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2011

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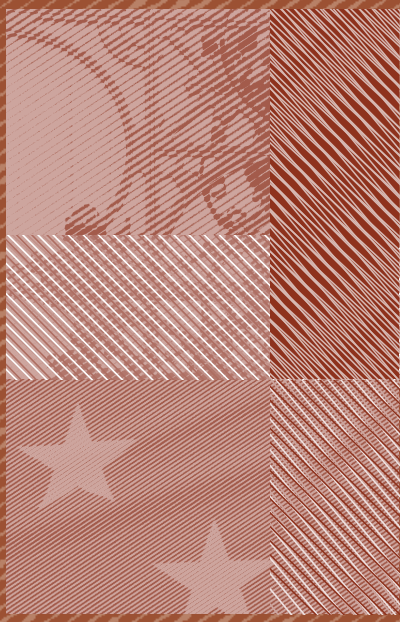

Documentos de Trabajo
N.º 1107

BANCO DE ESPAÑA
Eurosistema

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FISCAL POLICY, STRUCTURAL REFORMS AND EXTERNAL IMBALANCES: A QUANTITATIVE EVALUATION FOR SPAIN (*)

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(*) We thank António Afonso, Pablo Burriel, Miguel Cardoso, Rafael Doménech, Paul Hiebert, Miguel León-Ledesma, Carlos Martínez-Mongay, Gernot Müller, Anton Nakov and seminar participants at the XXIII Symposium of Moneda y Crédito, European Central Bank, National Bank of Slovakia (Conference on "The Euro Area and the Financial Crisis"), Banco de España (Conference on "Interactions between Monetary and Fiscal Policies") and European Commission (Workshop on "External Imbalances and Public Finances in the EU") for helpful comments. We also benefited from useful suggestions by the editor and one anonymous referee. The views expressed here are those of the authors and do not necessarily reflect the views of the Banco de España or the Eurosystem.

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The Banco de España disseminates its main reports and most of its publications via the INTERNET at the following website: http://www.bde.es.

ISSN: 0213-2710 (print)
ISSN: 1579-8666 (on line)
Depósito legal: M. 18426-2011
Unidad de Publicaciones, Banco de España

Abstract

This paper builds a large overlapping generations model of a small open economy featuring imperfect competition in the labor and product markets to understand i) which were the main determinants of the large expansionary phase experienced in Spain from the mid-1990s until the arrival of the global financial crisis in 2007-2008, ii) what role fiscal policy and structural reforms could have played to avoid the build-up of large external imbalance over this period, and iii) how these policies could affect the recovery of economic activity in Spain after the crisis. Our results indicate that falling interest rates and demographic changes were the main drivers of the Spanish expansionary phase. As for the macroeconomic behavior of the Spanish economy after the crisis, our results suggest that a front-loading in fiscal consolidation together with structural reforms that eliminate distortions in the goods and labor markets could make the recovery of economic activity in Spain more successful.

Keywords: overlapping generations, imperfect competition, fiscal consolidation, demographic change, structural reforms.

JEL classification: E62, H30, J11.

Resumen

Este artículo considera un modelo de generaciones solapadas, aplicado a una economía pequeña, abierta al comercio internacional y caracterizada por la existencia de competencia imperfecta en los mercados de bienes y de trabajo, para analizar: i) cuáles fueron los principales determinantes de la expansión observada en la economía española desde mediados de los 1990s hasta la llegada de la crisis financiera global en 2007-2008, ii) qué papel podrían haber jugado la política fiscal y las reformas estructurales en la reducción del desequilibrio externo acumulado durante este periodo, y iii) cómo estas políticas podrían influir en el proceso de recuperación de la actividad económica en España después de la crisis. Los resultados apuntan a que la caída en los tipos de interés y los cambios demográficos fueron los principales factores que impulsaron la última etapa expansiva en España. En cuanto al comportamiento macroeconómico de la economía española después de la crisis, los resultados sugieren que un adelanto en el proceso de consolidación fiscal, junto con la introducción de reformas estructurales que reduzcan las distorsiones existentes en los mercados de bienes y de trabajo, contribuirían a que la recuperación de la actividad fuera más exitosa.

Palabras claves: generaciones solapadas, competencia imperfecta, consolidación fiscal, cambio demográfico, reformas estructurales.

Códigos JEL: E62, H30, J11.

1 Introduction

From the mid-1990s to 2008, the Spanish economy enjoyed a phase of sustained economic growth in which real convergence with the core EMU member countries advanced notably. This expansionary phase was mostly driven by two factors. First, by a significant expansion of credit, that was induced by the fall in interest rates that followed Spain's adhesion to the EMU and, more broadly, by a pervasive relaxation in the conditions of access to credit. And second, by the large immigration inflows into Spain over the period that substantially modified the demographic structure of the Spanish population.[1]

Yet significant imbalances built up in the process. On the one hand, the Spanish economy became increasingly more dependent of external financing over the period. The fall in interest rates and the overall expansion of credit led to an investment boom, much of which materialized in the housing sector, that increased the share of investment in GDP from around 22% in 1995 to 29% in 2008. Thus, despite a move toward fiscal consolidation by the public sector, the Spanish current account deficit, that was close to zero in 1998, increased nearly monotonically over the period, reaching almost 10% of GDP by 2008. On the other hand, price-competitiveness of the Spanish economy also deteriorated significantly, due to very low productivity growth and to the existence of important distortions in the domestic labor and product markets.

When the global financial crisis struck and the very favorable international credit conditions suddenly disappeared, the Spanish economy began an inevitable adjustment process, with a substantial reduction in consumption and investment by 2008q4, when housing investment plummeted. This adjustment, that has helped to correct the excessive indebtedness of the private sector, has led however to a large decrease in economic activity, with GDP growth in 2009 at around -3.6%. At the same time, the work of automatic stabilizers, the loss of the revenue windfalls obtained during the expansion and the expansionary fiscal programs put in place by the government to mitigate the effects of the crisis, have led to a very rapid deterioration of public accounts, that have moved from a surplus of around 2% of GDP in 2007 to deficits of

[1] For a recent account of the evolution of the Spanish economy during this period, see Estrada, Jimeno and Malo de Molina (2009).

around 4% and 11% in 2008 and 2009, respectively. All together, the Spanish economy has very quickly reduced its need for external financing as its current account deficit has decreased from around 10% of GDP in 2008 to around 6% in 2009, being now mostly driven by fiscal deficits rather than by private indebtedness as in the expansionary phase.

With this evidence in mind, several questions arise: i) to what extent are the fall in interest rates and the profound demographic changes witnessed in the Spanish economy over the last decade responsible for the expansionary phase and the build-up of imbalances?, ii) could have fiscal policy contributed more to avoid the build-up of these imbalances?, iii) how would structural reforms increasing competition in the product and labor markets have diminished the saving-investment gap and the loss of price-competitiveness of that period?, and iv) looking ahead, once the economy has been hit by the global financial shock in 2008, how would alternative fiscal policies and reforms in the labor and product markets may affect the expected macroeconomic evolution of the Spanish economy?

In order to address these questions, this paper constructs and calibrates a small open economy model for Spain. The model economy is composed by households, firms and a government. To properly incorporate the intense demographic changes that the Spanish economy experienced over the last decade, and those expected to happen in the future, this paper considers a large scale overlapping generations model.[2] In each period, households take consumption, labor and savings decisions to maximize their lifetime utility. There are four types of firms in the economy, that produce a final consumption good, intermediate goods, labor services and capital services. As the Spanish economy is characterized by rigid labor and product markets, the model incorporates distortions in these markets via monopoly power of intermediate goods and labor services producers. This approach, relatively standard in the new Keynesian literature, is less common in the large scale OLG literature, that typically considers perfect competition in all markets. The government in the model consumes, gives lump-sum transfers, runs a social security system, levies taxes (on consumption and on labor and capital income) and issues debt. The description of the social security

[2] In this sense, the model is an extended version of the general equilibrium model with overlapping generations used in Izquierdo, Jimeno and Rojas (2010) to evaluate the impact of immigration on the Spanish economy, and in Jimeno, Rojas and Puente (2008) and Rojas (2005) to analyze the consequences of population ageing in Spain.

system in the model is particularly rich. This is very relevant since, undoubtedly, one needs to take into account the pressures on the social security system generated by the aging of the Spanish baby-boom generation in the near future in order to properly analyze the role played by fiscal policy in the recent and future macroeconomic developments of the Spanish economy.

The model is calibrated to match the main macroeconomic features of the Spanish economy in 1998 and then its performance of over the period 1998-2008 is analyzed under different scenarios concerning interest rates, demographic developments, fiscal policies and labor and product market distortions. Our results indicate that, in line with Izquierdo, Jimeno and Rojas (2010), interest rates and demographic changes are the main responsible for the investment boom and the build-up of a sizable external imbalance (measured as the ratio of net foreign assets to GDP) witnessed in the Spanish economy during the expansionary phase. In this context, we find a very limited role for fiscal policy in reducing the external imbalance accumulated in Spain over the period 1998-2008. In particular, our results show that a temporary reduction of government expenditure over the expansionary phase would have reduced the size of the Spanish external imbalance by 2008 only very slightly. A more permanent tightening of fiscal policy could have even increased this imbalance. With respect to the effects of structural reforms in product and labor markets pursuing an increase in competition in these markets, we find that, although they would have not helped in reducing the external imbalance of the Spanish economy over the period 1998-2008, they would have led to a short- and long-run expansion of output, employment and investment, and to a substantial improvement in competitiveness and in public accounts. It is precisely due to these positive effects on the economy that these structural reforms may naturally induce in the short-run an increase in the external indebtedness of the economy, as forward-looking households anticipate lower taxes and a more efficient economy in the future and try to smooth their consumption.

As for the macroeconomic behavior of the Spanish economy beyond 2008, our model suggests that, even without the arrival of the crisis, in the medium- and long-run the Spanish economy would have entered into a phase of lower GDP growth where the external imbalance of the economy would have been reduced but where public accounts would have deteriorated. This process, mostly driven by the aging of the Spanish population, has become more pronounced with global financial cri-

sis. Futhermore, the model highlights the relevance of fiscal policy and of structural reforms in the post-crisis scenario. Front-loading in fiscal consolidation would contribute to public accounts' sustainability and to mitigate the output losses induced by the crisis in the medium-term. In addition, policies aimed at improving competition help in reducing short- and medium-term output losses, while inducing a positive long-run effect on the level of output.

