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Abstract

We empirically explore the influence of inflation on fiscal variables in the short, medium and long run, for the case of the Spanish economy, in particular to draw policy lessons for the design of the ongoing process of rebalancing of fiscal accounts. We focus on this topic through the lenses of: (i) the government budget constraint, to assess the influence of inflation on changes in public debt; (ii) accounting decompositions of nominal revenue and expenditure items into their real and price parts; (iii) a large-scale macroeconometric model that contains a detailed fiscal policy block; and (iv) a long-run accounting model on pension expenditure.

Keywords: inflation, public finances, public debt, fiscal consolidation.

JEL classification: E31, E62, H6.

Resumen

En este documento exploramos empíricamente la influencia de la inflación sobre las variables fiscales en el corto, medio y largo plazos, para el caso de la economía española; en particular, para extraer lecciones de política para el diseño del proceso en curso de reequilibrio de las cuentas públicas. Proporcionamos evidencia basada en varios elementos analíticos: i) la restricción presupuestaria del Gobierno, para evaluar la influencia de la inflación sobre los cambios en la deuda pública; ii) desagregaciones contables de los ingresos y gastos nominales en sus partes real y de precios para, en particular, ilustrar el efecto de determinadas medidas de consolidación fiscal en distintos escenarios inflacionistas; iii) un modelo macroeconométrico que contiene un bloque muy detallado de política fiscal, para analizar el impacto presupuestario y macroeconómico de *shocks* de inflación, y iv) un modelo contable de largo plazo (en línea con la labor de Grupo de trabajo de envejecimiento de la Comisión Europea), para ilustrar los efectos sobre el gasto en pensiones de distintas sendas de inflación en el medio-largo plazo.

Palabras clave: inflación, finanzas públicas, deuda pública, ajuste presupuestario.

Códigos JEL: E31, E62, H6.

CONTENTS

1 Introduction

Advanced economies currently face the challenge of understanding the economic effects of a low inflation regime. In the particular case of Spain (see Chart 1), the traditional positive inflation differential with the euro area turned negative since the inception of the economic and financial crisis, and perspectives of low inflation dominate nowadays the opinion of public and private analysts. The literature has recently signalled that low inflation can challenge the operation of fiscal policies through a number of channels[1], particularly in episodes of fiscal retrenchment.

We empirically explore the influence of inflation on fiscal variables, such as government revenues, expenditure and debt, for the particular case of the Spanish economy. Our aim is to draw policy lessons for the design of the ongoing rebalancing process of the main fiscal aggregates in a low inflation environment. Indeed, while Spanish public finances are in a correction path since 2010, still high deficits and debt levels are registered by the different public administrations[2]. In addition, the yields of a number of structural fiscal policy measures implemented are contingent on the future path of inflation (in particular, pension reforms). We will take throughout the paper the current low inflation environment as given, without entering into its possible causes[3].

Against this framework, we assess, first, the (short-term) influence of inflation on fiscal adjustment strategies, in order to draw policy lessons for their design in a context of low inflation. In particular, we explore the implications of different inflation scenarios for public debt downsizing[4], the effectiveness of public spending measures (by looking at measures designed to contain public wage and pension spending), and the evolution of nominal government revenues in the exit process from the economic crisis. To put our analysis into perspective, we compare the current environment with the one experienced by the Spanish economy at the time of the exit phase from the previous economic recession (second half of the 1990s). While now prospects are of a low inflation environment, coupled with low interest rates and moderate economic growth, the 1990s recovery took place in a moment of more elevated inflation rates, interest rates and real GDP growth.

Second, in order to complement the previous exercises, we provide a quantitative assessment of the impact of inflation “shocks” on the main fiscal aggregates thorough the lens of a macroeconometric model. Certainly, the impact of an “inflation shock” depends on the source of the shock, given that inflation is a variable endogenous to the economic situation. Understanding the latter is crucial to evaluate the public finance effects of the shocks. Accordingly, we characterize “shocks” of different nature that push prices down by the same amount (one percentage point) using the Quarterly Model of Banco de España (MTBE, see Hurtado et al.,

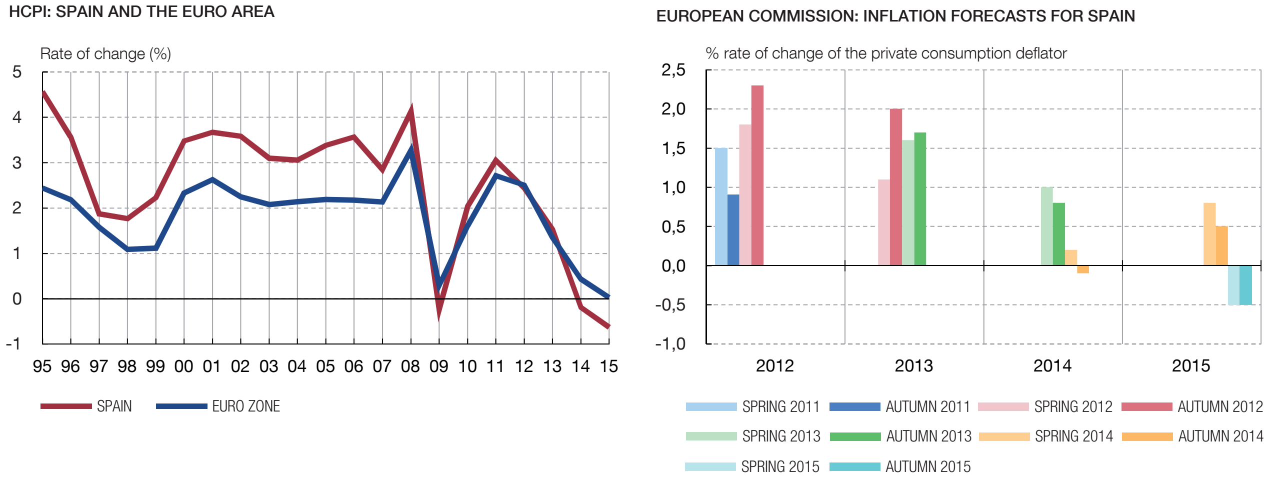
1 See among others End et al., (2015) or Attinasi et al., (2016), and the references quoted therein.

2 See European Commission (2016). For a review of the evolution of Spanish public finances through the financial crisis, see Martí and Pérez (2015).

3 A number of explanations have been provided in the literature. Factors behind the current low inflation situation include some of a structural nature, like the deregulation of labour markets, the trends in cost-competition between countries, the influence of commodity prices worldwide, or the impact of technological progress (through increased competition by lowering barriers to entry), and others of a more conjunctural nature.

4 Trying to grasp the necessary additional fiscal effort to compensate for a low inflation environment.

RECENT TRENDS IN INFLATION AND INFLATION EXPECTATIONS IN SPAIN CHART 1



SOURCES: National Statistics Institute and European Commission.

