Determining factors and future scenarios for the Spanish public debt

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Abstract

The Spanish public debt to GDP ratio has reached its highest level in 2020. In this paper, we study the evolution of the factors explaining the recent changes in this debt ratio from 2015 to 2021. Moreover, we estimate the fiscal consolidation efforts needed to achieve a determined level of public debt to GDP ratio. Likewise, a macroeconomic model is calibrated to simulate the future evolution of debt under different consolidation strategies. The simulations are obtained at country and regional levels. Our main conclusion indicates that it will be necessary a significant fiscal consolidation effort to address the deleveraging process that is expected to be required by the reform of the European fiscal rules.

1. Introduction

The new economic governance framework of the European Union (EU) will be centered in the public debt sustainability (European Commission, 2022). Nowadays, the Spanish public debt to GDP ratio is above the reference values determined by the Stability and Growth Pact (SGP), and it is necessary to begin with a deleveraging process as soon as possible. Moreover, it is important to consider the high level of decentralization of our public sector. This adds an additional complexity to the design of new fiscal rules guiding the fiscal and debt adjustments.

This paper analyzes from different points of view the public debt at country and regional levels. First, it is shown which factors explain the recent evolution of the public debt from 2015 to 2021. This exercise has been developed by Bank of Spain at country (Forte-Campos *et al.*, 2021) and by the Autoridad Independiente de Responsabilidad Fiscal at regional level (AIReF, 2022). Our main contribution in this context is the analysis of the deficit-debt adjustment[1]. At regional level, it is observed that the improves of fiscal balances in 2020 and 2021 have been used to purchase financial assets instead of reducing the debt level.

Second, it is offered an estimation of the fiscal consolidation effort needed to deleverage until determined debt to GDP ratios at different temporal horizon. In AIReF (2022) a similar exercise is developed with the classical debt requirements of 60% at country level and 13% at regional level. We propose a range of benchmark debt levels which are less restrictive aiming at offering more extensive fiscal consolidation paths. The debt requirements introduced by the "Ley Orgánica de Estabilidad Presupuestaria y Sostenibilidad Financiera (LOEPSF)" are unfeasible within a medium term. We also present the estimations under the classical debt requirements to show that the primary fiscal balances necessary to reduce the public debt are far away from its historical values.

Finally, it is developed a macroeconomic model to simulate the future evolution of public debt under different consolidation strategies. This consolidation effort is measured in terms of structural fiscal balance. The general equilibrium implications that a contractive fiscal policy causes in the economic activity, the interest rates, or the potential GDP growth are also considered. A similar exercise is developed for some Euro Area economies in Hernández de Cos *et al.* (2018).

Our contribution here is the application of such a model at regional level after some technical modifications. The model has been recalibrated to include the recent economy situation and the specific fiscal characteristics of the regions. The results also confirm the unfeasibility to reach the public debt ratio considered by the SGP in the medium term. At regional level, a high heterogeneity in the public debt levels is observed. Consequently, it is important to distinguish some types of regions depending on the debt level. The regions

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[1] The deficit-debt adjustment measures the differences between the fiscal deficit and the change in public debt. These differences occur because the debt issue can finance the purchase of financial assets, and because the public debt and deficit are measured using a different valuation criterion as well.

with lower public debt levels will reach and keep the level of 13%. However, for the regions with higher debt levels, it will be impossible to address such deleveraging.

The paper is structured as follows. In the second section we describe the evolution of the fundamental factors explaining the recent changes in the public debt ratio from 2015 to 2021. In the third section, the necessary fiscal consolidation effort to reach a determined level of debt to GDP ratio at different time frames is estimated. In the fourth section, we simulate the future evolution of Spanish public debt under different consolidation strategies. Finally, some concluding remarks are shown.

# 2. Factors behind the recent evolution of Spanish public debt

During the last fourteen years, Spain has tripled its public debt to GDP ratio. This ratio has increased from 35.8% in 2007 to a maximum of 120.4% in 2020. In comparison with other European countries, Spain presented the greatest increase in public debt ratio (Table 1, Graph 1). During the financial crisis, the Spanish public debt has increased in 67.5 pp. from 2007 to 2015. During the pandemic the public debt increased in 20.1 pp. from 2019 to 2021. Nowadays, Spanish public debt over DGP ratio is one of highest in the EU. As it is observed in Graph 1, the Spanish public debt has been greater than the average EU debt since 2012 and, currently, it is above the average EU in 30 pp. of GDP.

Table 1. Public Debt (% GDP). Average EU-27 and some countries of Euro Area

	Debt level year 2000	Before Financial crisis 2000-2007	Financial crisis 2007-2015	Before Pandemic 2015-2019	Pandemic 2019-2021	Whole period 2000-2021	Debt level year 2021
UE-27	66.3	-4.1	22.8	-7.5	10.6	21.8	88.1
Spain	57.8	-22.0	67.5	-5.1	20.1	60.5	118.3
Germany	59.3	4.9	7.7	-13.0	10.4	10.0	69.3
France	58.9	5.6	31.1	1.8	15.5	54.0	112.9
Italy	109	-5.1	31.4	-1.2	16.7	41.8	150.8

Sources: Eurostat (2022) and own elaboration.

Graph 1. Public Debt (% GDP). Spain and EU-27
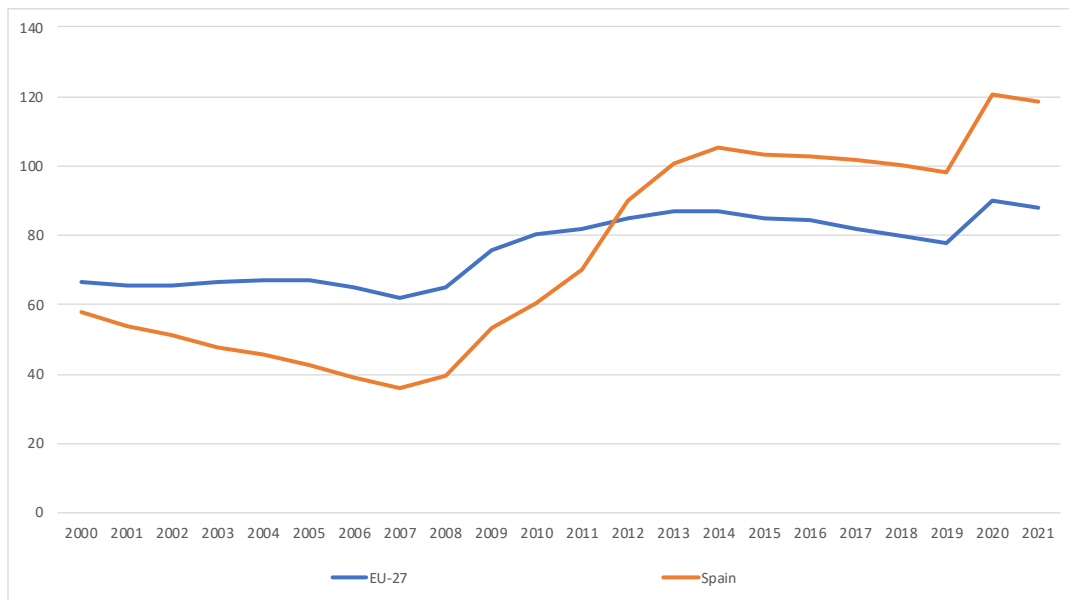
Sources: Eurostat (2022) and own elaboration.

In this section, the change in the public debt to GDP ratio is decomposed into its fundamental factors. The analytical expression we have used is based on Escolano (2010):

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

where *b* is the stock of public debt as percentage of GDP, *r* is the implicit nominal interest rate on debt[2], *g* is the real GDP growth, π inflation rate measured by the GDP deflator, *p* is the primary public balance and *add* are the deficit-debt adjustments as percentage of GDP. All variables are referring to a year t or t-1.

The interpretation of the Equation (1) is as follows. The change in the public debt to GDP ratio is explained, firstly, by the interest rates *r* to be paid for the previous stock of public debt; secondly, the inflation rate π, which reduces the indebtedness in real terms; and finally, the primary public balance (excluding the interest rates) *p*, that has a positive effect on the indebtedness. Moreover, the variables public debt and public balance must be connected using an accountant adjustment called the deficit-debt adjustment *add*.

The so-called EDP (acronym of Excessive Deficit Procedure) public debt is defined following European rules and the concept is not the same as the financial liabilities issued by the public administration. In this sense, three adjustments are needed: i) The EDP public debt is accounted using its nominal value whereas the financial liabilities are valued using the market value. ii) The commercial debt is not included into the concept of EDP public debt; however, the factoring without recourse is considered as public debt according to EDP. And iii), the financial liabilities of other public administrations must be discounted from the EDP public debt at national level.

The disaggregation of the change in public debt for the general government and for the state government sectors are shown in the Graphs 2 and 3. Following the Equation (1), the change in EDP public debt is decomposed into:

- Interest $\left(\frac{r_t}{1+g_t}\right) b_{t-1}$
- Primary deficit $(-p_t)$
- Nominal GDP growth $[-\left(\frac{\pi_t + g_t}{1+g_t}\right) b_{t-1}]$
- Deficit-debt adjustment: $+add_t$

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[2]The implicit nominal interest rate on debt is computed as the ratio of the interest expenditure in national accounts published by the "Intervención General de la Administración del Estado" (IGAE, 2022) and the average EDP public debt of year t. Notwithstanding, the interest rate expenditure includes the interests paid for the commercial debt, so the implicit nominal rate can be slightly overestimated.