The rest of the paper is organized as follows. Section 2 describes the model and Section 3 its calibration. Departing from the model economy calibrated to 1998, Section 4 quantifies the role played by demographic developments and interest rates in shaping the Spanish macroeconomic evolution over the period of analysis and performs counterfactual exercises regarding alternative fiscal policies and labor and product markets reforms. Then, Section 5 introduces the global financial crisis that hit the economy in 2008 into our model and shows its predictions beyond that date. Finally, Section 6 concludes.

2 The model

This section describes the model used to perform the quantitative experiments reported on the following sections on the macroeconomic effects of interest rates, demographic changes, fiscal policy and product and labor market reforms. In essence, it is a model for a small open economy within a monetary union that combines, on the household side, the large scale overlapping generations structure of Auerbach and Kotlikoff (1987) and, on the supply side, the now standard framework in the new Keynesian literature with firms producing final and intermediate goods, labor and capital services in the presence of monopolistic competition in the intermediate goods and labor markets.[3] The model economy is completed by a government that has a wide range of fiscal instruments at its disposal.

2.1 Households

Demographics.- The economy has overlapping generations of agents who live a maximum of I periods. The agents differ in their age, $i \in \{1, 2, ..., I\}$, and in their place of birth, $n \in \{1, 2, ..., I\}$, where $n = 1$ identifies a *native* and $n = n_0 \geq 2$ denotes an

[3] Unlike the new Keynesian literature we do not consider price rigidities.

immigrant who first entered the economy with age n_0.[4] We use $N_{i,n,t}$ to denote the total number of agents of type (i,n) in the economy at period t and $\mu_{i,n,t}$ to denote the share of these agents over the total population at that period. The former evolves over time in the following fashion:

$$N_{1,1,t} = \sum_i \sum_n N_{i,n,t-1} f_{i,t-1} \quad (Births) \tag{1}$$

$$N_{i,1,t} = N_{i-1,1,t-1} s_{i-1,t-1}, \ \forall i \geq 2 \quad (Natives) \tag{2}$$

$$N_{i,n,t} = N_{i-1,n,t-1} s_{i-1,t-1} + NI_{i,n,t}, \ \forall i \geq 2, \ \forall n \geq 2 \quad (Immigrants) \tag{3}$$

where $s_{i-1,t-1}$ denotes the conditional probability of surviving from age $i-1$ to age i at period $t-1$, $f_{i,t-1}$ is the probability of an agent of age i of having an offspring at that period, and $NI_{i,n,t}$ is equal to 0 when $i \neq n$ and to the number of immigrants of age i exogenously entering the economy at the beginning of period t when $i = n$. We assume that the survival and fertility probabilities are common to natives and immigrants, since there is no independent data readily available for these two population groups, and we consider the offspring of immigrants as natives.

Decision problem.- At an exogenous age I_A agents start taking decisions. At that time they have no assets, besides transfers emanating from accidental bequests. In each period, agents take consumption and labor decisions in order to maximize lifetime utility. At period t an agent of type (v,n) solves the following problem:

$$Max \ \sum_{i=v}^{I} \beta^{i-v} \psi^i_{v,t} U(c_{i,n,t+i-v}, h_{i,n,t+i-v}) \tag{4}$$

subject to

$$\begin{aligned} (1+\tau^c_t)\, c_{i,n,t} + a_{i+1,n,t+1} \leq \ & (1-\tau^l_t-\tau^{ss}_t) w_{i,t} h_{i,n,t} + (1+r_t(1-\tau^a_t))(a_{i,n,t}+b_t) + \\ & ss_{i,n,t} + tr_t + div_t \quad \forall t \end{aligned} \tag{5}$$

In the expression above, c is consumption, a denotes beginning of period assets and h is time spent at work. Agents are endowed with one unit of time per period. Between ages I_A and $I_R - 1$ this unit of time must be allocated between labor and

[4] We need to keep track of the age at which immigrants entered the economy because we assume that they arrive with no assets (as in, for instance, Storesletten (2000, 2003) and Razin and Sadka (1999)). Thus, conditional on age, two immigrants arriving to the economy at different ages take different consumption and labor decisions because they do not have the same wealth level.

leisure. Afterwards, agents are forced to retire. Only then, they receive social security benefits, ss, and devote their entire time endowment to leisure. In each period, regardless of their type, agents receive lump transfers, tr, accidental asset bequests, b, and dividends from the different firms operating in the economy, div. Regarding prices and taxes, we normalize the price of the final good consumed by households to one, w is the age-dependent wage (in units of c) agents receive for their working time, r is the net real interest rate paid on savings, τ_t^l and τ_t^{ss} are labor income taxes (the latter being the social security tax), and τ_t^c and τ_t^a denote proportional taxes on consumption and capital income, respectively. Finally, β is the discount parameter and $\psi_{v,t}^i$ is the unconditional probability of reaching age i for an individual that has age v at period t. Thus, $\psi_{v,t}^i = \prod_{k=v+1}^{i} s_{k-1,t+k-v-1}$ with $\psi_{v,t}^v = 1$.

2.2 Firms

Final good firm.- In each period, a final consumption good, Y_t, is produced within the small open economy by a perfectly competitive firm. The firm does so by combining a continuum of domestic intermediate goods, $y_{H,j,t}$, $j \in (0,1)$, and a continuum of foreign intermediate goods, $y_{F,z,t}$, $z \in (0,1)$, using the following technology:

$$Y_t = \left[(\alpha_C)^{\frac{1}{\eta_C}} Y_{H,t}^{\frac{\eta_C - 1}{\eta_C}} + (1-\alpha_C)^{\frac{1}{\eta_c}} Y_{F,t}^{\frac{\eta_C - 1}{\eta_C}} \right]^{\frac{\eta_C}{\eta_C - 1}} \tag{6}$$

where $Y_{H,t}$ and $Y_{F,t}$ are composites of the continuum of domestic and of foreign intermediate goods, respectively, and follow the constant elasticity of substitution functions

$$Y_{H,t} = \left[\int_0^1 y_{H,j,t}^{\frac{1}{\lambda_t^i}} \, dj \right]^{\lambda_t^i}, \; 1 \leq \lambda_t^i < \infty \tag{7}$$

$$Y_{F,t} = \left[\int_0^1 y_{F,z,t}^{\frac{1}{\lambda_t^{i^*}}} \, dz \right]^{\lambda_t^{i^*}}, \; 1 \leq \lambda_t^{i^*} < \infty \tag{8}$$

In the expressions above, $(1-\alpha_c)$ is the share of imports in consumption, η_c is the elasticity of substitution between the domestic and foreign composite goods, and λ_t^i ($\lambda_t^{i^*}$) denotes the time-varying substitutability of domestic (foreign) intermediate goods in the production of $Y_{H,t}$ ($Y_{F,t}$). Let $p_{H,j,t}$ ($p_{F,z,t}$) denote the price (in units of c) of the domestic (foreign) intermediate good j (z) in period t. Profit maximization

by the final good firm implies the following demands for the composite goods $Y_{H,t}$ and $Y_{F,t}$, and for each intermediate good $y_{H,j,t}$ and $y_{F,z,t}$:

$$Y_{H,t} = \alpha_C p_{H,t}^{-\eta_C} Y_t, \qquad y_{H,j,t} = \left(\frac{p_{H,j,t}}{p_{H,t}}\right)^{\frac{\lambda_t^i}{1-\lambda_t^i}} Y_{H,t} \tag{9}$$

$$Y_{F,t} = (1-\alpha_C)\, p_{F,t}^{-\eta_C} Y_t, \qquad y_{F,z,t} = \left(\frac{p_{F,z,t}}{p_{F,t}}\right)^{\frac{\lambda_t^{i^*}}{1-\lambda_t^{i^*}}} Y_{F,t} \tag{10}$$

where prices are related in the following fashion:

$$1 = \left[\alpha_C p_{H,t}^{1-\eta_C} + (1-\alpha_C)\, p_{F,t}^{1-\eta_C}\right]^{\frac{1}{1-\eta_C}} \tag{11}$$

$$p_{H,t} = \left[\int_0^1 p_{H,j,t}^{\frac{1}{1-\lambda_t^i}}\, dj\right]^{1-\lambda_t^i} \tag{12}$$

$$p_{F,t} = \left[\int_0^1 p_{F,z,t}^{\frac{1}{1-\lambda_t^{i^*}}}\, dz\right]^{1-\lambda_t^{i^*}} \tag{13}$$

Intermediate good firms.- Each domestic intermediate good, $y_{H,j,t}$, $j \in (0,1)$, is produced within the small open economy by a monopolist who rents capital, K, and labor, L, in the market and uses the technology

$$y_{H,j,t} = K_{H,j,t}^{\xi} \left(A_t L_{H,j,t}\right)^{1-\xi} \tag{14}$$

where $0 < \xi < 1$ and A_t denotes economy-wide labor augmenting technological change. As in Christiano et al. (2005), we rule out entry and exit into the production of intermediate goods. Profit maximization by these monopolists implies that, in each period, they set the price for their differentiated goods with a mark-up over their marginal costs. Namely:

$$p_{H,j,t} = \lambda_t^i MC_{H,j,t} \tag{15}$$

where the marginal cost, $MC_{H,j,t}$, depends on the rental price of the labor and capital inputs, W_t and $p_{K,t}$, respectively, according to

$$MC_{H,j,t} = \left(\frac{\xi}{1-\xi}\right)^{-\xi} \left(\frac{W_t}{p_{K,t}}\right)^{-\xi} \frac{W_t}{A_t\,(1-\xi)} \tag{16}$$

At the end of each period, the profits of these monopolists, $\pi_{H,j,t}$, $j \in (0,1)$ are distributed to the households in the form of dividends.