2014): an internal inflation shock and an external inflation shock. The "internal shock" is engineered as a reduction in Spanish firms' mark-ups, while the "external" one is modelled through a reduction of the price of oil in international markets. The two shocks generate very different responses of public sector variables.

Finally, in order to assess the medium-term impact on pension expenditure of a permanent low inflation regime, we analyse the link between inflation scenarios and the effectiveness of a key piece of the most recent pension reform, namely the "revaluation index" (see Ramos, 2014). Indeed, Sánchez (2014) states that a persistently low level of inflation could be as harmful for the success of the reform (in the long term) as poor immigration and productivity.

The structure of the rest of the paper follows the description of empirical exercises outlined in the previous paragraphs, preceded by a section (Section 2) of a general nature, in which we briefly review the main channels through which inflation may affect public finances. Thus, in Section 3, we look at the impact of inflation on fiscal adjustment strategies, in Section 4, we provide a quantitative assessment of the impact of inflation "shocks" on public finances thorough the lens of MTBE model, and in Section 5 we assess the linkage between pension expenditure and low-inflation. Finally, in Section 6 we provide some concluding remarks.

2 The impact of inflation on public finances: main channels

In this Section we briefly review the main channels through which inflation affects public finance variables (see e.g. Abbas et al., 2013; Attinasi et al., 2016; Prammer and Reiss, 2015), i.e. through the effect on: (i) the stock of debt and market interest rates; (ii) primary public expenditures; (iii) tax revenues. These channels will be at the core of the operation of the simulations that we present in the subsequent sections of the paper.

As regards channel (i), an unexpected increase in inflation erodes the public debt to GDP ratio, everything else equal, via the denominator effect that operates on outstanding debt issued prior to that increase ("debt erosion channel"). Nevertheless, newly issued debt is not affected to the extent that interest rates were adjusted accordingly, while inflation indexed debts and foreign currency denominated debt are not affected either (Abbas et al., 2013). In the latter respect, the sensitivity of the government debt to GDP ratio to inflation depends on the pass-through from inflation to nominal (expected) sovereign interest rates. The most recent empirical evidence for EU countries (Attinasi et al., 2016) suggest that the short term pass through from long term expected inflation to long term sovereign yields is quite high, close to one, thus validating the so called "Fisher effect".

Regarding primary public expenditures (channel ii), a lower inflation regime may affect the cost of the goods and services provided by the government sector, including personnel expenditure (public wages), and the valuation of pensions and other social transfers. In these cases, though, the transmission of this lower inflation to lower public spending is not automatic, and depends crucially on the degree of flexibility (indexation) of public contracts, wages and pensions.

Finally, inflation can influence tax revenues (channel iii) given that tax bases are typically defined in nominal terms, as follows.

First, if lower inflation leads to lower nominal incomes from wages, real public revenues from progressive income taxes may fall insofar as nominal incomes move into lower tax brackets, the so-called "bracket creep" effect or inflationary fiscal drag. The latter channels operates if there are no automatic indexation mechanisms. On different grounds, income tax nominally fixed allowances and tax credits suffer less erosion in a low inflation environment.

Second, while social security contributions are typically levied proportionally on wages, they are also usually subject to taxable maximums, that tend to be formally or informally indexed to some reference variable like inflation. Thus, the relative evolution of inflation, wages and those caps, determines the effect of inflation on revenue collection from this source.

Third, as regards indirect taxes, VAT type taxes are levied proportionally on prices, and in this respect are directly affected by changes in inflation. In turn, excise taxes are charged proportionally on quantities (with the exception of tobacco taxes), and as such there is no direct impact on nominal tax collection from this source of revenue. Thus, in terms of its ratio to GDP, a low inflation environment would erode less this type of tax collection. Along the same lines, recurring real estate taxation in the case of Spain is based on cadastral values, which are only updated at irregular intervals, instead of market values[5].

Fourth, corporate taxes in Spain are proportional to operating profits, and as such, no significant effect in terms of their ratio to GDP is envisaged. Nevertheless, in Spain depreciation allowances, which reduce profits, are based on historical nominal costs, i.e. the price that was paid when the investment was effected and, in this case, inflation dynamics may affect tax collection. In particular, a fall in prices would increase the real price of these allowances and, de facto, reduce the effective corporate tax rate.

5 Other channels like tax revenue collection lags or seigniorage are of minor importance for advanced economies (see e.g. Prammer and Reiss, 2015, for a discussion).

3 The impact of inflation on public finances: some accounting exercises

Following up on previous' Section general discussion, in this one we move one-step forward and illustrate the potential impact of the described channels (public debt, spending, and revenues), in particular from the point of view of a fiscal consolidation episode and a low inflation environment.

3.1 Public debt dynamics and inflation

We use the standard decomposition of public debt changes into its fundamental drivers (primary budget balance, interest payments, real GDP, the GDP deflator and the deficit-debt adjustment, see e.g. Hall and Sargent, 2010), to compare the public debt consolidation experiences of two periods of "fiscal stress", namely the most recent one, and the one of the 1990s. We carry out this exercise because the two periods present significant differences as regards average inflation. While the latter was a period of moderate/high inflation, compared to historical averages, the former is a period of low inflation. Thus, the comparison provides a natural framework to illustrate the impact of inflation on the adjustment process of government debt.

Let Y_t be nominal GDP and let D_t be the nominal value of government debt, both at time t. The government budget constraint accounts for how nominal interest rate i_t, net inflation π_t, net growth in real GDP, g_t, the net-of-interest deficit as a percent of Y_t, p_t, and the deficit-debt adjustment, DDA_t combine to determine the evolution of the government debt to GDP ratio,

$$\frac{D_t}{Y_t} = \frac{1 + i_t}{(1 + \pi_t)(1 + g_t)} \frac{D_{t-1}}{Y_{t-1}} + p_t + \frac{DDA_t}{Y_t} \tag{1}$$

where the nominal yield it and the stock of debt Dt are averages of pertinent objects across times to maturity. A standard, approximated version, suitable for accounting decomposition of the fundamental determinants of debt, takes the form

$$\frac{D_t}{Y_t} = (1 + i_t - \pi - g_t) \frac{D_{t-1}}{Y_{t-1}} + p_t + \frac{DDA_t}{Y_t} \tag{2}$$

With this decomposition it is possible to analyze, in particular, the sizeable impact that changes in prices may exert on the dynamics of the public debt to GDP ratio. In Chart 2 we assess these effects as well as the contribution of the other determinants described in equation (2), for two distinct periods of fiscal consolidation of the Spanish economy, both starting at a local maximum of the series of government deficit over GDP. The upper panel starts in 1993, the lower panel starts in 2009, and we analyze the subsequent evolution of the debt to GDP ratio over 6 years. In the former period, inflation averaged 3.6% per year while in the latter average inflation was substantially lower at 1.4% per year.