Graph 2. Evolution of public debt at country level (% GDP) (2015-2021)
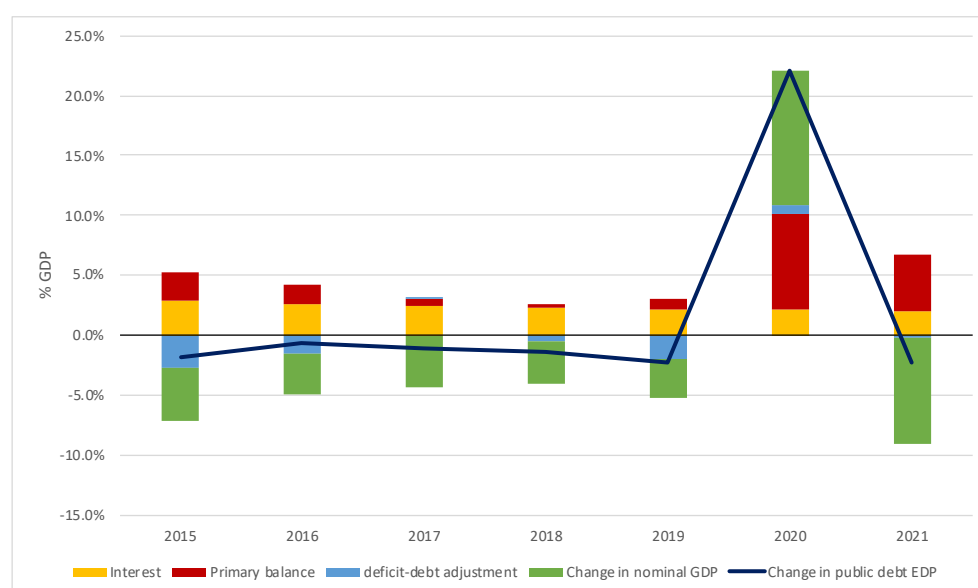
Sources: BDE (2022), IGAE (2022), INE (2022) and own elaboration

From 2015 to 2019, the deficit-debt adjustments and the change of nominal GDP have contributed to reduce the EDP public debt. However, on the other side, the interest rates and the public primary deficit have contributed to increase such a public debt. Jointly, the EDP public debt was slightly reduced from 103.3 to 98.2 pp of GDP.

In the year 2020, the public debt has increased in 22.1 pp of GDP. This is explained by the drop in the GDP growth (11.2 pp.) and in the high primary deficit (7.9 pp.), both caused by the Pandemic. Over the next year of 2021, the recovering of the GDP growth has helped to reduce the EDP public debt in 8.9 pp. However, considering the increment of debt caused by interest rates and the primary deficit, EDP the public debt has only reduced in 2.2 pp of GDP (Graph 2).

The evolution of public debt at regional level is shown in the Graph 3. In this case, the reduction in public debt before the Pandemic is produced only from the years 2017 to 2019. This decrease in debt is explained by the reduction of the primary deficit, which presented a slightly surplus in the year 2018. It is important to highlight that the deficit-debt adjustment contributed to increase the public debt before the Pandemic. This is explained by the purchase of financial assets and the payment of commercial debts with financial institutions though factoring operations.

The year 2019, in turn, is characterized by the negative deficit-debt adjustment explained by the sale of financial assets. In 2020, the regional public debt has increased in 3.5 pp. of GDP. This is explained, mainly, by the drop in the GDP growth. The deficit-debt adjustment has augmented the public debt in 0.6 and 0.7 pp. of GDP in 2020 and 2021, respectively. Moreover, it is important to noticed that the primary balance in 2020 and 2021 have recorded surpluses, which has contributed to reduce the public debt.

Graph 3. Evolution of public debt at regional level (% GDP) (2015-2021)
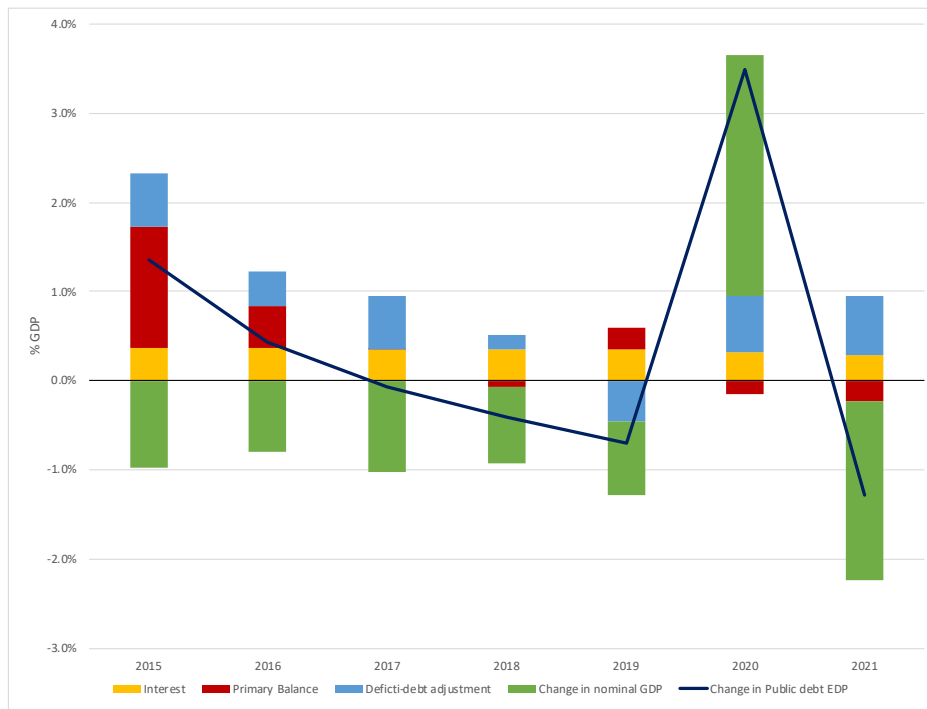
Sources: BDE (2022), IGAE (2022), INE (2022) and own elaboration

In Graph 4, the disaggregation of the change in the public debt ratio for each region from 2015 to 2021 is shown. In year 2020, the increment of public debt is greater in the regions with a greater drop in GDP growth. The most affected regions have been Andalucía, Baleares, Canarias, Cataluña, Galicia and Comunidad Valenciana. The regional primary balance was closed with a surplus for the whole. Only four regions closed with primary deficits: Comunidad Valenciana, Murcia, País Vasco y Navarra.

In 2021, the public debt ratio has reduced because of the higher nominal GDP growth and again the surplus of the regional primary public balance. Only the Comunidad Valenciana and Murcia presented primary deficits. It is important to notice that the primary surplus observed in 2020 and 2021 is explained by the financial assistance received by the Central government during the Pandemic[3].

It is important to consider here the differential pattern with respect to the previous years of the regional deficit-debt adjustments. Table 2 presents the disaggregation of this adjustment from 2015 to 2021. The positive deficit-debt adjustment observed in 2020 and 2021 is caused by the regional excess liquidity that it is materialized in the purchase of financial assets. Concretely, the regions purchased financial assets valued in €18.563 million in 2021. This number is tripled of the purchase observed in 2020 and it is also the highest of all the historical sequence.

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[3] De la Fuente (2022) explains in detail the financial assistance received by the regions.

A positive (negative) deficit-debt adjustment means that the increment of public debt has been superior (inferior) than the financial need of the public administration. In other words, given the primary surplus observed in the regions, the reduction in public debt would be higher. As this is not the case, it is needed a positive adjustment to reflect the increment of public debt. This increment of public debt is used by the regions to purchase financial assets.

An additional important component of the deficit-debt adjustment is that accounts payable vis-à-vis other general government units and/or referring to the change in commercial debts through the operation of factoring without recourse. The remainder adjustments include the effects produced by the reclassification of institutional units in the public administration, adjustments for accrual interest but not paid, adjustments for issuance premium, etc. As can be observed, this variable played a residual role in the last exercises.

Table 2. Disaggregation of the deficit-debt adjustment at regional level (2015-2021). Millions of euros.

	Deficit-Debt adjustment	Net purchases of financial assets	Other accounts payable		Remainder adjustments
			vis-à-vis other general government units	other	
2015	6,457	2,778	738	2,684	257
2016	4,246	811	788	2,295	352
2017	6,957	4,285	1,182	915	575
2018	1,991	2,228	970	-1,251	44
2019	-5,653	-4,702	970	-1,578	-343
2020	6,928	6,834	970	-916	40
2021	7,966	18,563	-8,270	-2,280	-47

Source: BDE (2022) and own elaboration

Graph 4. The evolution and factors determining the public debt by region (% GDP)

Interest | Primary Balance | Deficti-debt adjustment | Change in nominal GDP | Change in Public debt EDP
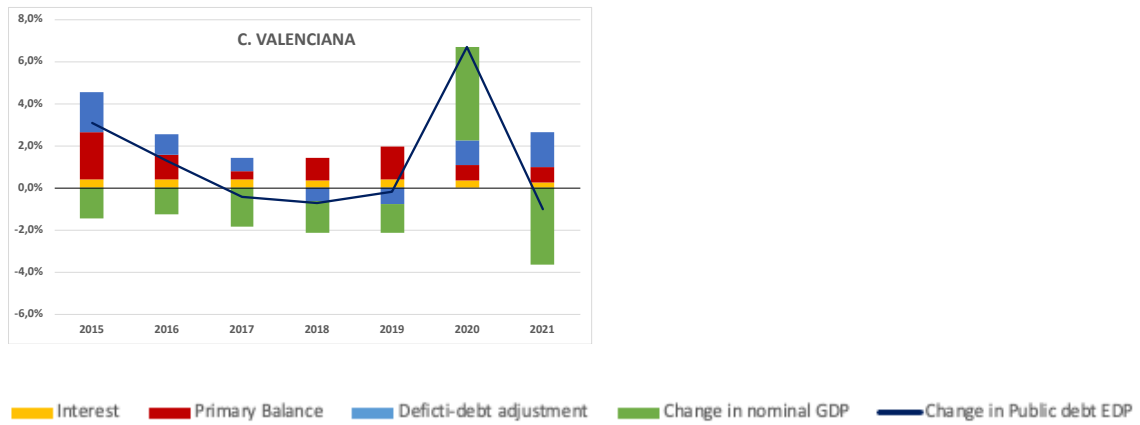
Graph 4 (cont´d). The evolution and factors determining the public debt by region (% GDP)

Graph 4 (cont´d). The evolution and factors determining the public debt by region (% GDP)

Sources: BDE (2022), IGAE (2022), INE (2022), AIReF (2022), de la Fuente (2020) and own elaboration

3. Fiscal effort to reach a determined public debt level

In this section, we address the following question: what would be the fiscal consolidation effort necessary to debt deleverage up to a public debt to GDP ratio in a determined period. Starting from the public debt to GDP ratios in 2021, the fiscal consolidation effort is defined in terms of the primary budget balance. This exercise will be done for the general government (whole public administration) and at a regional level (regional administration as a whole and for each region). It is considered two government public debt objectives over the GDP: 60% and 80%. The regional objectives considered are three: 13% (established in LOEPSF), 26% (regional debt to GDP ratio in 2021) and 19.5% (this value is exactly between the previous two objectives).

