section 4.3 with fiscal multiplier set at a value of 0.55.

a Maximum annual fiscal effort scenario (change in structural balance) of 0.5 pp per annum, until the Medium-Term Objective is attained (structural balance = 0). In the scenario of potential growth = 1.5% and fulfilment of the debt rule, the constant annual fiscal adjustment is calculated so that the rule holds on average, i.e. so that the annual average change in the public debt-to-GDP ratio falls by 1/20 of the distance between the debt value for each year and the 60% reference.

per annum compared with the previous case, up to 1.1% of GDP, and the average primary balance required would rise to 3.6% of GDP, given the adverse effects on economic growth. Further, in this latter case, if the economy's potential growth were to be 1 pp higher than the assumption in the baseline scenario (2.5% compared against 1.5%), the debt-improvement process would be significantly affected, meaning that a structural fiscal effort of 0.97 pp of potential GDP per annum would be required, as with the maintenance of an average primary surplus in 2018-2027 of 2.7% of GDP (see Table 3 once more). It is worth mentioning that if the fiscal multiplier were higher, e.g. β_1= 1.25, the fiscal structural adjustment per annum needed to reduce debt to 60% would be even higher, at 1.9% of GDP per annum, causing high persistence in the negative output gap generated by consolidation, and holding inflation very low, which would translate into a very subdued nominal GDP path that would hamper, in turn, the ongoing reduction of debt. Indeed, in this case, the public debt-to-GDP ratio does not begin to fall until 2022.

Lastly, in the context of the previous model, Chart 11 presents hypothetical scenarios of developments in public debt in the coming decade, under the assumption that the fiscal adjustment is tailored to the SGP requirements of convergence towards the so-called "medium-term objective" (MTO) (for Spain: zero structural balance), whereby an annual structural effort (change in the structural balance as a percentage of potential GDP) of 0.5 pp of potential GDP is made until this objective is attained.[26] In a scenario in which potential growth of 1.5% and a fiscal multiplier of 0.55 are assumed, fulfilment of the MTO would entail a cumulative reduction in the public debt-to-GDP ratio of around 10 pp in the coming decade, so that this ratio would stand slightly below 85% in 2027. Under the SGP framework, as discussed in section 3.2, there is –in addition to convergence on the MTO– a rule on convergence towards the reference of 60% of GDP; as a result, the countries with a debt ratio higher than this value should reduce, on average,

26 On the latest European Commission estimates (November 2017), the Spanish general government structural public balance is expected to stand in 2017 at close to 3.5% of GDP.

their debt by a proportion of 1/20 of the amount by which this reference value is exceeded. If it is imposed on this previous scenario that this additional rule should be met, on average, in the coming decade, the degree of fiscal adjustment needed per annum would be higher, at 0.6 pp, and public debt would stand at close to 80% of GDP in 2027, some distance nonetheless from the SGP reference value of 60%. Chart 11 also presents a scenario in which higher potential growth, of 2.5%, is assumed. In this case, the economy's greater dynamism would enable the MTO to be attained and the debt rule to be met with an annual fiscal adjustment of 0.5 pp, reducing debt to a value slightly below 80% of GDP.

It is further worth noting that the simulations presented evidence the difficulty of meeting the conditions set in the first transitory provision of the LOEPSF on the transitory period of convergence towards the reference values set by this legislation, values that are in line with those set in the SGP, i.e. 60% for the overall general government sector. According to this Provision, the public debt-to-GDP ratio for each tier of government shall be reduced at the necessary pace on an annual average basis so as to reach this aggregate limit in 2020.[27] The attainment of the objective in 2020 from the current levels, which are slightly higher than 98% of GDP, would require a reduction in the public debt-to-GDP ratio of close to 40 pp in three years, an even greater effort than that of the previous public deleveraging process from 1997 to 2007 (see section 2.2), which provided for a reduction of about 30 pp in somewhat over a decade in what was a very favourable macroeconomic context. In this respect, in line with the recommendations of the AIReF (the Spanish Independent Authority for Fiscal Responsibility), it might be best to use the appropriate legal mechanisms to extend the transitory period for the fulfilment of the limit set out in the LOEPSF, adapting the requirements specified in the first transitory provision of this legislation and defining a credible and demanding reference path for the sustained reduction of the debt ratio, consistent, in any event, with the requirements of the Stability and Growth Pact.[28]

In sum, the analytical approach in this section has helped illustrate the orders of magnitude and the channels through which a reduction in public debt would operate should it come about: degree of fiscal effort, composition of fiscal effort (which affects the multiplier value), macro-financial conditioning factors (economic growth in the short and long term, and interest rates), initial level of debt, objective of the public deleveraging process and the interactions that may arise between these determinants. There are other significant aspects, which have been omitted in this section for the sake of simplicity, such as the private-sector debt situation, the prevailing monetary policy reaction, and the combination of fiscal policy with other, structural reforms that might smooth the public finances readjustment process [in this respect see, inter alia, Banco de España (2017), Arce et al. (2016) and Andrés et al. (2016)].