The illustration is quite telling regarding the issue at hand. In the upper panel, the dynamics of prices allowed a reduction of the government debt to GDP ratio of above 12 percentage points of GDP, while in the more recent, "low inflation" episode the contribution of inflation to debt reduction has been almost negligible. For the evaluation of forward-looking sustainability risks, the dynamics of the ratio are even more important than the level of public debt over GDP. Indeed in the 1990s episode the ratio of public debt to GDP already got stabilized at t+3, while in the most recent episode debt over GDP kept growing still over the defined t+6 window.

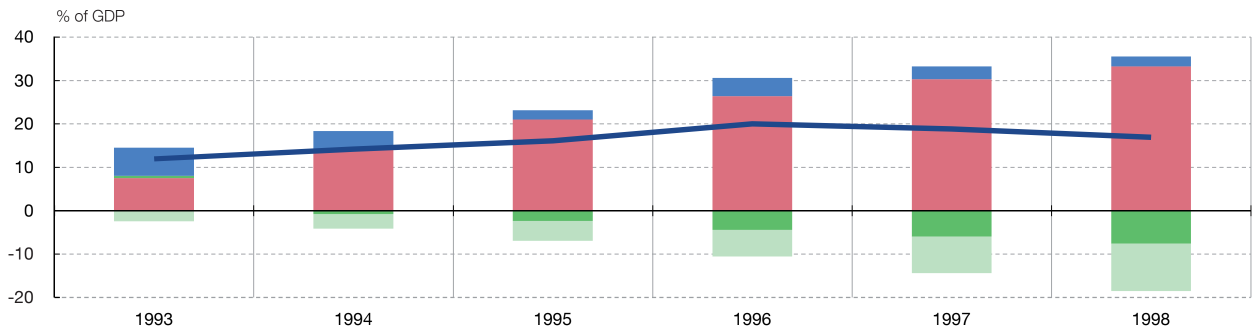
3.2 Inflation and the effectiveness of public spending discretionary measures

The direct, ex post budgetary savings derived from some cost cutting public spending discretionary measures with respect to a no policy change alternative depend on the inflation scenario. In particular, when public spending measures affect items typically linked to the inflation rate. For instance, in Spain public wages have been traditionally revalued, as a baseline, in line with expected inflation, as defined by the medium term ECB target of 2%, while as regards pensions, the usual reference has been the current year inflation outcome (November year on year growth rate). If the policy actions taken aim at breaking the link between the evolution of public wages and pensions with inflation, the derived budgetary savings would certainly be more relevant in a high inflation environment.

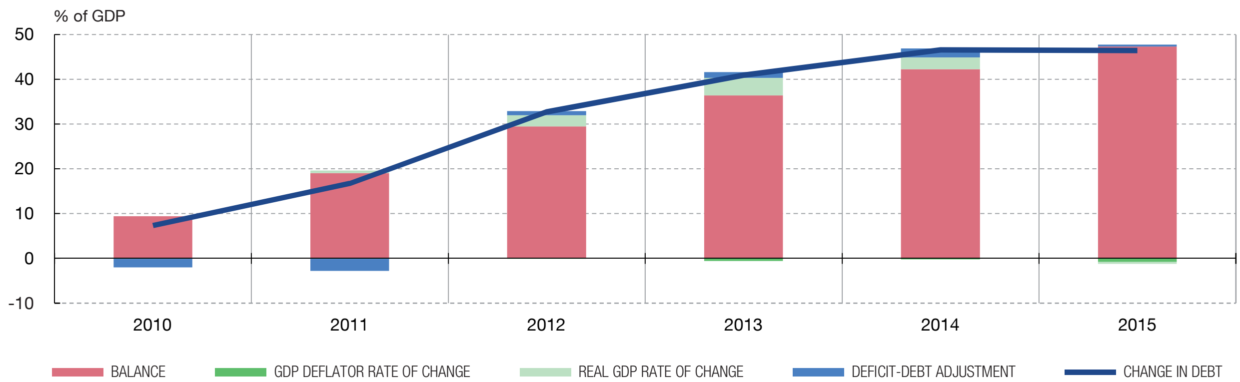
DETERMINANTS OF THE CHANGE OF PUBLIC DEBT IN SPAIN: FISCAL CONSOLIDATION EPISODES OF THE 1990s AND CURRENT

CHART 2

HIGH INFLATION EPISODE, CUMMULATED IMPACT



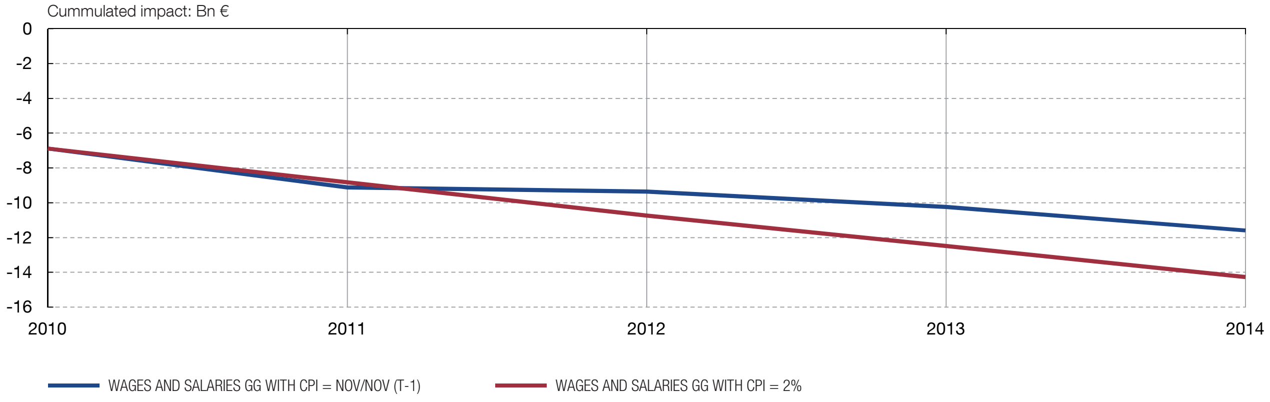
LOW INFLATION EPISODE, CUMMULATED IMPACT



SOURCE: Authors' calculations.

We simulate the savings derived from an adjustment of public wages per employee commensurate to that implemented over 2009 2014 in Spain, vis à vis two benchmark growth alternatives, namely a 2% yearly rate (in line with the traditional inflation reference for public wages) and the current-year inflation rate (that averaged 1.4% over 2009 2014). As regards discretionary measures, over that period, public wages were frozen year by year, and in addition in 2010 there was a 5% nominal cut across the board (see Martí and Pérez, 2015). The results are presented in Chart 3. The cumulated differential savings of these measures with respect to the 2% benchmark amounts to 14.3 bn euro, which is a number close to 1.5% of Spanish GDP. This is almost 2.7 bn euro (0.3% of GDP) of larger than in the ex post observed case of 1.4% average inflation growth. This shows that such measures, defined in nominal terms, deliver less budgetary savings in a low inflation environment.