Our theoretical framework is based on Escolano (2010):

$$b_t = (1 + \lambda_t)b_{t-1} - p_t, \tag{2}$$

where b_t is the debt to GDP ratio defined in (1), $\lambda_t = \frac{r_t - \gamma_t}{1 + \gamma_t}$, measures the relation between implicit nominal interest rate (r_t) and the nominal growth of GDP (γ_t) and p_t is the primary fiscal balance. This equation in differences is a reformulation of the expression (1) with the following solution:

$$b_N = b_0 \prod_{t=1}^{N}(1 + \lambda_t) - \sum_{t=1}^{N}\left[\prod_{i=1+t}^{N}(1 + \lambda_i)\right]p_t. \tag{3}$$

Suppose that $\lambda_t = \lambda$. Then the following expression is derived:

$$b_N = b_0(1 + \lambda)^N - \sum_{t=1}^{N}(1 + \lambda)^{N-t} p_t. \tag{4}$$

Finally, solving for p_t, the primary public balance needed (p^*) to reach a determined debt objective (d_N^*), starting with an initial ratio (d_0) and over a period of N years:

$$p^* = \frac{\lambda}{(1+\lambda)^{-N}-1}\left((1 + \lambda)^{-N}d_N^* - d_0\right). \tag{5}$$

The values chosen to simulate this equation are the following. The nominal GDP growth rates are the Spain and region average from 2001-2019. The implicit nominal interest rate are the Spain and region average from 2015 to 2019. This last one is computed as the ratio between the interest payments and the public stock level. The starting point of the public debt equation (5) d_0 is the public debt ratio in 2021. The regional level of public debt in 2021 is shown in Graph 5. According to this benchmark, we have classified the regions in four groups:

1. *Regions with reduced debt* (around 15%). Comunidad de Madrid, Navarra, Canarias y País Vasco. These regions are near to fulfill the debt objective of 13%.

2. *Regions with average-reduced debt* (around 19%). Galicia, Asturias y La Rioja.

3. *Regions with average debt level* (around 22-25%). Castilla y León, Andalucía, Aragón, Extremadura y Cantabria.

4. *Regions with high debt* (higher than 30%). Baleares, Murcia, Cataluña, Castilla-La Mancha y Comunidad Valenciana.

Graph 5. Regional public debt ratio in 2021 (% GDP)
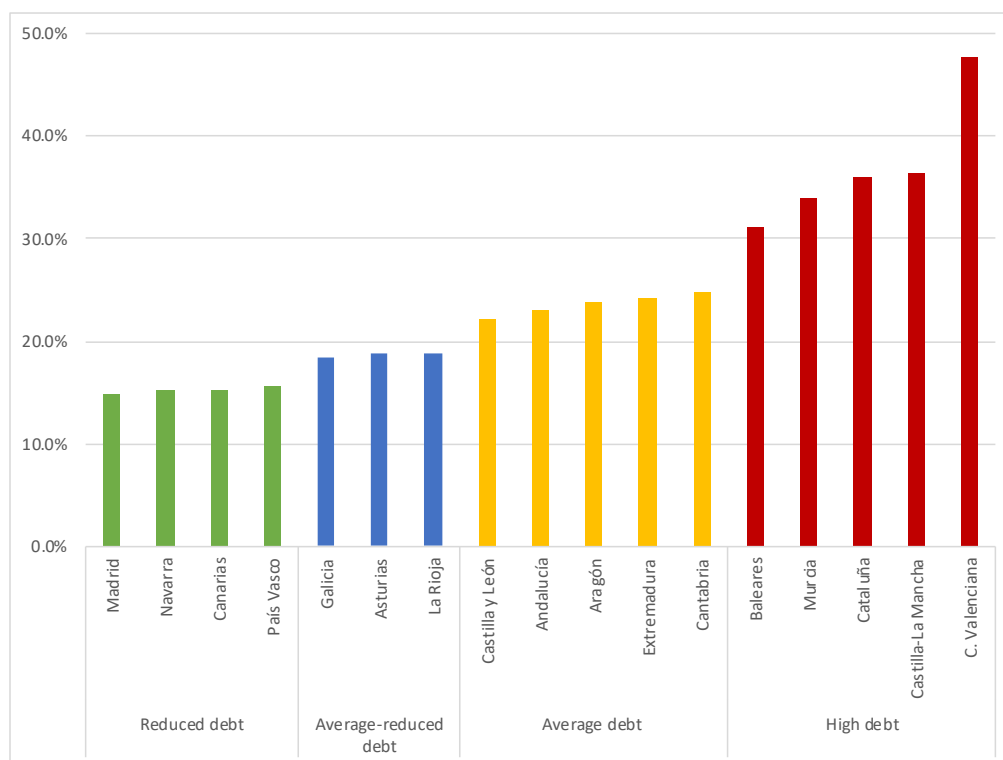
Source: BDE (2022) and own elaboration

Apart from the baseline scenario previously defined, two additional possible scenarios are considered. The first one is characterized by interest rates 50% higher than the baseline scenario. The second one by an increment of the interest rates in an additional 50% from the previous scenario and an increment of the GDP growth rate in a 50% as well. The first scenario reflects a more restrictive monetary policy than the one observed in the previous years. The second scenario combines this circumstance with higher inflation rates, which are compatible with higher nominal GDP growth rates.

In the following tables 3, 4, 5 and 6 we have opted for ranking the regions by ascendent level of public debt. The regions are colored to ease their ubication in each debt group as defined in Graph 5. Table 4 contains the information about the whole public administration.

The parameters used in the simulation model according to the scenario considered are shown in the Table 3. The parameter λ is proportional to the difference between the implicit interest rate and the nominal GDP growth. As it is interpreted by equation (5), if the

parameter λ takes positive values, the unique manner to reduce the public debt ratio is with primary surplus. However, if the parameter λ takes negative values and $(1 + \lambda)^{-N} d_N^* - d_0 > 0$, it is possible to reduce the public debt ratio even with primary deficits. As it is shown in the Table 3, under the baseline scenario for the whole public administration and for the total regions the parameter λ is negative, that is, the economic situation is favorable to reduce debt even with primary deficit. Notwithstanding, under the augmented interest rates scenario and the augmented interest rates and nominal GDP growth, the parameter λ becomes positive for the whole public administration and Navarra[4].

It is important to highlight that according to the data shown in Table 3, despite the heterogeneity observed at regional public debt level, the interest rates do not reflect the fiscal situation and public finance sustainability of each region. As an example: The Comunidad Valenciana closed 2021 with a debt level of 47.8% GDP and presents an interest rate of 0.9%. However, the region with the lowest level of debt, Comunidad de Madrid (14.8%) presents an interest rate of 2.3%. This is explained by the financial assistance received from the central government, which is provoking that the regions with high debt levels present financial expenses near to cero. However, the regions with lower debt levels opt to obtain the funds in the capital markets and do not use the financial assistance. Another, interesting characteristic is that the regions are financing at lower interest rates than the whole public administration (1,5% vs 2,6%).

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[4] The case of Navarra is explained as it is the region with the highest implicit interest rate (2.8%). The regional average interest rate is 1.5%.

Table 3. Parameter used in the simulation of the budgetary effort for Spain and the regional government

	Base scenario			Augmented interest rates (*)			Augmented interest rates and nominal GDP growth (*)		
	Nominal GDP growth (%). Average 2001-2019	Implicit interest rate (%). Average 2015-2019	λ	Nominal GDP growth (%). Average 2001-2019	Implicit interest rate (%). Average 2015-2019	λ	Nominal GDP growth (%). Average 2001-2019	Implicit interest rate (%). Average 2015-2019	λ
Spain	**3.6%**	**2.6%**	**-1.0%**	**3.6%**	**3.9%**	**0.3%**	**5.3%**	**5.8%**	**0.4%**
Total regions	**3.6%**	**1.5%**	**-2.0%**	**3.6%**	**2.2%**	**-1.3%**	**5.3%**	**3.3%**	**-1.9%**
Madrid	4.1%	2.3%	-1.7%	4.1%	3.5%	-0.6%	6.1%	5.2%	-0.8%
Navarra	3.4%	2.8%	-0.6%	3.4%	4.1%	0.7%	5.1%	6.2%	1.0%
Canarias	3.3%	1.2%	-2.0%	3.3%	1.8%	-1.4%	4.9%	2.7%	-2.1%
País Vasco	3.2%	1.6%	-1.6%	3.2%	2.5%	-0.8%	4.9%	3.7%	-1.1%
Galicia	3.6%	1.9%	-1.6%	3.6%	2.8%	-0.7%	5.4%	4.2%	-1.1%
Asturias	2.8%	1.2%	-1.6%	2.8%	1.7%	-1.0%	4.2%	2.6%	-1.5%
La Rioja	3.2%	0.4%	-2.8%	3.2%	0.6%	-2.6%	4.8%	0.9%	-3.8%
Castilla y León	2.8%	1.8%	-1.0%	2.8%	2.7%	-0.1%	4.2%	4.0%	-0.2%
Andalucía	3.5%	1.3%	-2.2%	3.5%	1.9%	-1.6%	5.3%	2.8%	-2.3%
Aragón	3.5%	2.0%	-1.4%	3.5%	3.0%	-0.5%	5.3%	4.5%	-0.7%
Extremadura	3.5%	1.8%	-1.7%	3.5%	2.6%	-0.9%	5.3%	3.9%	-1.3%
Cantabria	3.1%	1.4%	-1.7%	3.1%	2.1%	-1.0%	4.7%	3.1%	-1.5%
Baleares	3.9%	1.4%	-2.4%	3.9%	2.1%	-1.8%	5.9%	3.2%	-2.6%
Murcia	4.0%	1.4%	-2.5%	4.0%	2.1%	-1.8%	5.9%	3.1%	-2.6%
Cataluña	3.6%	1.4%	-2.1%	3.6%	2.1%	-1.4%	5.4%	3.2%	-2.1%
Castilla-La Mancha	3.7%	1.2%	-2.4%	3.7%	1.9%	-1.8%	5.5%	2.8%	-2.6%
C. Valenciana	3.3%	0.9%	-2.3%	3.3%	1.4%	-1.9%	5.0%	2.1%	-2.7%

(*) In the augmented interest rates scenario interest rates are multiplied by 1.5.