Firms producing labor services.- In each period, a representative competitive firm buys labor hours of households of different ages and transforms them into an aggregate labor input, L_t, which then sells to the domestic intermediate producers, using the following technology:

$$L_t = \left[\sum_{i=I_A}^{I_R-1} \left(\frac{1}{I_R - I_A} \right)^{\frac{\lambda_t^l - 1}{\lambda_t^l}} (e_i L_{i,t})^{\frac{1}{\lambda_t^l}} \right]^{\lambda_t^l}, \; 1 \leq \lambda_t^l < \infty \tag{17}$$

where $L_{i,t}$ is the total number of labor hours supplied by age-i households, e_i is an age-specific index which transforms those raw labor hours into efficient units of labor, and λ_t^l measures the time-varying substitutability of labor hours of households of different ages in the production of the aggregate labor input. Profit maximization by this representative firm in the labor market implies that its demand for labor hours of age-i households is equal to:

$$L_{i,t} = \left(\frac{1}{I_R - I_A} \right) \left(\frac{\tilde{w}_{i,t}}{W_t} \right)^{\frac{\lambda_t^l}{1-\lambda_t^l}} (e_i)^{\frac{1}{1-\lambda_t^l}} L_t \tag{18}$$

where $\tilde{w}_{i,t}$ denotes the price that this firm pays for one hour of labor of an age-i household and W_t is the unit price of the aggregate labor input. These are related via:

$$W_t = \left[\sum_{i=I_A}^{I_R-1} \left(\frac{1}{I_R - I_A} \right) \left(\frac{\tilde{w}_{i,t}}{e_i} \right)^{\frac{1}{1-\lambda_t^l}} \right]^{1-\lambda_t^l} \tag{19}$$

In Erceg, Henderson and Levin (2000), among others, each household is considered to be a monopoly supplier of a differentiated labor service implying that they can set their own wage. In this paper, due to the overlapping generations nature of our model, we follow a slightly different route to incorporate this friction in the labor market. Namely, we consider that, for each age $i \in [I_A, I_R - 1]$, there is a monopoly who buys labor hours directly to the households of age i at price $w_{i,t}$, and sells them to the representative firm producing the aggregate labor input at price $\tilde{w}_{i,t}$. As usual, these monopoly suppliers set their price with a mark-up over their marginal cost which, in this case, implies that $\tilde{w}_{i,t} = \lambda_t^l w_{i,t}$, $i \in [I_A, I_R - 1]$. At the end of each

period, these firms distribute their profits, $\pi_{L,i,t}$, $i \in [I_A, I_R - 1]$, to the households in the form of dividends.

The monopoly power of these firms comes from the fact that, as considered in (17), labor hours of households of different ages are imperfect substitutes in the production of the aggregate labor input. In this set up, as opposed to Erceg, Henderson and Levin (2000), households do not have any monopoly power because their labor hours are perfect substitutes in the production of the aggregate labor input with those of all the other households in the economy with the same age. Nevertheless, for the purposes of this paper, the relevant issue is that there exists a distortion in the labor market that leads to a misalignment between prices and marginal costs and not whether the monopoly power is held by the households or by these intermediate labor producers.

Investment firm.- In this small open economy, all capital is owned by a representative firm which rents it to the domestic intermediate producers at a unit price $p_{K,t}$ and takes investment decisions. Investment is assumed to be given by a CES aggregate of domestic and imported goods. Namely,

$$I_t = \left[(\alpha_I)^{\frac{1}{\eta_I}} I_{H,t}^{\frac{\eta_I - 1}{\eta_I}} + (1 - \alpha_I)^{\frac{1}{\eta_I}} I_{F,t}^{\frac{\eta_I - 1}{\eta_I}} \right]^{\frac{\eta_I}{\eta_I - 1}} \tag{20}$$

where $(1 - \alpha_I)$ is the share of imports in investment, I_H and I_F are the same composites of the continuum of domestic and of foreign intermediate goods as in (7) and (8), respectively, and η_I is the elasticity of substitution between these composite goods in investment. Thus, the unit price of this investment aggregate is given by

$$p_{I,t} = \left[\alpha_I p_{H,t}^{1-\eta_I} + (1 - \alpha_I) p_{F,t}^{1-\eta_I} \right]^{\frac{1}{1-\eta_I}} \tag{21}$$

and the demands of the domestic and foreign composites of the continuum of domestic and foreign intermediate goods, respectively, are given by

$$I_{H,t} = \alpha_I \left(\frac{p_{H,t}}{p_{I,t}} \right)^{-\eta_I} I_t \tag{22}$$

$$I_{F,t} = (1 - \alpha_I) \left(\frac{p_{F,t}}{p_{I,t}} \right)^{-\eta_I} I_t \tag{23}$$

We follow Christiano et al. (2005) and assume that this firm's investment decisions are conditioned by the existence of quadratic investment adjustment costs. As argued

in Lucca (2007), these adjustment costs are equivalent, up to a first order linearization, to a time-to-build representation of the investment process. Furthermore, along the lines of Garrett and Priestley (2000), among others, we also consider that this firm faces costs of changing the amount of dividends it distributes to households at the end of each period. Thus, in each period t this representative firm chooses an investment sequence to maximize, given prices, its discounted flow of future dividends, net of the dividends adjustment costs:

$$\max_{\{I_s\}_{s=t,t+1,..}} \sum_{s=t}^{\infty} \left(\prod_{j=t+1}^{s} \frac{1}{1+r_j} \right) \left[d_s - \frac{\varsigma}{2} \left(\frac{d_s}{d_{s-1}} - 1 \right)^2 \right] \tag{24}$$

subject to:

$$d_s = (1-\tau_s^k) p_{K,s} K_s - p_{I,s} I_s \left(1 + S\left(\frac{I_s}{I_{s-1}} \right) \right) \tag{25}$$

$$K_{s+1} = (1-\delta) K_s + I_s \tag{26}$$

where $\varsigma > 0$ gives a measure of the dividends adjustment costs, τ^k is a proportional tax rate on this firm's capital rents, and, as usual, the investment adjustment cost function, $S(\cdot)$, satisfies that $S(1) = S'(1) = 0$ and $S''(1) \equiv \chi > 0$.

2.3 Government

The government of this small open economy consumes, gives lump-sum transfers, runs a social security system, levies taxes and issues debt. In each period, the government devotes an exogenously given amount of resources to consume, G_t, and to give lump-sum transfers to the households, $TR_t = tr_t \left(\sum_n \sum_{i=I_A}^{I} N_{i,n,t} \right)$. It is assumed that the government consumes the same final consumption good as households.[5] The government also spends resources in social security benefits $SS_t = \sum_n \sum_{i=I_R}^{I} N_{i,n,t} ss_{i,n,t}$. For each retired worker these benefits are assumed to represent a fraction ϖ of its average labor earnings in the last I_{SS} periods before retirement. In order to finance these expenditures, the government may issue debt, D_{t+1}, or levy proportional taxes on households' consumption (τ_t^c), labor income (τ_t^l and τ_t^{ss}) and capital income (τ_t^a),

[5] Aggregate household consumption (C_t) involves consuming domestic ($C_{H,t}$) and foreign goods ($C_{F,t}$). Given equation (6), which defines the final consumption good, it is possible to derive that $C_{H,t} = \alpha_C \left(p_{H,t}\right)^{-\eta_C} C_t$ and $C_{F,t} = (1-\alpha_C) \left(p_{F,t}\right)^{-\eta_C} C_t$. The same applies to G_t, which can be divided into $G_{H,t}$ and $G_{F,t}$.

and on the investment firm's capital rents (τ_t^k). Thus, the government's budget constraint in period t is:

$$G_t + TR_t + SS_t + (1+r_t)D_t = D_{t+1} + \tau_t^c C_t + \left(\tau_t^l + \tau_t^{ss}\right) \sum_n \sum_{i=I_A}^{I_R-1} N_{i,n,t} w_{i,t} h_{i,n,t} + \tau_t^a r_t A_t + \tau_t^k p_{K,t} K_t \quad (27)$$

where $C_t = \sum_n \sum_{i=I_A}^{I} N_{i,n,t} c_{i,n,t}$ and $A_t = \sum_n \sum_{i=I_A}^{I} N_{i,n,t}(a_{i,n,t} + b_t)$ denote aggregate households' consumption and financial assets, respectively, D_t is the stock of public debt outstanding at the beginning of period t, and r_t is the exogenous interest rate in the small open economy.

As usual in models like this, a fiscal rule is needed so as to avoid explosive dynamics of public debt. We follow Kilponen et al. (2006) and, for the simulation exercises described in Section 4, we consider that the proportional labor income tax rate τ^l adjusts in each period to accommodate deviations of this rate and of the debt to GDP ratio from corresponding target levels according to the following rule:[6]

$$\tau_t^l = \tau_{t-1}^l - \kappa_1(\tau_{t-1}^l - \bar{\tau}^l) + \kappa_2\left(\frac{D_t}{GDP_t} - \overline{\frac{D}{GDP}}\right) \quad (28)$$

where $\kappa_1 > 0$ and $\kappa_2 > 0$ measure the sensitivity of τ^l to deviations of τ^l and $\frac{D}{GDP}$, respectively, from their targets.

In our simulation exercises below, we use (28) looking for a compromise between long-term and short-term dynamics in the following sense. On the one hand, from a long-term perspective, it seems reasonable to consider, as in (28), that excessive debt scenarios need to be corrected via tax rate adjustments. For instance, there is a general consensus that the pressure on public accounts that will be induced in the near future by the aging of the Spanish baby-boom generation would require significant tax reforms. On the other hand, in the short run, in line with the small changes in tax rates typically observed in the data, it seems more reasonable to assume that (28) does not apply. Thus, in order to accommodate these long- and short-term perspectives, in the simulation exercises presented in Section 4 we assume that (28)

[6] As it will be clear in Section 3, for the calibration of the model we do not use this fiscal rule. We simply fix the ratio of public debt to GDP to a target level and obtain a labor income tax rate τ^l endogenously so as to balance the government budget.

only operates beyond 2008, so that τ^l stays constant at its value in the calibration exercise prior to that date. Beyond 2008, when the rule is at work, we consider that $\overline{\frac{D}{GDP}} = 0.60$, in line with the Stability and Growth Pact in the euro area, that $\bar{\tau}^l$ is equal to its value in the calibration exercise and, following Kilponen et al. (2006), that $\kappa_1 = 0.3$ and $\kappa_2 = 0.1$.

2.4 Foreign economy

As already mentioned above, in this small open economy a fraction $(1 - \alpha_I)$ of aggregate investment and a fraction $(1 - \alpha_C)$ of aggregate private and public consumption correspond to imports of foreign goods. By a symmetric argument, a fraction of the domestic production of intermediate goods is exported abroad in each period to become part of foreign aggregate consumption (private and public) and investment. In this sense, in terms of the composite good defined in (7), which aggregates all domestic intermediate goods, we assume that, in each period t, domestic exports abroad equal X_t, defined as:

$$X_t = \left(\frac{p_{H,t}}{p_{F,t}}\right)^{-\eta_X} Y_t^* \tag{29}$$

where η_X is the elasticity of substitution in the world economy between the domestic and foreign composite goods, and Y^* is a measure of the total demand in that economy, which is completely exogenous to the domestic economy. Equation (29) closes the model. See the Appendix for a formal definition its equilibrium.