IMPACT OF COST-CUTTING PUBLIC WAGE MEASURES WITH RESPECT TO TWO BENCHMARK SCENARIOS OF INFLATION (2% AND HISTORICAL) CHART 3



SOURCE: Authors' calculations.

3.3 Public revenues and inflation

In this section, we explore the limits to tax collection that may exist in a low inflation environment despite a perceived real recovery of the economy. As explained above, the effect on tax revenues of low inflation would be different for different taxes, depending, inter alia, on the degree of progressivity of the public revenue item.

We break down standard nominal tax bases for the different revenue items into a “real” and a “price” part. This approach requires, first, the identification of the appropriate nominal tax base for each revenue item (VAT; income tax; corporate tax; social security contributions), and, second, the separation of its approximate real and deflator parts. The latter may involve the use of estimation methods in the cases in which the decomposition of nominal macroeconomic variables into their real and deflator parts is not available. We follow the standard approach in the extant literature to approximate macroeconomic bases (see e.g. Morris et al., 2009, or Leal et al., 2008).

As regards VAT, we take as nominal tax base private households’ consumption, households’ investment, tourism revenues, and general government intermediate consumption and investment. As the average deflator of these components, we take the GDP deflator, and then compute the real component as a residual using the nominal tax base. Regarding Stamp Duties, we take as its tax base housing investment, taking its deflator as the measures of prices. As to other indirect taxes, we approach the evolution of those bases by private consumption, and the decomposition follows the real-deflator decomposition of the national accounts.

With respect to direct taxation, we approximate the tax base of personal income taxes by compensation of employees, non wage household income, including interests and dividends, minus actual social contributions paid to the general government, and adding social payments. As regards corporate income taxes, national accounts tax bases are more difficult to identify. We take, as it is standard in the literature the gross operating surplus of firms. The deflator is estimated from the income side of GDP. Finally, as an approximation of social security contributions we take compensation of employees and non employees. As regards personal income taxes and social security contributions, the real component is estimated by the number of taxpayers, workers and social benefits' beneficiaries in the former case and workers in the latter.

In Chart 4 we present the decomposition of such tax bases into their real and deflator part. We focus on a couple of examples. First, as regards VAT out of the 4.9% growth in 1996, close to 50% was due to the real part and the other 50% to the price part, while in the first year of recovery from the latest recession the nominal growth of tax bases took place in a framework of falling prices. Second, as regards the two lower panels of the chart, wage moderation, that partly reflects low inflation, explains why tax collection on the verge of the late 2013 recovery has remained relatively subdued.

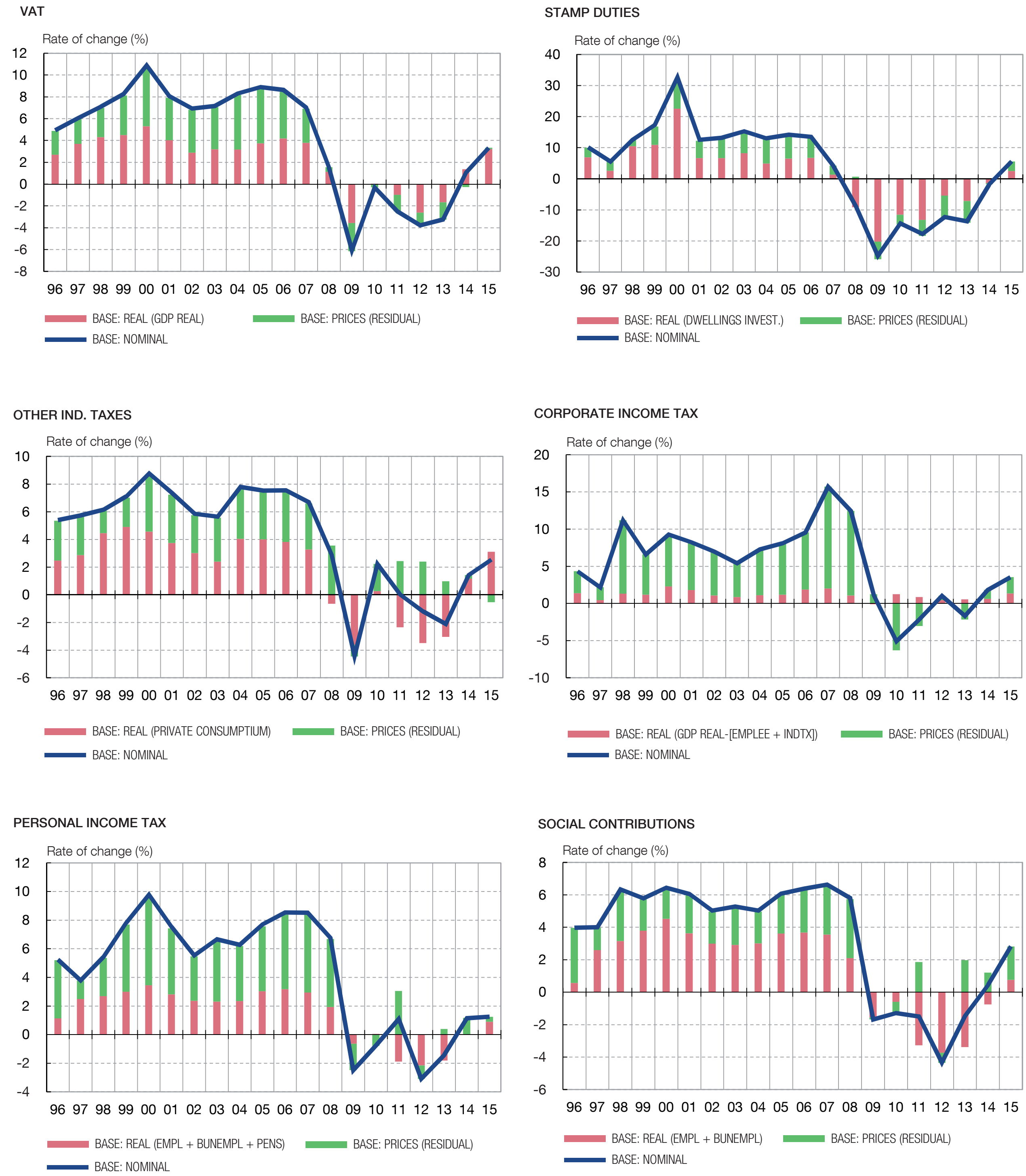
Nevertheless, the relevant object from the point of view of the fiscal adjustment is the impact on the government revenue to GDP ratio, not just on the nominal value of government revenues. From the latter point of view, the final effect would depend on the net impact on the numerator (nominal public revenues) and the denominator (nominal GDP). Related to this point, one may wonder if inflation forecast errors are behind forecast errors in planned government revenue to GDP ratios. In particular, a relevant question is to what extent negative news on government revenues could be related to lower-than-expected inflation rates. The latter is a complex question that would deserve a deep analysis that goes well beyond the aim of the current paper. In any case, as a first, extremely tentative approximation, we run the following simple regression:

$$\left(\frac{R_t}{Y_t} - \frac{R_{t-1}}{Y_{t-1}}\right) - \left(\widehat{\frac{R_t}{Y_t}} - \widehat{\frac{R_{t-1}}{Y_{t-1}}}\right) = \alpha\,(\pi_t - \hat{\pi}_t) + \beta\,(g_t - \hat{g}_t) + \varepsilon_t \qquad (3)$$