In the augmented interest rates and nominal GDP growth, interest rates are muliplied by 2.25 and GDP growth by 1.5.

Table 4 shows the fiscal consolidation effort needed by the whole public administration to reach the debt objective of 60% and 80% of GDP in time horizons: 2027 (5 years), 2032 (10 years) y 2042 (20 years). We have distinguished three scenarios: baseline, the augmented interest rates, and the augmented interest rates and nominal GDP growth at the same time.

Under the baseline scenario, the whole public administration should keep a primary surplus of 8.8% during the following 5 years (until 2027) to reach a debt level of 60%. If the time horizon increases by 20 years (2042), the primary surplus should be 1.9%. However, if the economic conditions worsen under a scenario of augmented interest rates and nominal GDP growth, the primary surplus will increase until 10.1% during the following 5 years (2027) and until 3.1% for 20 years a sight (2042). If the public debt objective considered is relaxed to 80%, the primary surplus needed under the baseline scenario should be 5.4% during the following 5 years and 0.9% for the next 20 years.

The last two columns of Table 4 show the average primary balance in the previous 20 years until 2019 (from 2000 to 2019) and during the previous 8 years (from 2012 to 2019). These historical values have been always negative, i.e., public deficit, and importantly they are clearly far away from the surplus needed to deleverage until the public debt objectives considered.

Table 4. Primary balance needed by the whole public administration to reach the objective debt of 60% and 80% over GDP

Public debt objective 60%				Historical primary balance	
	2027	2032	2042	2000-2019	2012-2019
Base scenario	8.8%	4.4%	1.9%		
Augmented interest rates (*)	10.0%	5.6%	3.0%	-1.3%	-2.5%
Augmented interest rates and nominal GDP growth (*	10.1%	5.7%	3.2%		
Public debt objective 80%				Historical primary balance	
	2027	2032	2042	2000-2019	2012-2019
Base scenario	5.4%	2.5%	0.9%		
Augmented interest rates (*)	6.7%	3.8%	2.1%	-1.3%	-2.5%
Augmented interest rates and nominal GDP growth (*	6.8%	3.9%	2.2%		

(*) In the augmented interest rates scenario interest rates are multiplied by 1.5.
 In the augmented interest rates and nominal GDP growth, interest rates are muliplied by 2.25 and GDP growth by 1.5.

Table 5 shows the fiscal consolidation efforts required by each region to reach a public debt objective of 13% GDP. It is shown the three scenarios considered and the time horizons (5, 10 and 20 years). As it can be observed in Table 5, the main difference among regions is explained by the different starting point of debt level. The regions with lower debt levels (colored in green) can reach the debt objective of 13% even with primary deficits in 10 and 20 years. However, the regions with higher public debt levels (colored in red) should do a costly fiscal consolidation effort to reach the debt objective of 13% in 10 or 20 years.

Tables 6 and 7 show the fiscal consolidation efforts required to reach public debt objectives less strict, that is, those of 19.5% and 26% over GDP. For simulation purposes it is considered that if the public debt to GDP ratio of a region is lower than the debt

objective (19.5% or 26%), the region keeps unchanged its debt level. This condition affects the regions with lowest public debt levels: Madrid, Navarra, País Vasco, Galicia, Asturias and La Rioja (colored in green and blue) closed 2021 with a debt ratio lower than 19% GDP. As can be observed in Table 6, these regions can incur in primary public deficits to keep unchanged its debt level. In Table 7, the regions with average public debt level (colored yellow) closed 2021 with a public debt level lower than 26% and must keep unchanged its debt level to reach the debt objective.

Despite the new relaxed public debt objectives (19,5% and 26%), the regions with high debt level (colored in red) should keep high primary surpluses during a large period of time to reach the objectives. These regions closed 2021 with debt levels above 30% GDP. As an example: Comunidad Valenciana closed 2021 with a debt level of 47.8%. This region could reach the debt objective of 26% under a primary balanced budget during 20 years under the scenario with worst economic conditions (augmented interest rates and nominal GDP growth) (Table 7).

Table 5. Regional primary balance needed to reach the public debt objective of 13% of GDP

	Base scenario			Augmented interest rates (*)			Augmented interest rates and nominal GDP growth (*)			Historical primary balance	
	2027	2032	2042	2027	2032	2042	2027	2032	2042	2000-2019	2012-2019
Total regions	**1.7%**	**0.8%**	**0.2%**	**1.9%**	**0.9%**	**0.4%**	**1.8%**	**0.8%**	**0.2%**	**-0.9%**	**-0.7%**
Madrid	0.1%	-0.1%	-0.1%	0.2%	0.1%	0.0%	0.2%	0.0%	0.0%	-0.5%	-0.4%
Navarra	0.3%	0.1%	0.0%	0.5%	0.3%	0.2%	0.5%	0.3%	0.3%	-0.3%	0.0%
Canarias	0.1%	-0.1%	-0.2%	0.2%	0.0%	-0.1%	0.1%	-0.1%	-0.2%	-0.4%	0.1%
País Vasco	0.2%	0.0%	-0.1%	0.3%	0.1%	0.0%	0.3%	0.1%	0.0%	-0.3%	0.0%
Galicia	0.7%	0.2%	0.0%	0.8%	0.4%	0.1%	0.7%	0.3%	0.1%	-0.5%	-0.2%
Asturias	0.7%	0.3%	0.0%	0.8%	0.4%	0.1%	0.7%	0.3%	0.0%	-0.8%	-0.5%
La Rioja	0.5%	0.1%	-0.2%	0.6%	0.1%	-0.1%	0.4%	-0.1%	-0.3%	-0.9%	-0.6%
Castilla y León	1.3%	0.7%	0.3%	1.5%	0.8%	0.4%	1.5%	0.8%	0.4%	-0.8%	-0.6%
Andalucía	1.3%	0.5%	0.1%	1.4%	0.6%	0.2%	1.2%	0.5%	0.1%	-0.7%	-0.7%
Aragón	1.5%	0.7%	0.3%	1.7%	0.9%	0.4%	1.7%	0.9%	0.4%	-0.9%	-0.9%
Extremadura	1.5%	0.7%	0.2%	1.7%	0.9%	0.4%	1.6%	0.8%	0.3%	-0.9%	-1.0%
Cantabria	1.6%	0.7%	0.2%	1.8%	0.9%	0.4%	1.7%	0.8%	0.3%	-1.0%	-0.8%
Baleares	2.5%	1.1%	0.3%	2.6%	1.3%	0.5%	2.4%	1.1%	0.3%	-1.4%	-0.5%
Murcia	2.9%	1.3%	0.4%	3.1%	1.5%	0.6%	2.9%	1.3%	0.4%	-1.5%	-1.7%
Cataluña	3.3%	1.6%	0.6%	3.5%	1.7%	0.7%	3.3%	1.6%	0.6%	-1.1%	-0.9%
Castilla-La Mancha	3.3%	1.5%	0.5%	3.5%	1.7%	0.7%	3.2%	1.5%	0.5%	-1.6%	-0.6%
C. Valenciana	5.0%	2.4%	1.0%	5.2%	2.6%	1.1%	4.9%	2.3%	0.8%	-1.7%	-1.5%

(*) In the augmented interest rates scenario interest rates are multiplied by 1.5.
In the augmented interest rates and nominal GDP growth, interest rates are muliplied by 2.25 and GDP growth by 1.5.

Table 6. Regional primary balance needed to reach the public debt objective of 19.5% of GDP

	Base scenario			Augmented interest rates (*)			Augmented interest rates and nominal GDP growth (*)			Historical primary balance	
	2027	2032	2042	2027	2032	2042	2027	2032	2042	2000-2019	2012-2019
Total regions	**0.6%**	**0.1%**	**-0.2%**	**0.8%**	**0.3%**	**0.0%**	**0.6%**	**0.1%**	**-0.1%**	**-0.9%**	**-0.7%**
Madrid	-0.2%	-0.2%	-0.2%	-0.1%	-0.1%	-0.1%	-0.1%	-0.1%	-0.1%	-0.5%	-0.4%
Navarra	-0.1%	-0.1%	-0.1%	0.1%	0.1%	0.1%	0.2%	0.2%	0.2%	-0.3%	0.0%
Canarias	-0.3%	-0.3%	-0.3%	-0.2%	-0.2%	-0.2%	-0.3%	-0.3%	-0.3%	-0.4%	0.1%
País Vasco	-0.2%	-0.2%	-0.2%	-0.1%	-0.1%	-0.1%	-0.2%	-0.2%	-0.2%	-0.3%	0.0%
Galicia	-0.3%	-0.3%	-0.3%	-0.1%	-0.1%	-0.1%	-0.2%	-0.2%	-0.2%	-0.5%	-0.2%
Asturias	-0.3%	-0.3%	-0.3%	-0.2%	-0.2%	-0.2%	-0.3%	-0.3%	-0.3%	-0.8%	-0.5%
La Rioja	-0.5%	-0.5%	-0.5%	-0.5%	-0.5%	-0.5%	-0.7%	-0.7%	-0.7%	-0.9%	-0.6%
Castilla y León	0.2%	0.0%	-0.1%	0.4%	0.2%	0.1%	0.4%	0.2%	0.1%	-0.8%	-0.6%
Andalucía	0.1%	-0.1%	-0.3%	0.3%	0.0%	-0.2%	0.1%	-0.2%	-0.3%	-0.7%	-0.7%
Aragón	0.4%	0.1%	-0.1%	0.6%	0.3%	0.1%	0.6%	0.2%	0.1%	-0.9%	-0.9%
Extremadura	0.4%	0.1%	-0.1%	0.6%	0.2%	0.0%	0.5%	0.1%	-0.1%	-0.9%	-1.0%
Cantabria	0.5%	0.1%	-0.1%	0.6%	0.2%	0.0%	0.5%	0.1%	-0.1%	-1.0%	-0.8%
Baleares	1.3%	0.4%	-0.1%	1.5%	0.6%	0.1%	1.3%	0.4%	-0.1%	-1.4%	-0.5%
Murcia	1.7%	0.7%	0.0%	1.9%	0.8%	0.2%	1.7%	0.6%	0.0%	-1.5%	-1.7%
Cataluña	2.1%	0.9%	0.2%	2.3%	1.1%	0.4%	2.1%	0.9%	0.2%	-1.1%	-0.9%
Castilla-La Mancha	2.1%	0.9%	0.2%	2.3%	1.0%	0.3%	2.1%	0.8%	0.1%	-1.6%	-0.6%
C. Valenciana	3.9%	1.8%	0.6%	4.1%	1.9%	0.7%	3.7%	1.6%	0.4%	-1.7%	-1.5%

(*) In the augmented interest rates scenario interest rates are multiplied by 1.5.
In the augmented interest rates and nominal GDP growth, interest rates are muliplied by 2.25 and GDP growth by 1.5.