27 Moreover, certain additional requirements are set out for the transition phase, under normal conditions: (i) the change in the non-financial uses of each tier of government may not exceed the Spanish economy's real GDP growth rate; (ii) as from the time at which the national economy attains a real growth rate of at least 2% per annum or generates net employment with growth of at least 2% per annum, the public debt ratio will annually decline, at least, by 2 pp of GDP; (iii) the overall general government structural deficit will decline, at least, by 0.8% of national GDP in annual average terms; however, in the event of an Excessive Deficit Procedure, the reduction in the deficit will be adjusted to what the EDP demands.

28 See the AIReF report dated 20 July 2016: "Sobre el cumplimiento esperado de los objetivos de estabilidad presupuestaria, deuda pública y regla de gasto 2016 de las AAPP".

5 Conclusions

Public debt levels relative to GDP in a majority of euro area countries are at very high levels according to the historical records available. In Spain's case, despite the slight reduction in the past three years, public debt as a proportion of GDP stood at around 98% in 2017, i.e. at levels not seen for more than a century. Adding to the challenges arising from these high levels of public debt are those associated with the ongoing population ageing in the developed countries. These challenges are expected to intensify in the coming decades and exert upward pressure on specific public spending items such as pensions, health and care for the elderly.

The economic literature is conclusive in highlighting that maintaining very high public debt ratios over prolonged periods may be harmful to economic growth and entail a source of vulnerability for the economy, in addition to reducing the stabilising capacity of the public budget. The literature also suggests that the effects on economic growth are determined not only by the level of debt but also by the attendant debt dynamics, whereby the adverse impact of a high public debt level would be diminished in a context of debt reduction.

The international evidence available on past episodes of reductions in public debt in the advanced economies since the 1980s shows that, although the contribution of the macroeconomic fundamentals has been significant, the main factor for the success of these processes has usually been the implementation of a significant fiscal consolidation process.

Against this background, the reforms to the European and Spanish fiscal frameworks, set out in the SGP and the LOEPSF, respectively, have tended to strengthen the disciplining role of the defined limit on public debt. Specifically, the SGP now accords greater significance to this variable throughout the budgetary surveillance process, and the conditions under which the correction of excessive debt situations (i.e. above the aforementioned reference limit) should come about are more precisely defined. Further to this reform, then, the countries with a debt ratio higher than 60% of GDP will be subject to the corrective mechanisms of the SGP, unless the debt moderates at a satisfactory pace, which will require, in the three years prior to the assessment, that debt should be reduced by a proportion of 1/20 of the amount by which it exceeds the reference value of 60% of GDP. Along these same lines, the LOEPSF also included the explicit limit of 60% of GDP, which was not envisaged in the previous stability laws.

The simulations performed in this paper show that a public deleveraging process such as that required by the SGP for the case of the Spanish economy will require a still-significant and durable fiscal consolidation effort. Specifically, given the level of public debt relative to GDP in 2017 and the European Commission's estimates of the Spanish general government structural deficit for that year, and on the basis of nominal average economic growth assumptions for the coming decade of 3% and of implicit interest rates on public debt of 2.5%, the fulfilment of this objective will call for an average primary surplus of 0.8% of GDP, compared with the 2017 deficit estimate of 0.6% of GDP. That would enable the public debt-to-GDP ratio to stand at slightly

over 85% in 2027. Average real GDP growth 1 pp higher than that set out in this scenario would, with the remaining assumptions holding, allow a public debt-to-GDP ratio close to 80% in 2027 to be attained, or, where appropriate, it would provide for achieving a public debt-to-GDP ratio such as that of the previous scenario but with a significantly smaller fiscal effort. Specifically, in this latter case, the average primary surplus needed would be 0.2% of GDP, 0.6 pp per annum below that of the baseline scenario. The simulations illustrate the importance of pursuing the fiscal consolidation process and of accompanying it with the structural reforms needed to increase the economy's growth capacity.

Lastly, these simulations evidence the difficulty of meeting the conditions set out in the first transitory provision of the LOEPSF, which would oblige the public debt-to-GDP ratio to stand below 60% in 2020. In this respect, it would be warranted using the legal mechanisms envisaged in the LOEPSF to extend the transitory period in order to attain the aforementioned limit, defining a credible and demanding path of reduction for the public debt ratio consistent with the requirements of the Stability and Growth Pact.

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