Where R_t denotes government revenue, and as described above Y_t is nominal GDP, π_t the inflation rate (GDP deflator) and g_t the real growth rate of GDP. A hat over a given variable denotes a forecast. Thus, we relate forecast errors in the dynamics of the ratio of the government revenue-to-GDP ratio to forecast errors in inflation and economic growth. The series of forecasts are computed by combining real-time forecasts from international organizations (European Commission, IMF and OECD) and official (government) plans. We compute monthly series that reflect in each month the latest available forecasts (for the current year and one-year-ahead), taking the perspective of the external analyst that processes incoming sources of forecast by informed agents. We run the regressions at the quarterly frequency (forecasts are averaged over the 3 months of a given quarter) over the period 1999Q1 2014Q4.

GOVERNMENT REVENUES AND INFLATION: DECOMPOSITION OF NOMINAL REVENUE MACROECONOMIC BASES BETWEEN ITS REAL AND PRICE PARTS

CHART 4



SOURCE: Authors' calculations.

4 Quantitative assessment of inflation shocks on public finances

In the previous Section we have illustrated the influence of inflation and "inflation shocks" on certain public finance variables, from a general point of view. However, the nature of the "inflation shock" is crucial to assess the impact on public finances. In this regard, in this section we use the Quarterly Macroeconometric Model of Banco de España (MTBE, see Estrada et al., 2004., and Hurtado et al., 2014) to simulate the public finance effects of two different "inflation shocks". Both push prices down by one percentage point, but are engineered through different channels: (i) an internal inflation shock (Spanish firms reduce their markups); and (ii) an external inflation shock (the price of oil in international markets goes down).

The MTBE is a large-scale macro econometric model used for medium term macroeconomic forecasting of the Spanish economy, as well as for evaluating the staff projections and, as will be the case here, for performing scenario simulations: we change some exogenous variables (markups and oil prices) and see how endogenous variables react. The model is specified as a large set of error correction mechanism equations, and, especially in the short run, is mostly demand driven.

The main results of our simulations are presented in Table 1. In the simulation of an internal inflation shock, firms reduce their mark-ups, which makes HICP and the GDP deflator fall by approximately the same amount (the size of the simulation is calibrated so that HICP falls by exactly one percentage point on the first year). This has positive effects on GDP, through two channels: on one hand, with lower prices, households have a higher real disposable income, so they increase their consumption and housing investment; and on the other hand, as goods produced in Spain now have a lower price, exports grow. With higher demand, firms invest more and hire more workers, which further increases income for households and demand for firms, so second-round effects reinforce and expand the initial first-round positive effects on GDP.

However, the total increase in real GDP is much less than 1%, so nominal GDP falls following this shock, and, because of this, nominal receipts of the public sector fall (the biggest impact is on direct taxes to firms, but direct taxes to households and indirect taxes also fall sharply in nominal terms). On the expenditure side, there is a very moderate fall because the economic expansion reduces unemployment benefits, but all other expenditure items remain mostly unchanged[6].

The net effect on the public sector balance is negative but very small (the deficit is slightly higher in the first year because revenues fall faster than expenditures, but even this effect dies out in the medium term). Nevertheless, even with a very small effect on the public deficit the debt-to-GDP ratio clearly worsens following this internal deflationary shock since the nominal GDP has fallen.

6 Pensions are kept constant because we impose the assumption that the indexation channel is shut down in these simulations, consistently with the results that will be presented in Section 4. Relieving this assumption and letting pensions react to inflation does not alter the main results of this exercise.

IMPACT OF LOWER INFLATION ON THE MAIN MACROECONOMIC AND PUBLIC SECTOR VARIABLES **TABLE 1**

Cumulative level differences, %

	Internal inflation shock (mark-ups)			External inflation shock (oil price)		
	Year 1	Year 2	Year 3	Year 1	Year 2	Year 3
Prices						
HICP	-1.0	-1.0	-0.9	-1.0	-1.0	-1.0
GDP deflator	-0.9	-0.8	-0.8	0.0	0.1	0.1
Real variables						
GDP	0.2	0.4	0.4	0.2	0.5	0.6
Private consumption	0.2	0.5	0.6	0.4	0.9	1.2
Private productive investment	0.5	1.0	1.3	0.3	0.7	0.9
Housing investment	0.6	1.0	1.1	1.1	2.1	2.6
Exports	0.2	0.4	0.4	0.0	0.0	-0.1
Imports	0.4	0.8	0.9	0.4	0.9	1.2
Nominal public sector variables						
TOTAL recipts	**-0.4**	**-0.3**	**-0.2**	**0.0**	**0.3**	**0.5**
Direct taxes to households	-0.6	-0.4	-0.3	0.3	0.7	1.0
Direct taxes to firms	-1.7	-1.1	-1.0	0.5	1.0	1.2
Social contributions	-0.1	-0.1	0.0	0.1	0.3	0.5
Indirect taxes	-0.7	-0.4	-0.4	-0.5	0.0	0.3
TOTAL expenditures	**0.0**	**0.0**	**0.0**	**0.0**	**-0.1**	**-0.1**
Public consumption	0.0	0.0	0.0	0.0	0.0	0.0
Public investment	0.0	0.0	0.0	0.0	0.0	0.0
Interest payments	0.0	0.1	0.2	0.0	0.0	-0.2
Unemployment benefits	-0.3	-0.8	-1.1	-0.5	-1.2	-1.8
Other social transfers	0.0	0.0	0.0	0.0	0.0	0.0
Primary balance (% of GDP, difference)	-0.2	-0.1	-0.1	0.0	0.1	0.2
Balance (% of GDP, difference)	**-0.2**	**-0.1**	**-0.1**	**0.0**	**0.2**	**0.2**
Public debt (% of GDP, difference)	**0.7**	**0.6**	**0.6**	**-0.2**	**-0.6**	**-1.0**

SOURCE: Authors' calculations.