Table 7. Regional primary balance needed to reach the public debt objective of 26% of GDP

	Base scenario			Augmented interest rates (*)			Augmented interest rates and nominal GDP growth (*)			Historical primary balance	
	2027	2032	2042	2027	2032	2042	2027	2032	2042	2000-2019	2012-2019
Total regions	-0.5%	-0.5%	-0.5%	-0.3%	-0.3%	-0.3%	-0.5%	-0.5%	-0.5%	-0.9%	-0.7%
Madrid	-0.2%	-0.2%	-0.2%	-0.1%	-0.1%	-0.1%	-0.1%	-0.1%	-0.1%	-0.5%	-0.4%
Navarra	-0.1%	-0.1%	-0.1%	0.1%	0.1%	0.1%	0.2%	0.2%	0.2%	-0.3%	0.0%
Canarias	-0.3%	-0.3%	-0.3%	-0.2%	-0.2%	-0.2%	-0.3%	-0.3%	-0.3%	-0.4%	0.1%
País Vasco	-0.2%	-0.2%	-0.2%	-0.1%	-0.1%	-0.1%	-0.2%	-0.2%	-0.2%	-0.3%	0.0%
Galicia	-0.3%	-0.3%	-0.3%	-0.1%	-0.1%	-0.1%	-0.2%	-0.2%	-0.2%	-0.5%	-0.2%
Asturias	-0.3%	-0.3%	-0.3%	-0.2%	-0.2%	-0.2%	-0.3%	-0.3%	-0.3%	-0.8%	-0.5%
La Rioja	-0.5%	-0.5%	-0.5%	-0.5%	-0.5%	-0.5%	-0.7%	-0.7%	-0.7%	-0.9%	-0.6%
Castilla y León	-0.2%	-0.2%	-0.2%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	-0.8%	-0.6%
Andalucía	-0.5%	-0.5%	-0.5%	-0.4%	-0.4%	-0.4%	-0.5%	-0.5%	-0.5%	-0.7%	-0.7%
Aragón	-0.3%	-0.3%	-0.3%	-0.1%	-0.1%	-0.1%	-0.2%	-0.2%	-0.2%	-0.9%	-0.9%
Extremadura	-0.4%	-0.4%	-0.4%	-0.2%	-0.2%	-0.2%	-0.3%	-0.3%	-0.3%	-0.9%	-1.0%
Cantabria	-0.4%	-0.4%	-0.4%	-0.3%	-0.3%	-0.3%	-0.4%	-0.4%	-0.4%	-1.0%	-0.8%
Baleares	0.2%	-0.2%	-0.4%	0.4%	0.0%	-0.3%	0.1%	-0.3%	-0.5%	-1.4%	-0.5%
Murcia	0.6%	0.0%	-0.3%	0.8%	0.2%	-0.2%	0.5%	-0.1%	-0.4%	-1.5%	-1.7%
Cataluña	1.0%	0.2%	-0.2%	1.2%	0.5%	0.0%	1.0%	0.3%	-0.2%	-1.1%	-0.9%
Castilla-La Mancha	1.0%	0.2%	-0.2%	1.2%	0.4%	0.0%	0.9%	0.1%	-0.3%	-1.6%	-0.6%
C. Valenciana	2.7%	1.1%	0.2%	2.9%	1.3%	0.4%	2.6%	1.0%	0.0%	-1.7%	-1.5%

(*) In the augmented interest rates scenario interest rates are multiplied by 1.5.
In the augmented interest rates and nominal GDP growth, interest rates are muliplied by 2.25 and GDP growth by 1.5.

4. Future evolution of public debt: some foreseeable scenarios

In this section, a forecasting exercise is carried out to simulate the expected public debt to GDP path under some fiscal consolidation strategies, which are measured in terms of structural fiscal balance. Particularly, a model is developed to simulate the evolution of public debt jointly with other macroeconomic variables, like the GDP growth or the cyclical budget balance, among others. This new approach is an extension of the model developed in the previous section. While the previous results are derived from the fulfillment of the dynamic equation of public debt under some economic conditions, now it is considered additionally how the variables of this dynamic of public debt are affected by the fiscal consolidation strategy at play.

The model followed is like the one proposed in Warmedinger *et al.* (2015). This model uses structural equations to measure the relationship among the variables. Hernández de Cos *et al.* (2018) calibrate this model for the Spanish economy. Our contribution in this article is the recalibration of the parameters to allow its extension at regional level. Additionally, the evolution of public debt of the whole public administration is also simulated to include the most recent data and the updating the parameters to consider the recent tightening of the financial conditions.

The starting point is the equation that relates the changes in the fiscal policy with its effect over the real GDP growth (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 g_t is the real GDP growth, which shows a persistence ρ with respect to past values; $\bar{g}$ is the potential (full employment) GDP growth in real terms; β_1 is the fiscal multiplier, Δd_t^E is the change in the structural primary balance as percentage of GDP, β_2 is the sensitivity of the real GDP growth to the closeness of the *output gap* O_t, β_3 is the sensitivity of the real GDP growth to the interest rates and r is the nominal interest rate.

According to the equation (6), the real GDP growth rate depends positively on its lag growth rates and on the growth rate of the potential GDP, and negatively on the reduction of the primary structural deficit, the output gap and the increment of the nominal interest rates.

The public balance, measured as percentage of GDP, is defined as the sum of the cyclical and structural balances:

$$d_t \equiv d_t^E \left(\frac{\bar{Y}_t}{Y_t}\right) + d_t^C, \qquad (7)$$

where $\bar{Y}_t$ is the level of potential GDP in nominal terms, Y_t is the nominal GDP and d_t^C is the cyclical balance derived in the next equation (8) using the semi-elasticity ϵ and the *output gap*:

$$d_t^C \equiv \epsilon O_t. \qquad (8)$$

It is also necessary to set up an equation, similar to a Phillips curve in an extensive way, which relates the inflation rate to the cyclical situation of the economy, that is, the *output gap* and the inflation rate expectations. These inflation rate expectations are defined using the past inflation rates and the European Central Bank (ECB) medium term objective (π^0):

$$\pi_t = \vartheta_0 \pi^0 + (1 - \vartheta_0) \frac{1}{4} (\pi_{t-1} + \pi_{t-2} + \pi_{t-3} + \pi_{t-4}) + \vartheta_1 O_t, \qquad (9)$$

where π_t is the inflation rate in *t* and ϑ_1 is the inflation sensitivity to the *output gap* O_t.

Finally, the dynamic of interest rates depends on the hysteresis process given by the parameter φ_r and the term that measures the decomposition of interest rates into long-term and short-term maturities of public debt. The resulting equation is as follows:

$$r_t = \varphi_r r_{t-1} + (1 - \varphi_r)\{(1 - \varphi_r^C)r_t^L + \varphi_r^C r_t^C\}, \qquad (10)$$

where the superscripts *C* and *L* are referring to the short and long-term issues of public debt. The long-term interest rates r_t^L also follow a hysteresis process and it is affected by the public finance situation, measured as the distance of the budget balance and the public debt to their reference values of the fiscal rule, $\bar{d}_t$ and $\bar{b}_t$, respectively. For the whole public administration, it is considered a budgetary balance $\bar{d}_t = -3\%$ and a reference value of public debt of $\bar{b}_t = 80\%$[5]. For the regional governments, a public balance of $\bar{d}_t = 0\%$ and a public debt objective of $\bar{b}_t = 13\%$ have been set up, as ruled by the LOEPSF.

$$r_t^L = r_{t-1}^L - \tau_d (d_{t-1} - \bar{d}_t) + \tau_b (b_{t-1} - \bar{b}_t). \qquad (11)$$

The short-term interest rate has a dependency relationship with respect to the long-term, as it is shown in the following expression:

$$r_t^C = r_t^L + \frac{1}{4} \sum_1^4 (r_{t-1}^C - r_{t-1}^L), \qquad (12)$$

where it is computed a moving average of the difference between the short- and long-term interest rates for the previous four years. The interpretation is that an improvement in the public finances produces better finance conditions in the short and in the long term.

For the calibration of the model, we have followed Warmedinger *et al.* (2015), Laubach (2009), Balducci and Kumar (2010), Álvarez and Urtasun (2013), Broussard *et al.* (2012), Bouabdallah *et al.* (2017) and Hernández de Cos *et al.* (2018). The values proceed from the macroeconomic scenario of the Budgetary Plan 2023 (2022). However, some adjustments are done to approximate these values to the particular case of the Spanish

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[5] The public debt objective has been increased from 60% to 80% to adopt a more attainable reference. The 80% reference value is roughly located in the middle of the regulatory reference value (60%) and the level of public debt achieved before the pandemic (100%).

regions according to the structural balances and semi-elasticities obtained in Díaz *et al.* (2022), Díaz y Marín (2021) y Marín (2020).