3 Calibration

An initial goal of this paper is to evaluate, in the context of the model described in the previous section, the role played by interest rates, demographic developments, fiscal policy and market distortions in explaining the macroeconomic performance of the Spanish economy over its last expansionary phase. To carry out this quantitative exercise we first need to set the values of the parameters, the initial conditions and the exogenous sequences of the model. This section describes our calibration strategy and Table 1 summarizes our parameter choices.[7]

[7] National accounts data are available at http://www.ine.es. Data for the current account and international investment position come from Banco de España. Data on tax revenues are available at http://www.meh.es.

Target year.- We choose 1998 as our calibration target year, so as to focus on the post-Euro performance of the Spanish economy. In this sense note that, although the expansion of economic activity in Spain began some years before the creation of the EMU, this process and the build-up of imbalances in the economy clearly accelerated after 1998.

Initial distributions.- A complete characterization of the model requires initial distributions of financial assets and of social security entitlements across households to be specified. Rather than setting those initial distributions arbitrarily in 1998, we set them for the year 1950, which then becomes the first year in our computations. By starting our numerical analysis in 1950, we are able to obtain (initial) distributions of financial assets and of social security entitlements across households in 1998 which are optimally derived from the model and, given that 1950 is far from 1998, do not depend on the initial distributions assumed in 1950.[8]

Demographics.- A period in the model corresponds to 1 year. Agents start taking economic decisions at age 16, they are forced to retire at age 65, and die with probability 1 at age 100. We take the age structure of the population in 1950 from the UN World Population Prospects. For the period 1951-1998 we propagate that population according to equations (1) and (2) using age-specific fertility and survival probabilities consistent with the evolution of average fertility and life-expectancy in the data. Thus, we consider the 1950-1998 calibration period as a non-immigration period (only *native* households are active). In this sense note that it was after 1998, when immigrants represented less than 3% of the Spanish population, when the largest immigration inflows into Spain took place.[9] Beyond 1998, we propagate the population under the assumption that households expect constant (at their 1998 levels) fertility and survival probabilities and do not anticipate the immigration inflows happening after 1998. These flows will be described and incorporated into the analysis in Section 4.

Preferences.- We assume a standard CRRA specification of the per period utility

[8] An additional reason to start our analysis in 1950 is that the demographic information provided by the UN World Population Prospects also starts in that year.

[9] Furthermore, if we were to consider the presence of immigrants in Spain before 1999, we would not have information available about the years in which those immigrants first entered in the country.

function:

$$U(c,h) = \frac{\left(c^{\theta}(1-h)^{(1-\theta)}\right)^{1-\sigma}}{1-\sigma} \tag{30}$$

where σ and θ determine households' risk aversion and the relative importance of consumption over leisure, respectively. We set $\sigma = 3$, which falls within the standard range of this parameter in the literature, and choose θ so that in 1998 households in the model economy spend on average one-third of their time endowment at work.

Technology, foreign economy and discount factor.- From households' point of view, in order to generate an empirically plausible age profile of asset holdings, it is necessary to account for the fact that earnings grow with experience. In this sense, the standard practice in the literature is to endow agents with an age-specific profile of productivity which in our model is represented by e_i. We have obtained this profile by computing average age-specific hourly wages from the Structural Earnings Survey (SES) in Spain in 2002.

The depreciation rate of capital δ, the discount parameter β and the exogenous world interest rate and output, r and Y^* respectively, are chosen simultaneously to reproduce the following targets in 1998: i) a ratio of investment to GDP of 23.5%, ii) a ratio of international investment position to GDP of -31.7%, iii) a ratio of net exports to GDP of -0.22%, and iv) a ratio of exports to GDP of 26.7%. The values generated by these targets are $\delta = 9.95\%$, $\beta = 0.9964$, $r = 3\%$ and $Y^* = 0.0197$.[10]

We set $\alpha_C = 0.60$, $\alpha_I = 0.40$, $\lambda^l = 1.20$ and $\lambda^i = 1.10$. This implies a 60% (40%) share of domestic goods in consumption (investment) and a 20% (10%) markup in the labor (product) market. These values fall within the typical range for these parameters considered in the literature for the Spanish economy. Following Domenech and Taguas (1995) we also set $\xi = 0.375$. Finally, regarding the elasticities of substitution between domestic and foreign goods, we follow the work of Adolfson et al. (2007) and consider that $\eta_C = 5$ and $\eta_I = 2.5$. Furthermore we assume that $\eta_X = \eta_C$.

Government.- In 1998, government consumption, government transfers and public debt represented 17.3%, 5% and 64.1% of the Spanish GDP, respectively. In line with this evidence, in the calibration exercise we choose sequences of government

[10] In 1998, the calibrated model exhibits a ratio of current account to GDP of -1.04% and a capital-output ratio of 2.25. The values of these non-targeted variables are reasonably close to those observed in the data (-0.11% and 2.42, respectively).

consumption, government transfers and public debt such that, in each period, the model economy replicates those ratios. As for taxes, the ratios of consumption taxes to private consumption, of social security contributions to labor income and of capital taxes to GDP observed in Spain in 1998 were equal to 18%, 25.7% and 5.2%, respectively. Consequently, in the calibration, we consider a constant proportional consumption tax rate, τ_t^c, equal to 18%, a constant proportional social security tax rate, τ_t^{SS}, equal to 25.7%, and set constant capital income tax rates $\tau_t^a = \tau_t^k = 14.8\%$ such that the model economy replicates the latter ratio.

Regarding to the social security system, the Spanish Regimen General de la Seguridad Social considers the last 15 years of contributions prior to retirement to compute the pension. Thus, we choose $I_{SS} = 15$ in our numerical exercises. As for the pension replacement rate, ϖ, we set this parameter such that in 1998 our model economy matches the ratio of social security expenses to GDP observed in the Spanish economy in that period (9.5%). Finally, in each period of the calibration exercise we determine τ_t^l endogenously so that the government budget constraint (27) is met. The value of the labor income tax that satisfies this restriction is 10.3% in 1998 (its counterpart in the data is 12.1%).

Table 1: Calibrated parameters

Parameter	Value	Target
Demographics		
I_A	16	Assumed
I_R	65	Assumed
I	100	Assumed
$s_{i,t}$ and $f_{i,t}$	UN Population Prospects	Data
Preferences		
σ	3	Assumed
θ	0.5	Average labor hours $= \frac{1}{3}$
Tech. and foreign ec.		
e_i	Structural Earnings Survey	Data
δ	0.0995	$\begin{cases} \frac{p_I I}{GDP} = 23.5\% \\ \frac{IIP}{GDP} = -31.7\% \\ \frac{X-M}{GDP} = -0.22\% \\ \frac{X}{GDP} = 26.7 \end{cases}$
β	0.9964	
r	0.03	
Y^*	0.0197	
α_C	0.60	Assumed
α_I	0.40	Assumed
λ^l	1.20	Assumed
λ^i	1.10	Assumed
ξ	0.375	Domenech and Taguas (1995)
η_C	5	Adolfson et al. (2007)
η_I	2.5	Adolfson et al. (2007)
η_X	5	Assumed
χ	2	Christiano et al. (2005)
ς	15	Assumed
Government		
$\frac{G}{GDP}$	0.173	Data
$\frac{TR}{GDP}$	0.05	Data
$\frac{D}{GDP}$	0.641	Data
τ^c	0.18	Data
τ^{SS}	0.257	Data
$\tau^a = \tau^k$	0.148	$\frac{Capital\ taxes}{GDP} = 5.2\%$
I_{SS}	15	Data
ϖ	0.56	$\frac{S.S.\ expeditures}{GDP} = 9.5\%$

4 Findings: the expansion

We now analyze the quantitative performance of this model economy beyond 1998 with a two-fold purpose. First, we want to evaluate to what extent the large decline in

interest rates and the intense demographic changes observed in the Spanish economy after 1998 may explain the evolution of the main macro-aggregates in this country over the period 1998-2008. And second, we aim to quantify how this evolution could have changed under different scenarios concerning fiscal policy and labor and product markets distortions.

4.1 The role of demographic changes

In Spain, traditionally an out-migration country, immigration inflows reached a significant scale in the years immediately before the creation of EMU and accelerated afterwards. Thus, foreign population residing in Spain increased from 0.35 millions (1% of total population) in 1995 to 5.22 millions (11% of total population) in 2008. In addition, these inflows have modified the age distribution in the Spanish population reducing its dependency ratio since, as usual, the age distribution of the immigrants that entered into Spain has been younger than that of natives. On top of that, survival and fertility probabilities have also changed over time. To evaluate the macroeconomic impact of these developments in the context of our model, we depart from our economy calibrated to 1998 and assume that demographic variables evolve as follows:

Immigration inflows.- We assume that, beginning in 1999, immigration flows behave according to the long-term demographic projections of the Instituto Nacional de Estadística (INE).[11] The age distribution of these immigration inflows is assumed to be constant over time and equal to that of new immigrants entering in Spain in 1999 according to the Estadística de Variaciones Residenciales.[12] For computational reasons, we also assume that immigrants can only enter the country with ages between 16 and 44. In 1999, the immigrants who entered in Spain with these ages accounted for 60% of the total.

Survival and fertility probabilities.- Rather than assuming that these probabilities stay constant beyond 1998, as in the calibration exercise, we assume that they change

[11] Specifically, we use the projections published in May 2005. In January 2010, the INE reviewed these projections and significantly reduced the expected net immigration flows in the long-run. Different simulation exercises, available from the authors upon request, show that the main qualitative results discussed in this paper are robust to this revision of the long-term immigration dynamics.

[12] These data refer to 10-years age groups. We make it annual by fitting a second order polynomial to the available age distribution.

over time in order to match the average fertility and life-expectancy data in the UN World Population Prospects for Spain. These projections end in 2050. Afterwards, we assume that the survival and fertility probabilities stay constant at their 2050 levels.

Findings.- The response of our calibrated model economy to the demographic developments described above over the period 1998-2008 is summarized in Figure 1 and Table 2. A first implication of these demographic changes is a fall in the dependency ratio of the economy. This can be seen in panel I of Figure 1, which compares, for the period 1998-2008, the dependency ratio in the calibration exercise (Baseline) and the associated to the demographic changes witnessed in Spain after 1998. In the model, this expansion of working-age population leads to a rise in aggregate employment, in aggregate investment and, consequently, in GDP. In this sense, according to the model, the observed demographic changes in Spain would have been responsible, on its own, for 60% of the observed expansion in aggregate investment (Table 2).