The simulation of an external inflation shock is also calibrated so that HICP falls by 1% in the first year (oil prices fall by 24%, from 77 to 58 euros per barrel), but in this case the effects on public-sector variables are completely different. For a start, in this case the direct effect on the GDP deflator is approximately zero: there is no internal production of oil, so the price of goods produced at home is not hit directly by the shock. Even the second-round effects on the GDP deflator are approximately zero with the estimated coefficients of MTBE (in fact, if anything, they are positive: the deflationary effect on wages and internal prices is estimated to be very small, and is dominated in the medium term by the also not particularly big inflationary effect of higher demand).

The competitiveness channel through which lower inflation improved GDP after a fall in mark-ups is almost non existent in the case of oil prices, because this is an international shock that also affects our trading partners. The increase in GDP is due only to the higher real disposable income of households, who increase their consumption and housing investment after the shock[7]. Firms face higher demand, so they invest more and hire more workers, generating second round effects that are similar to the ones described for the previous simulation.

In this case nominal GDP clearly rises (real variables grow, the GDP deflator does not change), which makes nominal government receipts grow as well (mainly through direct taxes to firms, but also direct taxes to households and social contributions; indirect taxes initially fall, then restore their original level). In turn, unemployment benefits again drive a very small fall in public sector expenditures. Summing up, there is a slightly positive effect on the budget balance, and a sizeable fall in the debt to GDP ratio, because of the slightly lower deficit but even more importantly because of higher nominal GDP.

These two simulations highlight the importance of taking into account the sources of low inflation when assessing its impact over the public finances. We have chosen to show the effects of two shocks that generate an identical fall in the HICP but also a similar rise in GDP. Despite those similarities the effect on public finances turns out to be markedly different: they deteriorate if the low inflation comes from a fall in markups, but they improve if it comes from a fall in oil prices.

7 This channel is actually stronger now: the positive effect on real GDP was smaller in the previous simulation because after the fall in mark-ups firms pass smaller profits on to households, which is not the case after the fall in oil prices.

5 The effectiveness of the most recent pension reform in a low inflation regime

In this Section we explore the impact of changes in inflation assumptions in an accounting model of pension expenditure estimation along the lines of European Commission (2015), as done by Ramos (2014). A recent strand of pension reforms in Spain provide a natural framework to assess their effectiveness depending on the inflationary regime.

Spain is no exception in the gradual ageing of the population foreseen in the demographic projections available for most developed countries, with the corresponding pressure over pension systems. Indeed, in recent decades Spain has undergone a radical demographic transformation, characterised by a sharp fall in the birth rate, higher life expectancy, and a shift in net migration, which was highly positive in the years of the economic expansion (from 1997 to 2008) but has been negative since 2009 (see Ramos, 2014). Furthermore, since the Spanish pension system is pay as you go, the economic crisis has made evident the accumulation of imbalances, as the demographics driven increase in pension expenditure was coupled with a sharp fall in the number of contributors.

5.1 The "revaluation index" of pensions

With a view to counteracting the impact of these demographic shifts, in recent years various pension reforms have been passed in Spain. For the purposes of this paper, the most relevant one is the reform enacted at the end of 2013, in particular the establishment of a new revaluation index. Under the later, pensions have been adjusted on a year by year basis according to the performance of variables pivotal to the Social Security system, such as revenue, expenditure and the number of pensions, replacing the former system, in force since 1997, which linked pensions to CPI inflation[8]. The revaluation index is obtained from the budget constraint on the pension system, that is, from equating revenue to expenditure in year t+1, and decomposing expenditure into three components: revaluation, number of pensions and the substitution effect.

Specifically, the revaluation index works as follows[9]:

$$RI_{t+1} = \bar{g}_{r,t+1} - \bar{g}_{p,t+1} - \bar{g}_{s,t+1} + \alpha \left[\frac{R_{t+1} - E_{t+1}}{E_{t+1}} \right] \quad (4)$$

Where RI_{t+1} is the revaluation index, i.e. the amount by which pensions grow between years t and t+1. The variables that come into play in the calculation, from left to right, are: the rate of change of the revenues of the Social Security System ($\bar{g}_{r,t+1}$), the rate of change of the

8 Quite importantly, the 2013 reform also regulates the so-called *sustainability factor.* From 2019, starting pensions will be automatically linked to the increase in life expectancy. For further details, see Ramos (2014).

9 See Ramos (2014) and De la Fuente and Domenech (2013) for additional details and references.

number of pensions ($\bar{g}_{p,t+1}$), the substitution effect ($\bar{g}_{s,t+1}$)[10] and a component that adjusts for imbalances that may arise between Social Security revenue (R) and expenditure (E). When the difference between revenue and expenditure is positive, this component adds to the revaluation of pensions, while if it is negative it reduces it. The imbalance between revenue and expenditure is multiplied by parameter α, which measures the speed at which the imbalances are corrected. The extant legislation stipulates that a value of α equal to 0.25 is to be used, which means that in each year 25% of the imbalance between revenue and expenditure is corrected.

Quite importantly, all these components of the right hand side of the formula are not included in as current year values, but via 11 year averages centered on t+1. This allows for smoothing of the year to year rates of revaluation and mitigates the effects of the business cycle.

In any case, the result of the formula just described does not yield automatically the revaluation of pensions in year t+1, as the law establishes both a floor and a ceiling, which will be crucial for the purposes of this paper. In particular, the revaluation cannot result in a pension increase, which is lower than 0.25% or higher than a rate equal to inflation plus 0.5%.

5.2 Some simulations

The simulations are based on the latest Ageing Report of the European Commission (see European Commission, 2015). Social security revenues and the demographic path are given, and the pension expenditure path, in turn, is determined by the above-described formula determining pension increases. The model is comprehensive enough to account for the main features of the social security system, from an accounting point of view. Agents' reaction to the policy path (reform) and the evolution of minimum pensions are not reflected in the exercise. Moreover, the simulations are based on a non-policy scenario environment, meaning it is assumed that there are no changes to the different parameters of the system, in particular on the revenue side. The simulations are not to be considered as long-term forecasts, given dependence on exogenous assumptions and the uncertainty surrounding them, but rather as an illustration of how the revaluation formula works in different scenarios, particularly for inflation.

The main assumptions of the simulations are shown in Table 2, together with the main outcomes of the exercises. From 2015 revenues are set to the expected outturn of that year, namely 10.9% of GDP, while the rate of change of new pensions is linked to the rate of change of average wages. The number of pensions gains speed as of the decade of 2020 due to the retirement of baby boomers (Chart 5a and 5b). Pension expenditure and the average pension are obtained endogenously.