Specifically, the parameters used in the simulation are the following:

$\rho = 0{,}5$ (persistence of the real GDP growth rates)
$\beta_1 = 0{,}55$ (fiscal multiplier)
$\beta_2 = 0{,}2$ (closing of the output gap)
$\beta_3 = 0{,}5$ (elasticity of the change in rates on growth)
$\bar{g} = 1\%$ (potential GDP growth rate according to the Budgetary Plan 2023)
$\epsilon = 0{,}15$ (semi-elasticity of the public balance with respect to the output gap for each region, 0.15 is the average value for all the regions; these semi-elasticities are computed in Marín (2020); in the case of the whole public administration, it is considered a value of 0.56 according to Mourre *et al.*, 2019)
$\vartheta_0 = 0{,}3$ (anchoring of inflation to its medium-term objective) and
$\vartheta_1 = 0{,}1$ (inflation response to output gap).

The parameters used to determine the interest rates are in turn:

$\tau_d = 0{,}11$ (impact of a 1% of GDP increase in the deficit/GDP ratio on the long-term interest rates; this value has been reduced from 0.15 mentioned by the literature previously cited).
$\tau_b = 0{,}01$ (impact of 1% GDP increase in the public debt/GDP on the long-term interest rates; this value has been reduced from 0.02 mentioned by the literature).

These parameters τ_d and τ_b has been reduced given the absence of fiscal rules of the previous years and the ECB purchase bond program.

$\varphi_r = 0{,}7$ (persistence of the implicit rate with respect to past values; this value has been reduced by 20 basic points with respect to the value used in the literature. This can be explained by the recent change in the monetary policy).
$\varphi_r^C = 0{,}2$ (weight of short-term debt to determine the interest rates)

Two scenarios of fiscal consolidation for the general public administration have been considered:

   a) The fiscal consolidation effort is cero, that is, the structural deficit is kept unchanged. This value is 3.4% GDP in 2023 according to the Budgetary Plan 2023. This scenario is called *conservative*.

   b) The public administration reduces the structural deficit by 0.25% GDP from the previous year. This scenario is called *reactive*.

The fiscal consolidation scenarios considered in the case of the regions are the following ones:

a) The fiscal consolidation effort is cero, i. e., the structural balance is kept unchanged. This value is estimated for 2022 for each region. This scenario is called *conservative*.

b) The regions will reduce yearly the structural deficit by 0.25% GDP from 2022 to a superior limit of 0.75% GDP. This fiscal consolidation effort is done for a public debt above the objective of 13% of GDP. This scenario is called *reactive*.

c) A yearly fiscal consolidation effort which keeps the structural balance as the regional historical average from 2014 to 2021. This value is -0.54% GDP.

d) A fiscal consolidation effort which keeps the structural balance as the specific region historical average from 2014 to 2021.

The estimated structural public balances are computed in Díaz *et al*. (2022), Díaz y Marín (2021) y Marín (2020). The scenarios conservative and the scenarios c) and d), which keep the average structural balance and the specific structural balance for each region, are conservative scenarios in line with the previous experience. However, the reactive scenario presents an important fiscal consolidation effort with a upper limit of 0.75% and in line with AIReF (2021 and 2022).

In this sense, the effectiveness in the reduction of public debt ratio from the previous fiscal consolidation scenarios will be assessed during a period of ten years (from 2022 to 2032). The simulation model depicted before provides insights on the effects of a restricted fiscal policy over the economic activity, the cyclical balance and the public debt ratio over GDP.

Graph 6 shows the simulation results for the whole public administration under the two scenarios previously defined: *conservative* and *reactive*. Obviously, the reduction in the ratio of public debt is only observed in the *reactive* scenario (orange line). The *conservative* scenario increases the public debt from 113.2% in 2022 to 117.8% in 2032. In the *reactive* scenario this ratio is reduced only in an insignificant quantity to 109.9% in 2032 (3 pp. of GDP in ten years). This let us to consider the fiscal consolidation effort of 0.25% GDP as not ambitious enough.

While the public balance under the *conservative* scenario is kept practicably without changes at the end of the period, under the *reactive* scenario the reduction in deficit can reach the level of 3% since the year 2030. With respect to the composition of the cyclical balance, it is important to notice that in the *conservative* scenario the cyclical balance is nearly 30% of the total in 2032, while in the *reactive* scenario the cyclical balance represents the 60% of the public balance.

The simulation results for the regions are shown in Graph 7 and in the Tables 8, 9, 10 and 11. The Graph 7 shows the simulation paths for public debt, public balance, cyclical balance and real GDP growth for the regions as an average under the first two scenarios labeled as a) *conservative* and b) *reactive*. Tables 8, 9, 10 and 11 show only the public debt path by each region under the scenarios a), b), c) and d) previously defined.

The ratio of public debt over GDP of the regions is reduced by only 2.5 pp. of GDP (from 24.6% to 22.1%) in ten years under the *conservative* scenario. By contrast, this public debt ratio is reduced up to 16.1% under the *reactive* scenario. Although, this level is still above the reference level of 13% proposed in the LOEPSF, the total amount of public debt has been reduced by 8.5 pp. of GDP in ten years.

Graph 6. Evolution of public debt, budgetary balance, cyclical balance, and real GDP growth. Spain
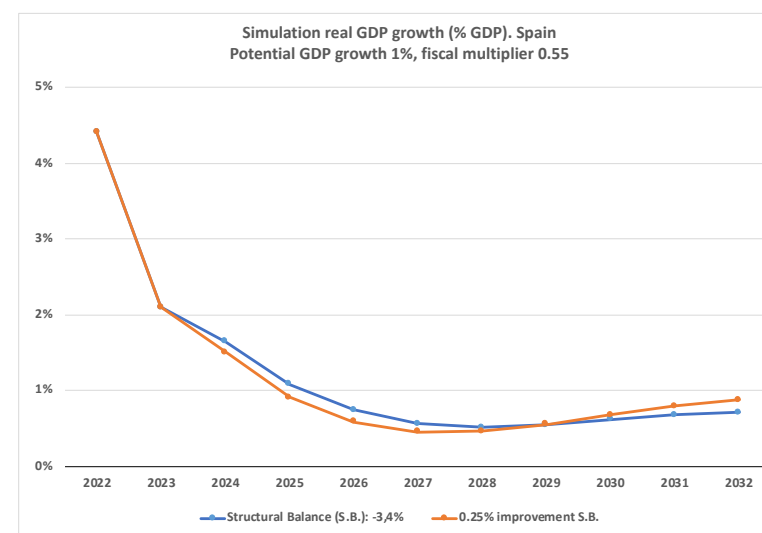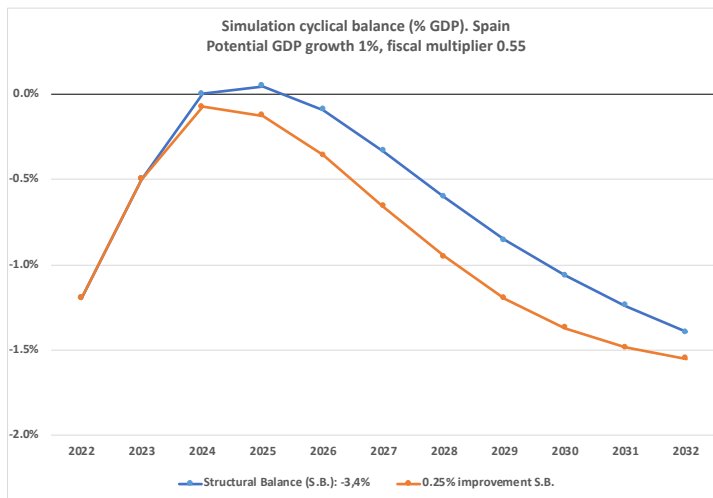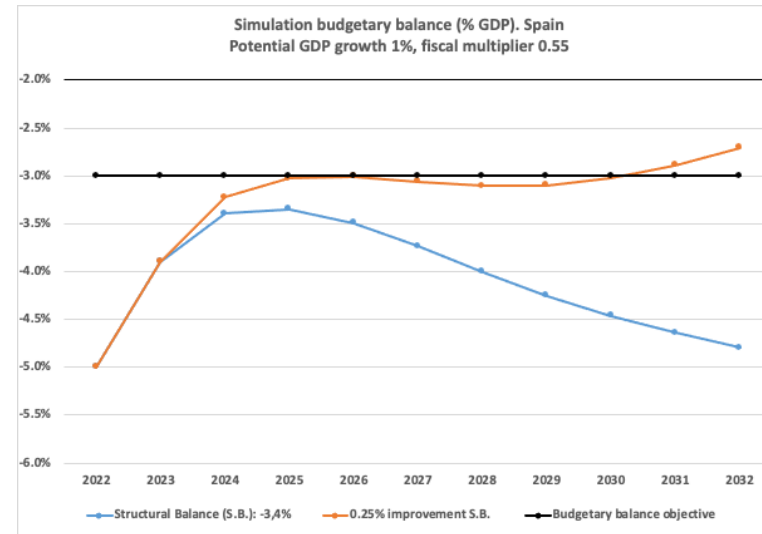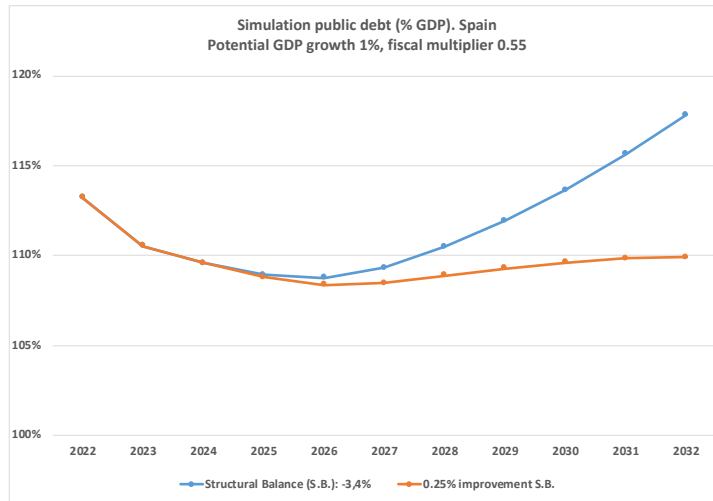
The public deficit is only reduced by 2 tenths of GDP in ten years under the *conservative* scenario. However, the public balance under the *reactive* scenario will reach surplus since 2026 (inclusive). The decomposition of this balance between its components cyclical and structural is similar in both scenarios.