Table 2: Role of demographic changes

	Data		Model	
	1998	2008	1998	2008
Investment/GDP	23.5%	29.3%	23.4%	26.9%
Public Debt/GDP	64.1%	39.5%	64.1%	53.8%
Foreign Assets/GDP	−31.7%	−80.6%	−31.7%	−44.9%

Fiscal consolidation in Spain during the period 1998-2008 contributed to a considerable reduction in the ratio of public debt to GDP, that decreased from 64.1% in 1998 to 39.5% in 2008. This consolidation, achieved both through a reduction in expenditures and through an increase in revenues, made public accounts to gradually move from a deficit of around 3% of GDP in 1998 to a surplus of around 2% of GDP in 2007.[13] In response to the demographic changes considered above, the model can account for 42% of the improvement in the ratio of public debt to GDP observed in the data. This has to do, mostly, with the increase in tax revenues associated to the expansion of economic activity, although the fall in the dependency ratio also contributes to a reduction in public debt via improving the balance of the social security system.[14]

[13] In 2008, however, with the arrival of the global financial crisis, government disbursements increased again, revenues fell and public deficit reached 4% of GDP.

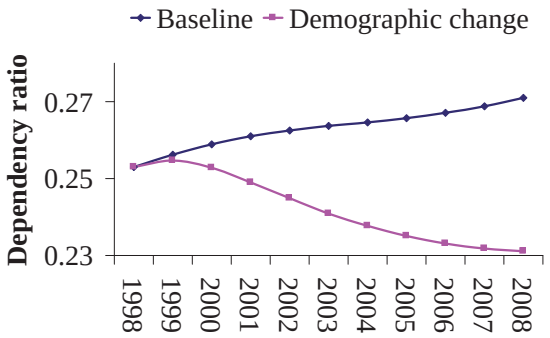
[14] In this exercise we are keeping the share of government spending in GDP constant at a 17.3%, as in the calibration exercise.

The Spanish current account balance as a percentage of GDP fell almost monotonically during the 1998-2008 period and led to a very intense deterioration in the share of net foreign assets in GDP, that decreased from −31.7% in 1998 to −80.6% in 2008.[15] According to the model, 27% of this deterioration could be explained by the demographic changes hitting the economy. In the model, the aforementioned increase in investment driven by demographic changes, together with minor changes in aggregate savings, impacts negatively on the current account and leads to a worsening in the economy's external imbalance (measured as the ratio of net foreign assets to GDP).

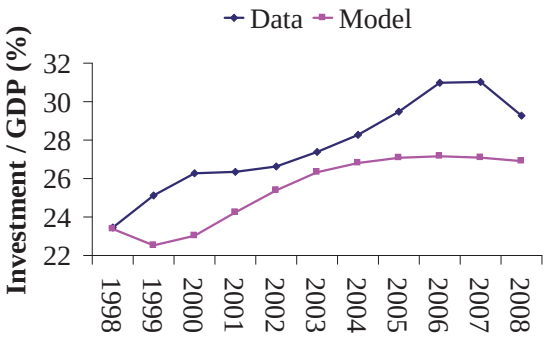
In Figure 1 panels III and IV compare the evolution over time of the ratios of public debt and of net foreign assets to GDP in the model economy and in the data. According to the model, much of the observed short-term dynamics of these ratios would be driven by the aforementioned demographic changes. A better accounting of these observed dynamics requires incorporating additional elements into the model economy. We do this next.

[15] The increasing current account deficits over this period, despite the process of consolidation of public accounts, clearly points to the rise in private indebtedness as the main origin of Spain's external imbalance.

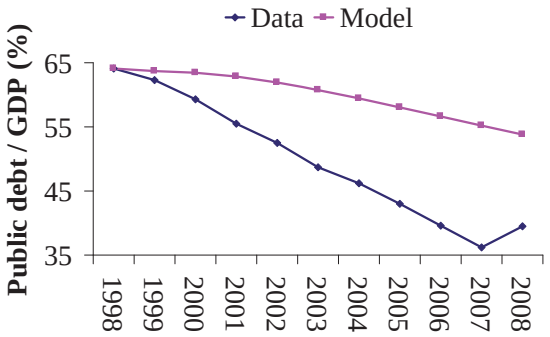
Figure 1. Demographic changes: data vs. model.



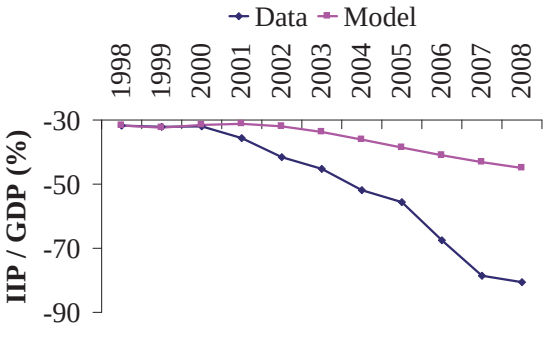
I. Dependency ratio.



II. Aggregate investment.



III. Public debt.



IV. International investment position.

4.2 The role of interest rates

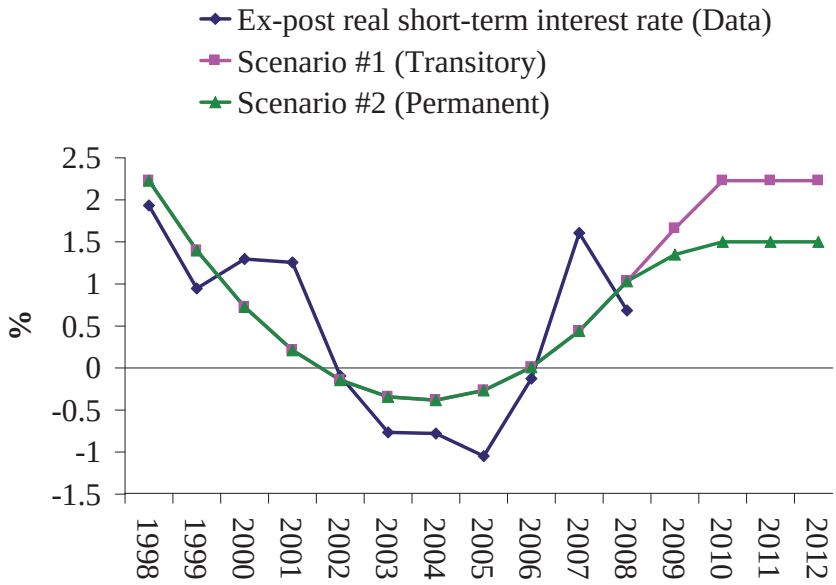
Despite a slight increase after 2005, the fall in ex-post real interest rates in Spain during the 1998-2008 period was truly remarkable.[16] Nominal convergence in the run-up to EMU, lax monetary policy since the early 2000s, anchoring of inflation expectations, and a positive inflation differential in Spain are behind that large decrease. To evaluate the macroeconomic impact of this interest rate evolution, we depart from

[16] It is somehow controversial, however, to what extent this fall truly resembles a reduction in the cost of financing. For some (see, for instance, Blanco and Restoy (2007) and Gimeno and Marques (2008)), the reduction in inflation uncertainty explains a great deal of the decline in real interest rates, so that the actual real cost of financing might have decreased significantly less than that indicated by ex-post real rates.

our model economy calibrated to 1998 and consider, together with the demographic developments described above, two alternative interest rate scenarios.

Scenarios.- To construct these scenarios we take the smoothed evolution of the ex-post real short-term interest rate (measured as the one year Euribor) in Spain over the period 1998-2008 and consider two possibilities. In the first scenario we assume that the fall in interest rates observed over the period 1998-2008 is transitory, so that by 2010 the interest rate gets back to its 1998's level, staying constant afterwards. In the second scenario, instead, we consider that the fall in interest rates is permanent. Namely, rather than returning to their 1998's levels, interest rates increase slightly between 2008-2010 and stay constant at a 1.5% level afterwards. These scenarios are depicted in Figure 2.

Figure 2. Interest rate scenarios.



Findings.- Departing from our initial state in 1998, we now incorporate into our model economy both the demographic changes described in Section 4.1 *and* the interest rate scenarios in Figure 2. In addition to the macroeconomic effects discussed above induced by demographic changes, the fall in interest rates (in both scenarios) has two main effects in the economy. Very intuitively, it contributes to a further expansion in aggregate investment and, via a reduction in the debt burden, to a more intense improvement in public debt (Table 3). It turns out that the former effect

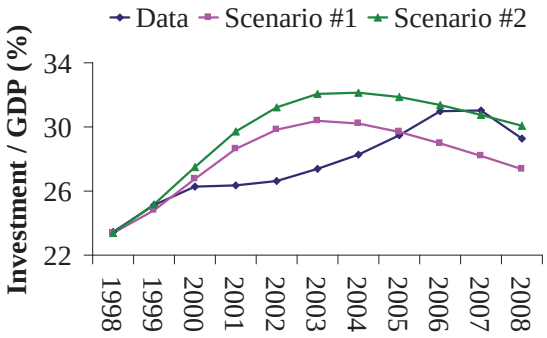
dominates so that the fall in interest rates leads to a further deterioration of the economy's international investment position. Naturally, all these effects are larger when the fall in interest rates is permanent (Scenario #2) rather than transitory (Scenario #1).

Table 3: Role of interest rates and demographic changes

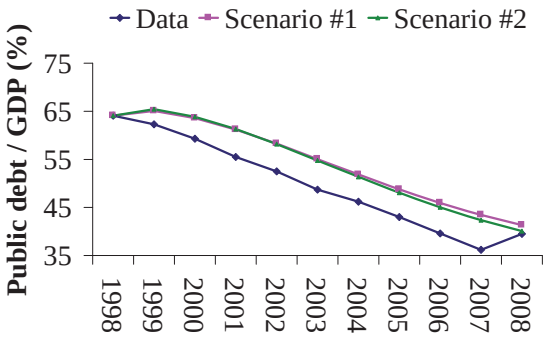
	Data		Model	
	1998	2008	2008 (Scenario #1)	2008 (Scenario #2)
Investment/GDP	23.5%	29.3%	27.4%	30.1%
Public Debt/GDP	64.1%	39.5%	41.3%	40.1%
Foreign Assets/GDP	−31.7%	−80.6%	−63.9%	−77.3%

Not surprisingly, by adding the observed interest rate developments, the model delivers a better description of the evolution of the ratios of public debt and of net foreign assets to GDP in the Spanish economy over the period 1998-2008 (Figure 3). Thus, according to the model, the developments in interest rates and demographic variables observed in the Spanish economy over this period would have been responsible for much of the observed improvement in public accounts in Spain (93% in Scenario #1 and 97% in Scenario #2) and of the deterioration of its external imbalance (66% in Scenario #1 and 93% in Scenario #2).