10 This is defined as the increase in the average pension in a year in the absence of any revaluation that year. That is to say, the increase in the average pension that comes about owing to the fact that the pensions of new pensioners are usually higher than the pensions of pensioners who die and abandon the system. In this way, the substitution effect depends on the number and amount of pensions of new pensioners relative to the number and amount of the pensions of pensioners exiting the system. It is estimated that the substitution effect would currently stand at around 1.0%. This component enters the formula with a negative sign, meaning that the revaluation index is smaller in order to counteract the upward pressure on expenditure due to the amount and number of new pensions.

PENSION EXPEDITURE SCENARIOS (ACCOUNTING SIMULATIONS) TABLE 2

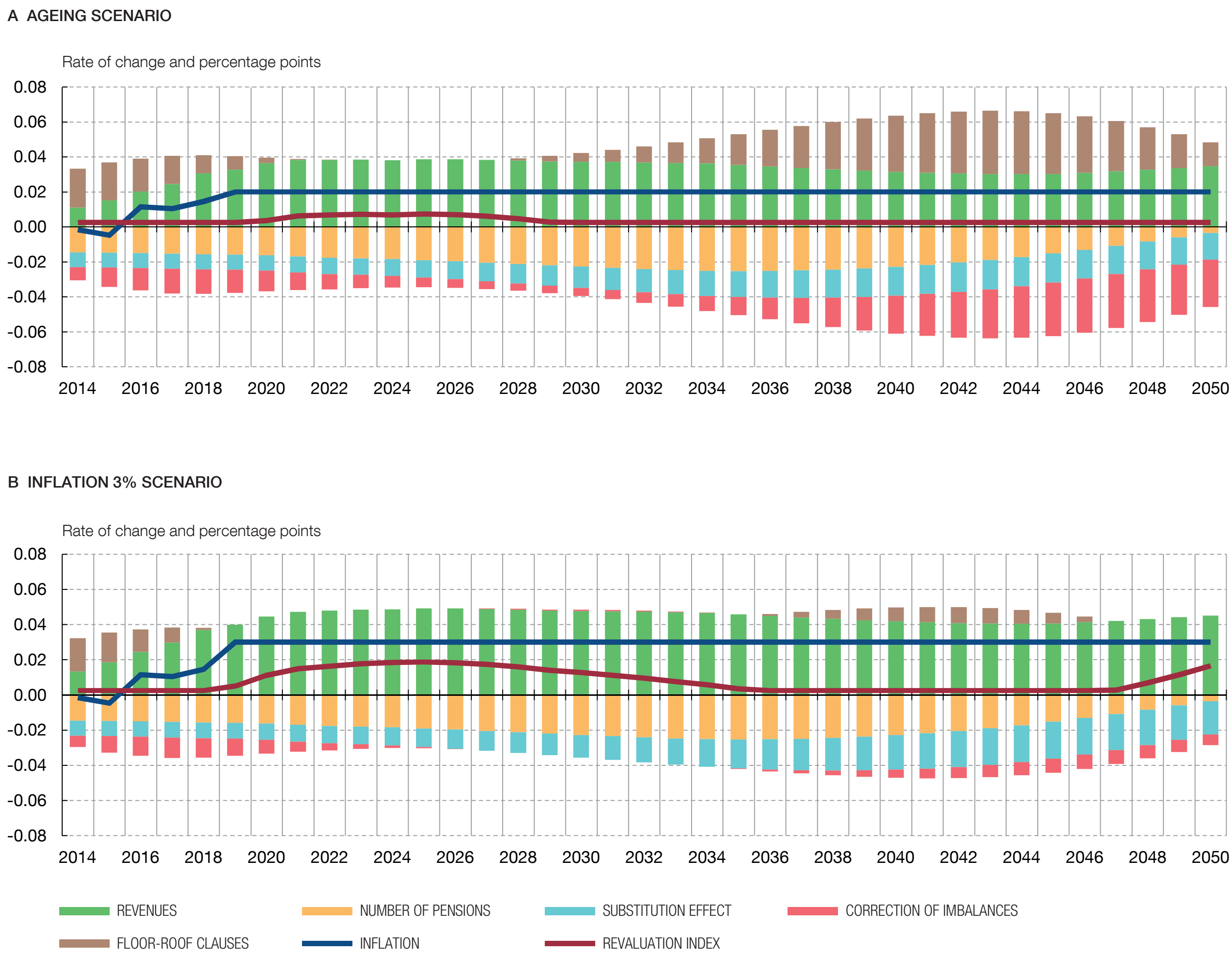
		2015	2016-2024	2025-2050	2050
Revaluation index (ageing scenario) (a)					
Pension expenditure (b)	% of GDP	11.99	11.24	11.54	12.17
Social Security revenues (c)	% of GDP	10.87	10.87	10.87	10.87
Social Security balance	% of GDP	-1.13	-0.38	-0.67	-1.30
Inflation rate	%	-0.47	1.74	2.00	2.00
Average index revaluation	%	0.25	0.45	0.31	0.25
Average pension / average wage (d)	ratio	57.10	52.87	39.96	32.10
Growth of number of pensions (c)	%	0.84	1.69	2.00	0.28
Growth of initial pension before sustainability factor	%	0.11	2.85	3.50	3.58
Sustainability factor (c)	factor	1.00	0.98	0.85	0.77
Growth of initial pension after sustainability factor (b)	%	0.11	2.15	2.72	2.90
Revaluation index (inflation 3.00% scenario)					
Pension expenditure (b)	% of GDP	11.99	11.18	11.01	11.13
Social Security balance	% of GDP	-1.13	-0.31	-0.15	-0.27
Inflation rate	%	-0.47	2.41	3.00	3.00
Average index revaluation	%	0.25	1.01	0.77	1.65
Average pension / average wage	ratio	57.10	52.55	38.34	29.28
Revaluation index (inflation 0.25% scenario)		0.00	0.00	0.00	0.00
Pension expenditure (b)	% of GDP	11.99	11.58	14.01	16.13
Social Security balance	% of GDP	-1.13	-0.72	-3.14	-5.27
Inflation rate	%	-0.47	0.57	0.25	0.25
Average index revaluation	%	0.25	0.25	0.25	0.25
Average pension / average wage	ratio	57.10	54.49	48.26	42.89
Revaluation floor at 1.00% (ageing scenario) (a)					
Pension expenditure (b)	% of GDP	11.99	11.48	12.49	13.67
Social Security balance	% of GDP	-1.13	-0.61	-1.62	-2.81
Average revaluation of pensions	%	0.25	0.92	1.00	1.00
Average pension / average wage (d)	ratio	57.10	53.99	43.15	36.20
Revaluation floor at 2.00% (ageing scenario) (a)					
Pension expenditure (b)	% of GDP	11.99	11.87	14.28	16.37
Social Security balance	% of GDP	-1.13	-1.00	-3.41	-5.50
Average revaluation of pensions	%	0.25	1.81	2.00	2.00
Average pension / average wage (d)	ratio	57.10	55.88	49.26	43.53

SOURCE: Authors' calculations.

a Demographic varibles and Social Security revenues are taken as exogenous. Projections rest mainly on 2015 Ageing Report assumptions. Pensión expenditure evolves according to demographic projections and the revaluation of pensions. GDP and inflation are based on Budgetary Plan up to 2018.
b Including other Social Security expenditure.
c Invariant assumption across scenarios.
d Average wage grows 3.3% on average, according to 2015 Ageing Report.