The following results shown in the Tables 8, 9 and 10 present the public debt path by each region under the scenarios a), b), c) and d). This path is affected by initial level of debt of each region. As it was shown in the Graph 5, the regions start from heterogeneous debt to GDP ratios. The lowest regional public debt ratio in 2021 was 14.8% and the highest level was 47.8%. The fiscal consolidation scenarios c) and d) hardly reduce the regional public debt level as these scenarios keep unchanged the regional average and the specific region average structural balance from 2014 to 2021. The regional public debt ratio is only reduced in 3.5 pp. GDP from 2022 to 2032 in both scenarios.

In the c) scenario it is observed a reduction in the dispersion of the final values with respect to the initial ones. The regions with relatively low levels of public debt keep these values at the end of the period (2032), while the regions with higher public debt levels reduce the debt level in a higher proportion as if it is considered their specific historical debt average. This is the case of Murcia and Comunidad Valenciana, whose public debt paths show a difference of 10 pp. of GDP between both scenarios c) and d). In contrast, the regions with reduced average debt path will keep these ratios during the following 10 years when it is applied the average of all the regions, however they present a greater reduction if they follow their own specific historical path. This is the case of Canarias, Navarra and País Vasco, which will reduce their public debt until 1.7%, 6.2% and 6.2%, respectively, in 2032 under the scenario d).

The fiscal consolidation scenario a) *conservative* keeps unchanged the structural public balance estimated in 2022 along the whole period from 2022 to 2032. Two regions will worsen their starting debt situation, Murcia and Comunidad Valenciana. Both will increase their public debt to GDP ratio in 15.2 and 12.3 pp., respectively, until the levels of 49.2% and 58.9%. By contrast, País Vasco, Navarra, Asturias, Cantabria and La Rioja will reduce their public debt ratio around 10 pp. (all of these regions present structural surplus in 2022). In this analysis, the structural balance in 2022 determines the future debt path.

The fiscal consolidation scenario b), *reactive,* will reduce structural deficit by 0.25%. The regions highly indebted as Comunidad Valenciana and Murcia hardly improve the level of debt (-0.5 pp. of GDP the first one) or even worsen it (2.7 pp. the second one). The remaining regions experience improvement of different proportion. Andalucía, Aragón, Asturias, Baleares, Canarias, Cantabria, Castilla y León, Extremadura, Galicia, La Rioja, C. Madrid, Navarra y País Vasco reach the public debt objective of 13%.

Graph 7. Evolution of public debt, budgetary balance, cyclical balance, and real GDP growth. Regions, 2022-2032

Simulation public debt (% GDP). Regions
Potential GDP growth 1%, fiscal multiplier 0.55

— Structural Balance (S.B.) 2022: -0,56%   — 0.25% improvement S.B.   — Debt objective

Simulation budgetary balance (% GDP). Regions.
Potential GDP growth 1%, fiscal multiplier 0.55

— Structural Balance (S.B.) 2022: -0,56%   — 0.25% improvement S.B.   — Budgetary balance objective

Simulation cyclical balance (% GDP). Regions
Potential GDP growth 1%, fiscal multiplier 0.55

— Structural Balance (S.B.) 2022: -0,56%   — 0.25% improvement S.B.

Simulation real GDP growth (% GDP). Regions
Potential GDP growth 1%, fiscal multiplier 0.55

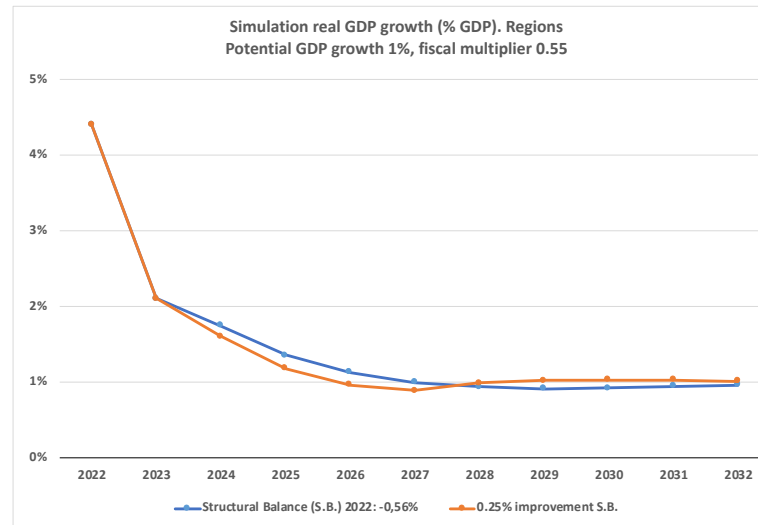— Structural Balance (S.B.) 2022: -0,56%   — 0.25% improvement S.B.

Table 8. Simulation of public debt by regions. Scenario a)

	PUBLIC DEBT (% GDP). Scenario a) *Conservative*											
	2022	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**	**2031**	**2032**	**Variation 2032-2022**
Total regions	24.6%	23.8%	23.4%	23.0%	22.6%	22.4%	22.3%	22.2%	22.1%	22.1%	22.1%	-2.4%
Andalucía	22.0%	21.4%	21.1%	20.8%	20.6%	20.4%	20.4%	20.4%	20.4%	20.4%	20.5%	-1.5%
Aragón	22.3%	21.2%	20.4%	19.6%	18.9%	18.3%	17.8%	17.3%	16.8%	16.4%	16.1%	-6.2%
Asturias	17.1%	15.7%	14.6%	13.4%	12.2%	11.2%	10.2%	9.3%	8.4%	7.6%	6.8%	-10.3%
Baleares	29.3%	28.1%	27.5%	26.8%	26.3%	25.8%	25.5%	25.2%	24.9%	24.7%	24.5%	-4.9%
Canarias	14.8%	14.6%	14.5%	14.4%	14.3%	14.2%	14.2%	14.3%	14.4%	14.4%	14.5%	-0.3%
Cantabria	23.0%	21.7%	20.8%	19.8%	18.9%	18.1%	17.4%	16.7%	16.1%	15.6%	15.1%	-8.0%
Castilla-La Mancha	35.2%	34.7%	34.9%	35.0%	35.3%	35.7%	36.3%	36.9%	37.6%	38.3%	39.1%	3.9%
Castilla y León	21.1%	20.3%	19.9%	19.4%	19.0%	18.7%	18.5%	18.3%	18.2%	18.1%	18.0%	-3.1%
Cataluña	34.1%	33.0%	32.5%	32.0%	31.6%	31.4%	31.4%	31.4%	31.4%	31.5%	31.5%	-2.5%
Extremadura	23.3%	22.7%	22.4%	22.1%	21.9%	21.8%	21.7%	21.8%	21.9%	22.0%	22.1%	-1.2%
Galicia	17.7%	17.3%	17.1%	16.9%	16.6%	16.5%	16.5%	16.5%	16.5%	16.5%	16.6%	-1.1%
La Rioja	17.3%	16.0%	15.0%	13.9%	12.9%	12.0%	11.2%	10.4%	9.7%	8.9%	8.2%	-9.0%
Madrid	13.8%	13.0%	12.5%	11.9%	11.4%	10.9%	10.5%	10.1%	9.8%	9.5%	9.2%	-4.5%
Murcia	34.0%	34.7%	36.0%	37.2%	38.5%	40.1%	41.8%	43.5%	45.4%	47.3%	49.2%	15.2%
Navarra	13.5%	12.0%	10.6%	9.3%	8.0%	6.7%	5.6%	4.5%	3.5%	2.5%	1.6%	-11.9%
País Vasco	13.7%	12.2%	10.9%	9.6%	8.3%	7.1%	6.0%	4.9%	3.9%	3.0%	2.1%	-11.6%
C. Valenciana	46.6%	46.5%	47.3%	48.1%	49.2%	50.5%	52.0%	53.6%	55.3%	57.1%	58.9%	12.3%

Table 9. Simulation of public debt by regions. Scenario b)

	PUBLIC DEBT (% GDP). Scenario b) Reactive											
	2022	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**	**2031**	**2032**	**Variation 2032-2022**
Total regions	24.6%	23.6%	22.9%	22.1%	21.2%	20.3%	19.4%	18.6%	17.7%	16.9%	16.1%	-8.4%
Andalucía	22.0%	21.2%	20.5%	19.5%	18.4%	17.2%	16.0%	14.8%	13.6%	12.4%	11.5%	-10.5%
Aragón	22.3%	20.9%	19.7%	18.3%	16.8%	15.5%	14.2%	13.0%	12.0%	11.3%	10.8%	-11.5%
Asturias	17.1%	15.5%	14.1%	12.7%	11.5%	10.7%	10.1%	9.6%	9.2%	8.8%	8.5%	-8.7%
Baleares	29.3%	27.9%	26.8%	25.5%	24.1%	22.6%	21.2%	19.9%	18.5%	17.2%	15.9%	-13.4%
Canarias	14.8%	14.3%	13.8%	13.0%	12.1%	11.4%	10.9%	10.5%	10.1%	9.7%	9.4%	-5.4%
Cantabria	23.0%	21.5%	20.1%	18.5%	17.0%	15.6%	14.3%	13.1%	11.9%	10.9%	10.2%	-12.8%
Castilla-La Mancha	35.2%	34.5%	34.2%	33.7%	33.2%	32.6%	31.8%	30.9%	29.8%	28.5%	27.1%	-8.1%
Castilla y León	21.1%	20.1%	19.2%	18.1%	16.9%	15.6%	14.3%	13.1%	11.9%	11.0%	10.3%	-10.7%
Cataluña	34.1%	32.7%	31.8%	30.7%	29.5%	28.2%	26.9%	25.4%	24.0%	22.6%	21.3%	-12.8%
Extremadura	23.3%	22.5%	21.8%	20.8%	19.8%	18.6%	17.4%	16.2%	15.1%	13.9%	12.7%	-10.5%
Galicia	17.7%	17.0%	16.4%	15.5%	14.5%	13.3%	12.2%	11.3%	10.6%	10.1%	9.7%	-8.0%
La Rioja	17.3%	15.7%	14.4%	13.0%	11.7%	10.7%	10.0%	9.5%	9.1%	8.7%	8.3%	-8.9%
Madrid	13.8%	12.8%	12.2%	11.5%	10.9%	10.4%	10.0%	9.5%	9.2%	8.8%	8.5%	-5.2%
Murcia	34.0%	34.5%	35.3%	35.9%	36.4%	36.9%	37.3%	37.5%	37.5%	37.2%	36.7%	2.7%
Navarra	13.5%	12.0%	10.8%	9.9%	9.2%	8.5%	8.0%	7.5%	7.2%	6.8%	6.6%	-6.9%
País Vasco	13.7%	12.2%	11.1%	10.2%	9.5%	9.0%	8.5%	8.1%	7.7%	7.4%	7.1%	-6.5%
C. Valenciana	46.6%	46.3%	46.6%	46.9%	47.1%	47.4%	47.6%	47.5%	47.3%	46.9%	46.2%	-0.5%