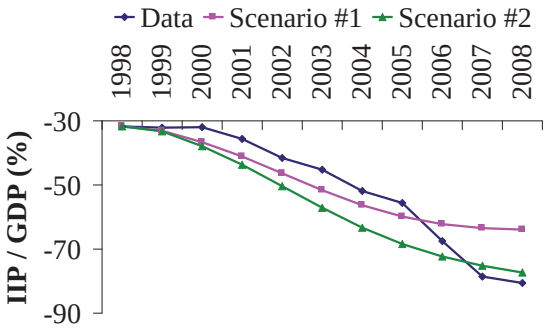
Figure 3. Demographic *and* interest rate changes: data vs. model.



I. Aggregate investment.



II. Public debt.



III. International investment position.

4.3 The role of fiscal policy

The previous section showed that much of the investment boom, the consolidation of public accounts and the increase in external indebtedness observed in the Spanish economy over the period 1998-2008 can be rationalized, in the context of our model economy, as the natural reaction of the economy to the observed developments in interest rates and demographic variables. This section analyzes to what extent this macroeconomic behavior would have changed if a different fiscal policy would have been in place. In particular, we study whether a more restrictive fiscal policy, involving a reduction in government consumption, could have attenuated the dramatic deterioration of the Spanish external position over the 1998-2008 period.

Thus, rather than assuming, as in the simulation exercises described above, that government consumption represents a constant fraction of GDP (17.3%) in each period, we now consider two alternative fiscal policy scenarios. In these scenarios government consumption stays constant, in per capita terms, at its 1998's level for 10 (Scenario #1) and 20 (Scenario #2) years. Beyond 2008 in Scenario #1, 2018 in Scenario #2, government consumption represents again a 17.3% of GDP in each period. Given that, as mentioned above, GDP increases in the model over the period of analysis in response to interest rate and demographic developments, these fiscal policy scenarios imply, in practice, a temporary reduction in the share of government expenditure to GDP, being this more permanent in Scenario #2. Namely, in Scenario #1 (Scenario #2) this share decreases smoothly from 17.3% in 1998 to 15.8% (14.8%) in 2008 (2018).

Table 4 shows the results of these counterfactual exercises using as a benchmark the exercise described in Section 4.2 that incorporates demographic changes and a transitory fall in interest rates (Scenario #1). Intuitively, the model predicts that in both fiscal scenarios less government consumption over the period 1999-2008 would have led to a more intense improvement in public accounts by 2008 than that in the benchmark case. This fiscal tightening, however, would have helped very little in attenuating the build-up of the economy's external imbalance over this period. In particular, the transitory tightening of government consumption in Scenario #1 would have only reduced the size of this imbalance by 2008 by 1 percentage point. The more permanent tightening of fiscal policy in Scenario #2 would have even increased that imbalance.

Table 4: Role of fiscal policy

	Model (year 2008)		
	Benchmark	Fiscal Scenario #1	Fiscal Scenario #2
Investment/GDP	27.4%	27.5%	28.0%
Public Debt/GDP	41.3%	36.7%	36.9%
Foreign Assets/GDP	−63.9%	−63.0%	−75.9%

The intuition behind this little effectiveness of fiscal policy in addressing the economy's external imbalance lies on the forward-looking behavior of households in the model. Certainly, a reduction in government consumption leads to an improvement in public accounts and this, by itself, attenuates the economy's need for external financing. However, to the extent that households anticipate that the reduction in the share of public debt to GDP is going to imply a reduction in labor income taxes in the future (once the fiscal rule (28) operates), they immediately modify their labor and consumption profiles so that current private borrowing increases. This increase therefore counteracts the fall in public financing needs and, depending on the temporal dimension of the fiscal tightening, it may even imply a more intense deterioration in the economy's external imbalance.

4.4 The role of labor and product market distortions

The Spanish economy is characterized by the existence of important distortions in the labor and product markets, which hinder productivity growth, a proper allocation of resources and, more broadly, damage the external competitiveness of the economy. In this section we explore how structural reforms on these markets could have affected the macroeconomic performance of the Spanish economy over the period 1998-2008. In particular, we study the reaction of our model economy to a 2 percentage points decrease in the labor and product markets markups. Christopoulou and Vermeulen (2008) report that the markup in the U.S. manufacturing sector was, on average over the period 1993-2004, 6 p.p. greater than in the Euro Area. In a similar vein, Andres, Ortega and Valles (2008) argue that a 5 p.p. differential in the product market markup is a conservative estimate of the importance of markup differences across European markets. In this sense, our simulated reduction in markups would entail closing around one third of these differences in the competitive environment. A number of papers in the literature have conducted quantitative exercises similar

to ours. For instance, Gomes et al. (2009) show the macroeconomic implications of a decline in German markups in the product and labor markets of 5, 10 and 15 p.p. Moreover, Kilponen and Ripatti (2006) show the effects for the Finnish economy of a reduction of 5 p.p. in the labor market markup and of 2 p.p. in the product market markup.

As in the previous section, we use the exercise described in Section 4.2 that incorporates demographic changes and a transitory fall in interest rates (Scenario #1) as a benchmark. Departing from that benchmark, we first consider a labor market reform setting $\lambda^l = 1.18$ (rather than 1.20) and then a product market reform setting $\lambda^i = 1.08$ (rather than 1.10). Not surprisingly, reducing the inefficiencies in these markets leads, compared to the benchmark, to an expansion of economic activity, with increases in aggregate investment and employment, and to an improvement in external competitiveness. According to the model, the positive effects of the same 2 p.p. reduction in the markup are larger if the reform is carried out in the product market rather than in the labor market. Namely, with a product market reform, GDP, employment and the terms of trade would have been, by 2008, 1.5% higher, 0.7% higher and 0.3% lower, respectively, than with a labor market reform. On the long run, these differences persist: GDP, employment and the terms of trade would have been 1.6% higher, 0.6% higher and 0.3% lower, respectively, with a 2 p.p. decrease in the product market markup than with the same decrease in the labor market markup.

The impact that these structural reforms would have had on Spanish publics accounts and on the economy's external imbalance over the period 1998-2008 is summarized in Table 5. Due to the aforementioned expansion of economic activity, the consolidation of public accounts over this period would have been more intense with the reforms. The external imbalance of the economy, however, would have been higher by 2008 if the reforms had been carried out. The reason for this result is that, as in the case of fiscal policy, households anticipate lower taxes and a more efficient economy in the future. Thus, in order to smooth consumption, they increase current private borrowing what, together with the increase in aggregate investment, dominate the improvement in public accounts and then lead to a more intense external indebtedness.

Table 5: Role of labor and product market distortions

	Model (year 2008)		
	Benchmark	Labor Market Reform	Product Market Reform
Investment/GDP	27.4%	27.6%	28.4%
Public Debt/GDP	41.3%	38.0%	36.6%
Foreign Assets/GDP	−63.9%	−65.0%	−68.4%

Fiscal policy vs. structural reforms.- According to the model, an structural reform in the product market (like the one considered in this section) could achieve a short-run reduction (over the 1998-2008 period) in the ratio of public debt to GDP similar to that achieved with the fiscal tightening exercises presented in Section 4.3. This, together with fact that the long-term positive effects of structural reforms on GDP, employment, investment and competitiveness are absent with alternative fiscal policy experiments, strongly point to structural reforms as a powerful instrument to pursue improvements in the economy's public accounts, not only for the period 1998-2008 but for the future. In this sense, as mentioned above, the fact that these reforms may lead to a deterioration in the economy's external imbalance in the short run should not be worrisome. It naturally comes from i) increased investment (once inefficiencies have been reduced) and ii) households' smoothing behavior (as the economy will be wealthier in the future with less distortions).

5 Findings: beyond the financial crisis

The previous section showed the performance of the model over the period 1998-2008 under alternative scenarios. This section, instead, studies its implications beyond 2008. To do that in a meaningful way, we first introduce several shocks into the model economy in 2008 that aim to capture the arrival of the global financial crisis to the Spanish economy. Once these shocks have been incorporated, we address two questions: i) how the macroeconomic evolution predicted for the Spanish economy beyond 2008 has changed due to the global financial crisis and ii) to what extent that predicted evolution may be altered by fiscal policy and structural reforms.

5.1 The global financial crisis

In order to incorporate into our model economy the arrival of the global financial crisis in 2008 we take, as a benchmark, the exercise described in Section 4.2 including

demographic changes and a transitory fall in interest rates (Scenario #1), and assume that the economy is hit by the following shocks in 2008:

(S1) Between 2008 and 2009 capital depreciates an additional 10% and the depreciation rate goes back smoothly to its initial calibrated level ($\delta = 0.0995$) in 5 years.

(S2) Beyond 2008, during 20 years, TFP growth is 1 percentage point smaller than in the benchmark.

(S3) In 2009, the age-specific index, e_i, which transforms households' raw labor hours into efficient units of labor, decreases by 10% and it goes back to its initial level after 5 years.

(S4) In 2009, the share of government consumption plus government transfers in GDP increases by 5 p.p. with respect to the benchmark and it goes back smoothly to its calibrated level ($\frac{G+TR}{GDP} = 0.223$) in 10 years.[17]

Certainly, the global financial crisis has hit the Spanish economy in many different dimensions, some of which can not be incorporated into the framework developed in this paper. Consequently, the aim of this exercise is not to perform a full account of the quantitative implications of the crisis, but to broadly incorporate its main consequences. In this sense, shock (S1) tries to capture the view that much of the investment made in Spain during the last expansionary phase was not as productive as initially thought so that its value will need to adjust gradually. The second shock (S2) we consider is a fall in TFP growth. This could be justified on two grounds: as a revision of households' expectations about future growth prospects (maybe too optimistic before the crisis) and/or as a way of capturing the real effects of the financial turmoil. The recent crisis has also led to a very rapid and intense increase in unemployment, that rose from around 9% in 2007 to around 19% in 2009, whose future reduction is expected to be very gradual. Shock (S3) incorporates into our model economy the effects of this fall in the workforce. Finally, with the arrival of the crisis public accounts in Spain have experienced a quick and intense deterioration. This has been mostly due to the work of automatic stabilizers and to the expansionary programs put in place by the government to mitigate the effects of the crisis. In our model, this is captured by shock (S4). It should be noted that, although the magnitude of these shocks has not been chosen to replicate the observed deteriora-

[17] In each year, the increase in $\frac{G+TR}{GDP}$ with respect to the benchmark is split evenly between government consumption and transfers.

tion of macroeconomic aggregates over the crisis period, they are able to generate a contraction of real GDP between 2008 and 2009 of -1.7%, which is in line with the HP-filtered growth rate observed in the data (-1.66%). Furthermore, in terms of the dynamics of public accounts, the model generates an increase in public deficit of 6 p.p. (7 p.p. in the data).