With the basic assumptions outlined above, and under the revaluation index, pensions would grow with the floor over the simulation horizon (see Chart 5a), although slightly above between 2020 and 2028. This is due to the fact that at the beginning of the simulation horizon the imbalance of the Social Security system inherited from the crisis dominates the formula. Then, in the twenties, the rate of growth of revenues is higher enough to compensate the increase in the number of pensions and to gradually correct the deficit. But then, as of the decade of the 2030, demographic pressures hit and the deficit widens again. Under this simulation, despite the fact that the inflation rate in the baseline AWG averages 1.7% over 2016 2024 and 2% as of

FUNCTIONING OF THE REVALUATION AND SUSTAINABILITY FACTOR UNDER DIFFERENT INFLATION SCENARIOS CHART 5



SOURCE: Authors' calculations.

2025, pensions are set to grow most of the years at 0.25%. Given that in the model wages are assumed to grow in line with nominal productivity, the ratio of average pension to average wage falls from 0.57 in 2015 to 0.32 in 2050 (see Table 2). Thus, the ratio of pension expenditure over GDP evolves from 12.0% in 2015 to 12.2% in 2050, increasing just 0.2 pp of GDP over that period, despite the adverse demographics.

The importance of the inflation regime for the application of this revaluation index formula is clear when comparing this baseline simulation with other two scenarios[11]. First, an inflationary scenario where the inflation rate is supposed to increase steadily by 3%, affecting nominal variables but without an impact on real variables. In this case, Social Security revenues (linked to nominal GDP) allow for a revaluation of pensions close to 2% in the twenties and by 2050, while the substitution effect still pushes the revaluation index to the 0.25% floor in the middle of the simulation horizon (see Chart 5b). Nevertheless, the ratio of the average pension to

11 In these alternative scenarios, real variables are the same as in the baseline scenario (same number of pensions, same number of employees, etc.). Nominal variables are changed in line with new prices (higher GDP, higher nominal SS revenue level, higher wages, etc.).

the average wage falls to 0.29 in 2050, while the ratio of expenditure to GDP is in 2050 11.1%, a level below the starting point of the simulation, 2015.

On the contrary, if the inflation rate is supposed to remain at 0.25%, the outcome is a smaller fall in the ratio of the average pension to the average wage, to 0.43 in 2050, as pensions do not lose purchasing power each year. The downside of this is that the ratio of pension expenditure increases significantly between 2015 and 2050, by 4.1 pp of GDP. This result makes evident that there is always a tradeoff between the ratio of the average pension to the average wage, on the one hand, and the ratio of pension expenditures to GDP, on the other.

These simulations show that, even with the same basic rule for calculating the revaluation of pensions, different inflation scenarios result in very different outcomes in terms of the purchasing power of pensions (ratio of average pension to average wage in 2050 ranging from 0.29 to 0.43, with 0.32 on the baseline scenario). In addition, these inflation scenarios also lead to significant differences in the total cost of the pension system, i.e. the ratio of pension expenditures to GDP in 2050 ranges from 11.1% to 16.1%, with 12.1% in the baseline scenario.

An alternative way to gauge the importance of inflation is to change the revaluation of pensions in the basic scenario. In this case, a floor to the revaluation of pensions of 1% per year would push up the ratio of pension expenditure to GDP to 13.7% by 2050 (12.2% in the basic scenario) while the ratio of the average pension to the average wage to fall to 0.36 (0.32 in the basic scenario). However, if the floor of the revaluation of pensions is supposed to be 2% per year, the ratio of pension expenditure to GDP would be 16.4% by 2050 (12.2% in the basic scenario) while the ratio of the average pension to the average wage would fall to 0.4 (0.32 in the basic scenario).

In any case, in all the scenarios presented here, the Social Security system would remain in deficit for the whole period. This deficit reaches 1.3% of GDP in the baseline scenario, and 5.3% of GDP in the scenario where inflation is 0.25% per year.

In addition to the accounting simulations provided above, it is worth mentioning that some recent work by Sánchez (2014) also highlights the importance of the inflation regime on the outcomes of pension reforms. The latter author uses an overlapping generations model to analyse the effectiveness of recent pension reforms in Spain, and he concludes that persistently low levels of inflation could be as harmful for the success of the reform (in the long term) as poor immigration and productivity.

6 Concluding remarks

We empirically explore the influence of inflation on fiscal variables in the short-, medium- and long-run, for the case of the Spanish economy, in particular to draw policy lessons for the design of the pending process of rebalancing of fiscal accounts. Indeed, while Spanish public finances are in a correction path, still high government deficits and debt levels are registered by the different public administrations. In addition, the yields of a number of structural fiscal measures implemented are contingent on the future path of inflation, and the nature of inflation shocks/regimes. In this paper, we look at these issues through the lenses of: (i) The government budget constraint, to assess the influence of inflation on changes in public debt; (ii) Accounting decompositions of nominal revenue and expenditure items into their real and price parts; (iii) A large-scale macroeconometric model, that contains a detailed fiscal policy block; (iv) A long-run accounting model, on pension expenditure (along the lines of the works of the AWG).

Our main findings are as follows. First, we find that during the recent episode of fiscal consolidation, discretionary fiscal policy measures yielded less adjustment due to the situation of lower inflation. This applied to debt reduction strategies, both as regards government revenues and expenditures. In addition, public debt dynamics were significantly more adverse than in the higher-inflation episode of the second half of the 1990s when the stabilization of government debt was supported by favorable GDP and inflation dynamics. Second, we illustrate how the impact of low inflation on public finances depends crucially on the source of the inflation shock hitting the economy, with some external shocks (a fall in oil prices) presenting even a positive impact over public finances, while internal price shocks (a decrease in mark-ups) still have the potential of worsening public debt to GDP ratios. Finally, in our pension-accounting model we show how different inflation regimes crucially determine the effects of the major pension reform of 2013, measured by the long term dynamics of the ratios of pension expenditure over GDP and average pension over average wage. In this sense, and assuming there are not changes in other parameters of the system (in particular, revenues), we find that, given the revaluation scheme in place since 2013, a regime of lower inflation would keep the average pension closer to the average wage, but would increase the cost of the pension system as a share of GDP. Along the same lines, a higher inflation regime would assure sustainability by keeping the ratio of pension expenditure to GDP close to current levels but could lead to a potential problem of insufficiency of public pensions.

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