Table 10. Simulation of public debt by regions. Scenario c)

	PUBLIC DEBT (% GDP). Scenario c)											
	2022	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**	**2031**	**2032**	**Variation 2032-2022**
Total regions	24.6%	23.8%	23.2%	22.7%	22.2%	21.8%	21.6%	21.4%	21.2%	21.1%	21.0%	-3.6%
Andalucía	22.0%	21.4%	21.0%	20.7%	20.4%	20.2%	20.1%	20.0%	20.0%	20.0%	20.0%	-2.0%
Aragón	22.3%	21.6%	21.3%	20.9%	20.6%	20.3%	20.2%	20.1%	20.1%	20.0%	20.0%	-2.2%
Asturias	17.1%	16.8%	16.6%	16.4%	16.2%	16.1%	16.1%	16.1%	16.1%	16.2%	16.3%	-0.9%
Baleares	29.3%	28.2%	27.7%	27.2%	26.7%	26.4%	26.1%	25.9%	25.8%	25.6%	25.5%	-3.8%
Canarias	14.8%	14.6%	14.5%	14.4%	14.3%	14.3%	14.4%	14.4%	14.5%	14.6%	14.7%	-0.1%
Cantabria	23.0%	22.3%	21.9%	21.5%	21.1%	20.9%	20.8%	20.7%	20.6%	20.6%	20.6%	-2.4%
Castilla-La Mancha	35.2%	33.8%	33.1%	32.4%	31.8%	31.4%	31.1%	30.9%	30.7%	30.5%	30.3%	-4.9%
Castilla y León	21.1%	20.4%	20.1%	19.8%	19.5%	19.3%	19.2%	19.1%	19.1%	19.1%	19.1%	-1.9%
Cataluña	34.1%	32.7%	32.0%	31.2%	30.6%	30.1%	29.8%	29.6%	29.3%	29.1%	29.0%	-5.1%
Extremadura	23.3%	22.6%	22.2%	21.8%	21.4%	21.2%	21.0%	20.9%	20.9%	20.9%	20.9%	-2.3%
Galicia	17.7%	17.3%	17.1%	16.9%	16.8%	16.7%	16.7%	16.7%	16.7%	16.8%	16.8%	-0.9%
La Rioja	17.3%	16.9%	16.8%	16.6%	16.5%	16.4%	16.4%	16.4%	16.5%	16.5%	16.6%	-0.7%
Madrid	13.8%	13.5%	13.4%	13.3%	13.2%	13.2%	13.2%	13.3%	13.3%	13.4%	13.6%	-0.2%
Murcia	34.0%	32.7%	32.1%	31.4%	30.8%	30.4%	30.2%	30.0%	29.8%	29.6%	29.5%	-4.6%
Navarra	13.5%	13.3%	13.2%	13.0%	12.8%	12.7%	12.7%	12.7%	12.8%	12.9%	13.0%	-0.4%
País Vasco	13.7%	13.5%	13.4%	13.3%	13.2%	13.1%	13.2%	13.2%	13.3%	13.4%	13.6%	-0.1%
C. Valenciana	46.6%	44.7%	43.7%	42.7%	41.9%	41.4%	41.0%	40.7%	40.4%	40.1%	39.8%	-6.8%

Table 11. Simulation of public debt by regions. Scenario d)

	PUBLIC DEBT (% GDP). Scenario d)											
	2022	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**	**2031**	**2032**	**Variation 2032-2022**
Total regions	24.6%	23.8%	23.3%	22.7%	22.2%	21.9%	21.6%	21.4%	21.3%	21.2%	21.1%	-3.5%
Andalucía	22.0%	21.2%	20.7%	20.1%	19.7%	19.3%	19.0%	18.8%	18.6%	18.4%	18.3%	-3.7%
Aragón	22.3%	22.0%	22.0%	21.9%	22.0%	22.1%	22.3%	22.5%	22.8%	23.1%	23.4%	1.2%
Asturias	17.1%	16.4%	15.9%	15.4%	14.9%	14.5%	14.2%	13.9%	13.6%	13.4%	13.2%	-4.0%
Baleares	29.3%	27.9%	27.0%	26.0%	25.2%	24.5%	23.9%	23.4%	22.9%	22.4%	21.9%	-7.4%
Canarias	14.8%	13.1%	11.7%	10.2%	8.8%	7.5%	6.2%	5.0%	3.9%	2.7%	1.7%	-13.2%
Cantabria	23.0%	22.3%	21.9%	21.4%	21.1%	20.8%	20.6%	20.5%	20.4%	20.4%	20.4%	-2.6%
Castilla-La Mancha	35.2%	34.0%	33.4%	32.9%	32.4%	32.1%	32.0%	31.9%	31.9%	31.9%	31.9%	-3.3%
Castilla y León	21.1%	20.4%	20.1%	19.7%	19.4%	19.2%	19.1%	19.0%	18.9%	18.9%	18.9%	-2.1%
Cataluña	34.1%	33.1%	32.6%	32.2%	31.9%	31.7%	31.7%	31.8%	31.8%	32.0%	32.1%	-2.0%
Extremadura	23.3%	23.1%	23.3%	23.3%	23.5%	23.7%	24.1%	24.6%	25.0%	25.5%	26.1%	2.8%
Galicia	17.7%	17.0%	16.5%	16.0%	15.6%	15.2%	14.9%	14.6%	14.3%	14.1%	13.9%	-3.8%
La Rioja	17.3%	16.8%	16.5%	16.2%	15.9%	15.7%	15.6%	15.5%	15.5%	15.4%	15.4%	-1.9%
Madrid	13.8%	13.4%	13.2%	12.9%	12.7%	12.5%	12.4%	12.4%	12.3%	12.3%	12.3%	-1.4%
Murcia	34.0%	33.8%	34.1%	34.4%	34.8%	35.4%	36.1%	36.9%	37.7%	38.6%	39.5%	5.4%
Navarra	13.5%	12.5%	11.7%	10.8%	9.9%	9.2%	8.5%	7.8%	7.3%	6.7%	6.2%	-7.2%
País Vasco	13.7%	12.7%	11.8%	10.9%	10.1%	9.3%	8.6%	7.9%	7.3%	6.7%	6.2%	-7.5%
C. Valenciana	46.6%	45.6%	45.5%	45.4%	45.5%	45.9%	46.5%	47.1%	47.7%	48.4%	49.2%	2.5%

5. Concluding remarks

Public debt will be in the center of the European fiscal policy discussion in the next years. This is motivated by the intrinsic concern generated by the high amount of public debt accumulated by the economies leaving the pandemic COVID-19. And importantly, the new European fiscal governance seems to be based on the public debt objective. The (structural) public balance is expected to be at a secondary position.

In this article, we have addressed from different perspectives the Spanish public debt at country and regional levels. Firstly, it has been analyzed the recent evolution of public debt. It is important to notice that since 2012 Spanish public debt ratio is above the EU average ratio. Although, the interest expenses are low, the increment of interest rates due to the new ECB monetary policy would change this situation. The Spanish public debt is concentrated in the central government. However, it is important to highlight that the central government has funded the regions through extraordinary financial mechanisms, which seem to be permanent. This has produced that nearly 60% of regional public debt is in hands of the central government.

Secondly, the public debt has been disaggregated into its fundamental factors for the whole public administration and the regions (total and for each one). In the last two years (2020 and 2021), we have highlighted the effect of the change in GDP growth and the interest rates as main drivers of the evolution. In turn, whereas the primary balance (deficit) has worsened the whole public administration debt ratio over GDP, the surplus primary balance obtained by the regions (thanks to the financial aid received from the government) has reduced the regional debt ratio. Notwithstanding this, the high positive deficit-debt adjustments produced by abnormal purchases of financial assets have contributed to increase the regional public debt to GDP ratio.

Additionally, we have computed the fiscal consolidation effort (primary surplus) needed to reach a determined public debt level during different time horizons (5, 10 and 20 years) under three possible scenarios, which combine several assumptions over interest rates and GDP growth. In the case of the whole public administration, the primary surplus needed to reach the public debt objective of 60% and 80% of GDP is quite above the historical values. The primary surplus required to reach the public objective of 80% in 2042 under the baseline scenario is nearly 1% GDP. The historical primary deficits since 2000 are on average 1.3% GDP. In the case of the regions, it has been defined several debt objectives (13%, 19.5% and 26% GDP). A public debt objective of 26% of GDP (average regional sector in 2022) can be reached with a primary deficit of 0.5% of GDP, which is in line with the historical values over the period 2012-2019 (-0.7% of GDP).

Other scenarios include lower public debt objectives and, consequently, lower primary surplus as requirement. Of course, the regional heterogeneity is very high and the results obtained are linked to the initial public debt level. There are some regions with debt ratio near to the objective of 13% of GDP. These regions can reach this objective with efforts in line with their historical primary balances. By contrast, the regions highly indebted will

need primary surplus during a large period to reach the debt objectives. This is the case of Baleares, Murcia, Cataluña, Castilla-La Mancha and Comunidad Valenciana.

Finally, we have carried out a simulation exercise of the public debt to GDP path under some fiscal consolidation strategies, which have been defined in terms of structural fiscal balance. For the whole public administration, the fiscal consolidation effort of reducing by 0.25% yearly the primary structural deficit would reduce the public debt to 110% of GDP in 2032. For the regions, a similar fiscal consolidation effort would decrease the public debt to 16% of GDP in 2032. In both cases, the public debt will be above the debt objectives stablished in the current legislation.

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