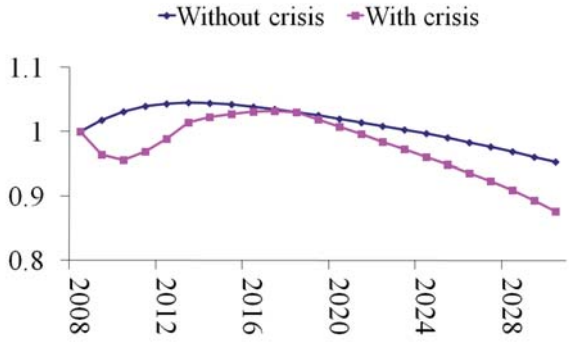
5.2 The effects of the crisis

Departing from our benchmark in 2008, Figure 4 shows the short-run behavior of our model economy beyond that date with and without the arrival in 2008 of the global financial crisis, represented by the shocks described in Section 4.1. Two main conclusions can be extracted from this figure. First, even without the arrival of the crisis, in the short-run the Spanish economy would have entered into a phase of lower, even negative, GDP growth where the external imbalance of the economy would have been reduced but where public accounts would have deteriorated. In this non-crisis scenario, that already incorporates an increase in interest rates beyond 2008, these dynamics are driven to a large extent by demographic changes. Namely, by the behavior of the dependency ratio in Spain that, after decreasing over the period 1998-2008 due to immigration inflows (panel I, Figure 1), increases again in 2009 and especially over the period 2020-2050 with the aging of the Spanish baby boom generation (Figure 5). In the short-run, this reduction of the working-age population has an obvious negative effect on GDP and investment (which helps to correct the external imbalance of the economy) and, due to social security expenditures, on public accounts.

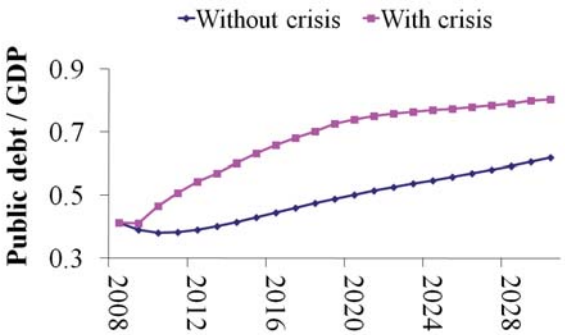
And second, in the short-run, the arrival of the global financial crisis accentuates the aforementioned dynamics that would have taken place without the crisis. Namely, the deterioration of GDP growth and public accounts and the improvement of the economy's external imbalance. To the extent that the crisis constitutes a negative wealth shock for the economy, households' consumption reduces substantially with respect to the non-crisis scenario, what explains the more intense improvement in the economy's the external imbalance. In addition, the shock increasing government consumption and transfers clearly leads to a deeper deterioration in public accounts. Finally, the negative shocks to the capital stock and to the age-specific index, e_i, cause an immediate fall in GDP after the crisis, which only recovers gradually. In this sense,

the model predicts that by 2018 the economy is able to get back to the GDP level that would have had without the arrival of the crisis. At that moment, however, GDP starts deviating again from the non-crisis scenario. The reason is that in 2018 the fiscal rule (28) begins to operate in the crisis scenario and, given the increase in the debt to GDP ratio over the period 2009-2018, it leads to a substantial increase in labor taxes. Intuitively, this tax increase improves the dynamics of public accounts beyond 2018 (panels II and III, Figure 4) but cause a fall in aggregate labor what has an adverse effect on GDP. Note, however, that, as shown in Figure 6, the global financial crisis does not have any long-term effect on the economy and, in particular, on GDP. This is a natural consequence of the way in which we have modelled the crisis in Section 5.1, exclusively through temporary shocks.

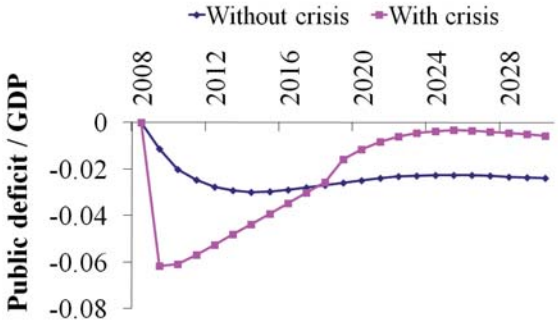
Figure 4. Short-run behavior with and without financial crisis.



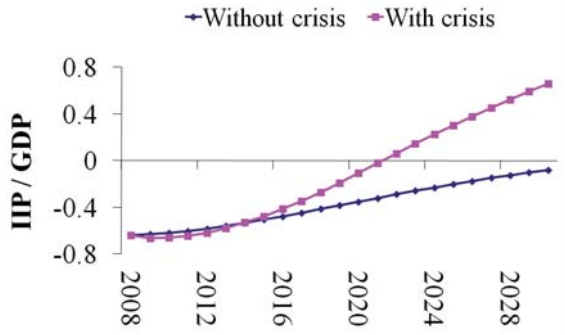
I. GDP.



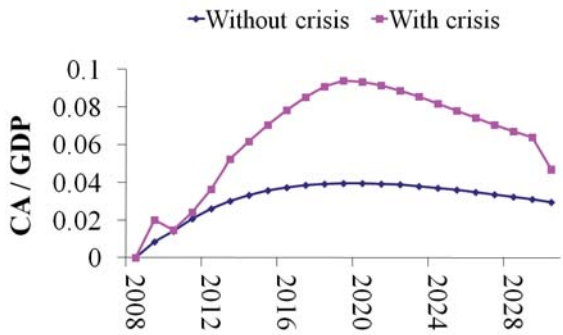
II. Public debt.



III. Public defficit.



IV. International investment position.



V. Current account.

Note: GDP (panel I), deficit to GDP (panel III) and current account to GDP (panel V) normalized by the corresponding 2008's levels in the model economy.

Figure 5. Dependency ratio.

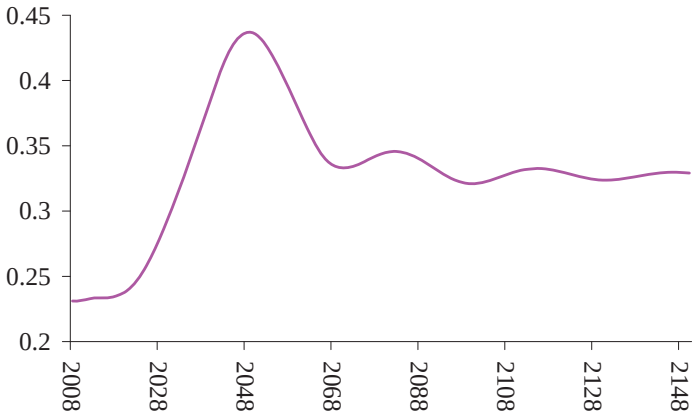
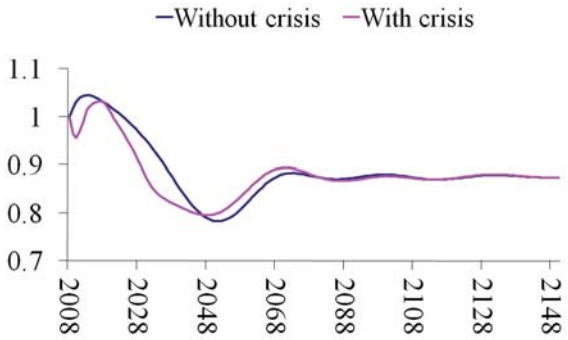
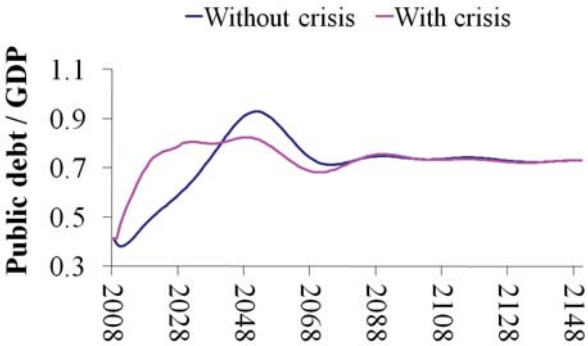


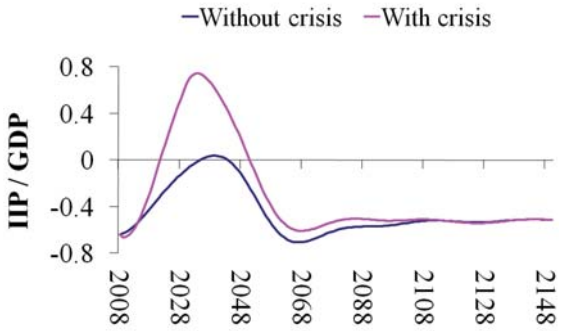
Figure 6. Long-run behavior with and without financial crisis.



I. GDP.



II. Public debt.



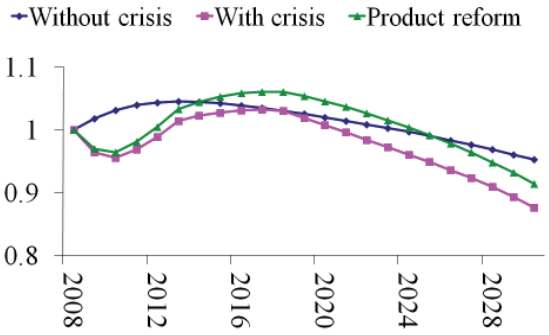
III. International investment position.

Note: GDP (panel I) normalized by its 2008's level in the model economy.

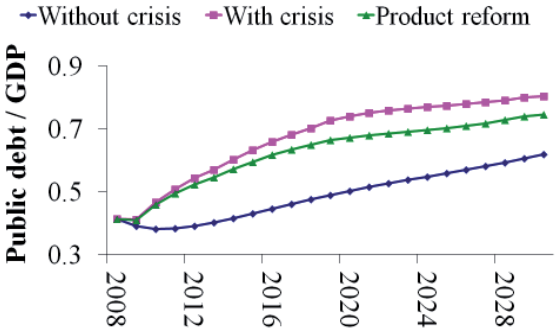
5.3 The role of structural reforms and fiscal policy

Product market reform.- Figure 7 shows the short-run behavior of our model economy beyond 2008 when, besides the shocks coming from the global financial crisis, in 2009 the economy experiences a permanent fall in the markup in the intermediate goods market of 2 p.p. (λ^i falls from 1.10 to 1.08). Very intuitively, with respect to a non-reform scenario (*With crisis*), in the short-run this structural reform mitigates the deterioration in output and in public accounts caused by the crisis without significantly affecting the economy's external imbalance. The effect of the reform on GDP is particularly strong. With the reform, the economy could recover the GDP level that it would have had without the arrival of the crisis before, compared to a non-reform scenario (2014 vs. 2018), and it could even enjoy of greater output levels compared to a non-crisis scenario for some time (over the period 2014-2025). In addition to these short-term effects, this structural reform also has important long-term effects in line with those discussed in Section 4.4. In particular, output is higher and public debt is lower in the long-run when the distortions in the product market are reduced.

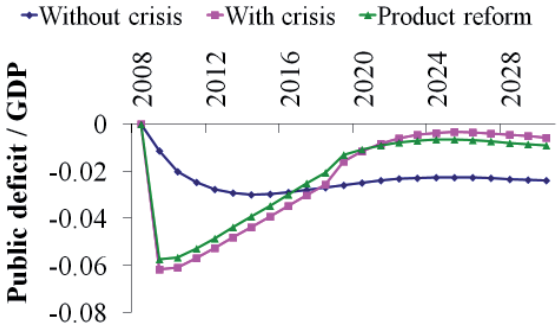
Figure 7. Short-run behavior with product market reform.



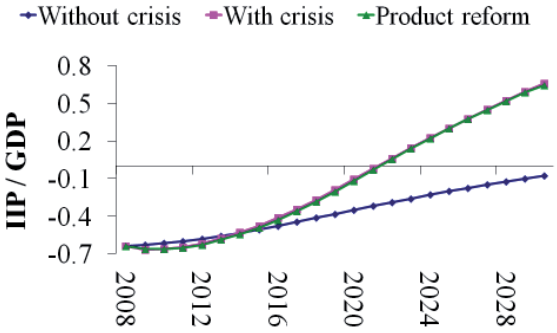
I. GDP.



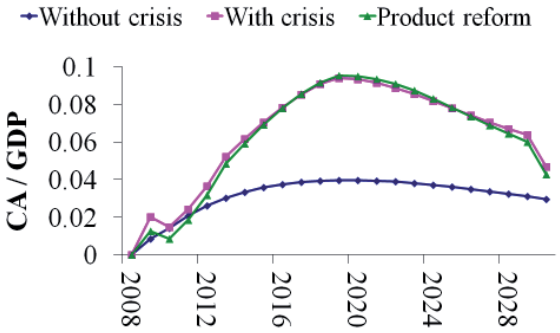
II. Public debt.



III. Public deficit.



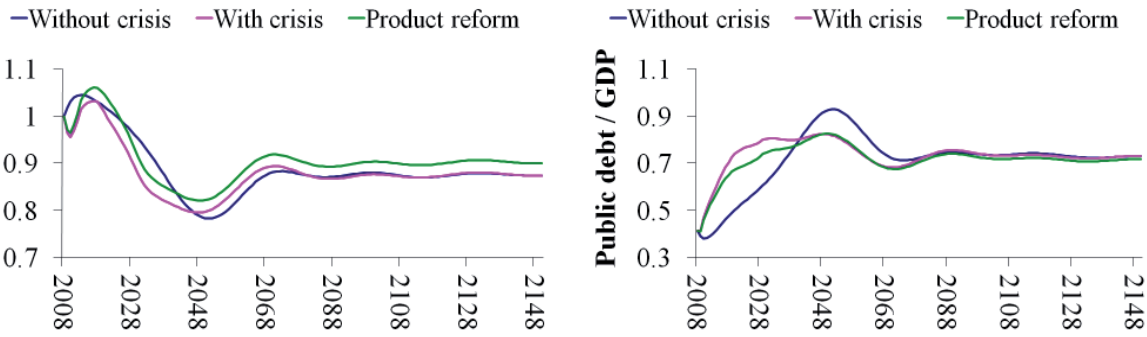
IV. International investment position.



V. Current account.

Note: GDP (panel I), deficit to GDP (panel III) and current account to GDP (panel V) normalized by the corresponding 2008's levels in the model economy.

Figure 8. Long-run behavior with product market reform.

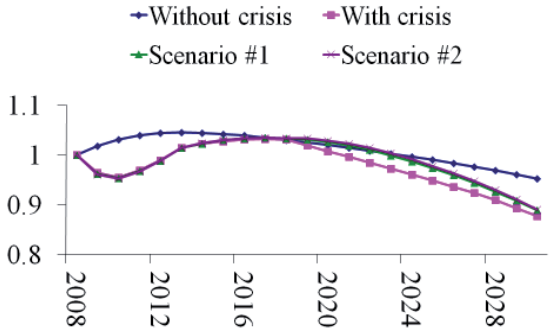


I. GDP. II. Public debt.

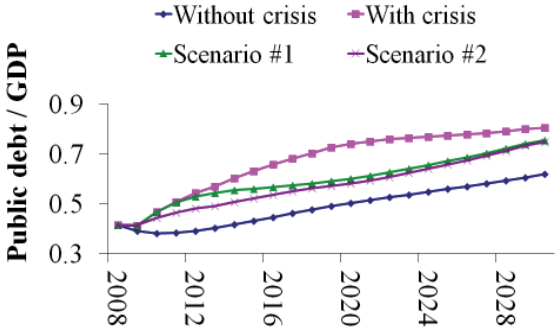
Note: GDP (panel I) normalized by its 2008's level in the model economy.

Fiscal policy.- In the crisis scenario (*With crisis*) considered so far the arrival of the global financial crisis was accompanied by a shock to the share of government consumption plus government transfers in GDP. Namely, we assumed that in 2009 this share increases by 5 p.p. with respect to the non-crisis scenario and that it goes back smoothly to its calibrated level ($\frac{G+TR}{GDP} = 0.223$) in 10 years. To evaluate how fiscal policy can modify the macroeconomic evolution of the Spanish economy beyond 2008, we now consider two alternative fiscal scenarios. The aim of Scenario #1 is to assess the effectiveness of fiscal policy in mitigating the output losses induced by the crisis in the short-run. To that extent, it considers a smaller fiscal shock than in the crisis scenario in 2009 ($\frac{G+TR}{GDP}$ only increases by 2.5 p.p. with respect to the benchmark) that takes 10 years to correct. Scenario #2, instead, tries to evaluate the gains of front-loading in fiscal consolidation. For that purpose, it considers a fiscal shock with the same initial size as the one considered in the crisis scenario, but that reverts to the benchmark in 5 years rather than 10. Figure 9 shows how these alternative fiscal policies modify the short-run behavior of our model economy once it has been hit by the global financial crisis.

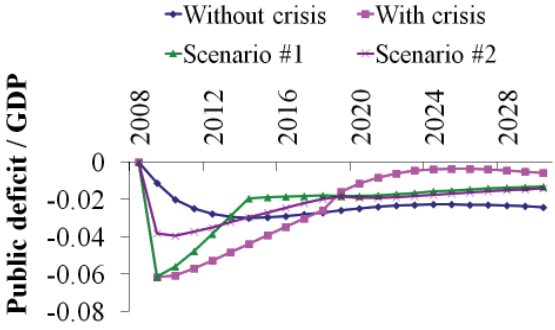
Figure 9. Short-run behavior with tighter fiscal policy.



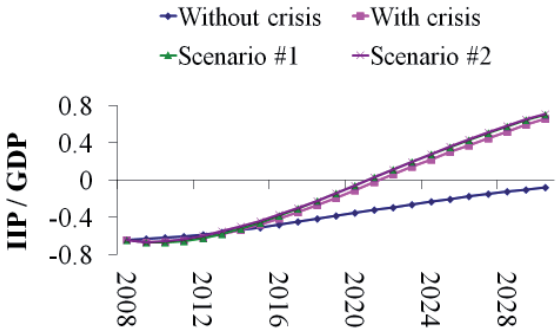
I. GDP.



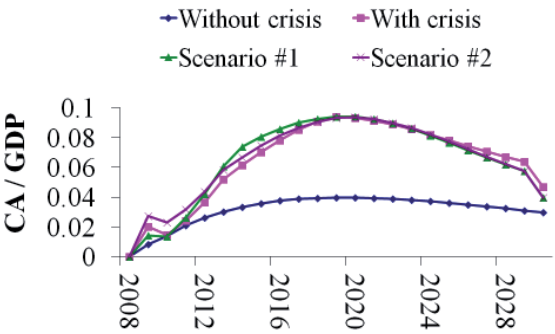
II. Public debt.



III. Public deficit.



IV. International investment position.



V. Current account.

Note: GDP (panel I), deficit to GDP (panel III) and current account to GDP (panel V) normalized by the corresponding 2008's levels in the model economy.

As it is clear from the figure, a tighter fiscal policy leads to a less intense deterioration in public accounts and, for the reasons detailed in Section 4.3, it has very little effects on the economy's external imbalance. In terms of output, the response of the model economy to the two fiscal scenarios considered is very similar. While an expansionary fiscal policy does not appear to be very effective in mitigating output losses in the short-run, a more intense front-loading in fiscal consolidation substantially helps in avoiding the medium-term (beyond 2018) output losses associated to the crisis scenario. In particular, with a faster the consolidation, the eventual increase in taxes needed to restore fiscal soundness is smaller, what has a less adverse effect on aggregate labor and output.

6 Concluding remarks

The emergence of a huge current account deficit was one of the main characteristics marking developments in the Spanish economy during the period of robust economic growth prior to the current crisis. This paper tries to disentangle the main drivers behind this upswing. To this end, we calibrate a small open-economy model for Spain that replicates relatively well the main features of the Spanish economy during the last decade. According to this model two main factors arise as particularly relevant in explaining these developments. First, the decline in interest rates derived from Spain's participation in the European Monetary Union; and further, the far-reaching demographic change brought about by huge immigration flows.

Apart from the role of these two factors, which have already been emphasized by the existing literature, our paper investigates the role played by economic policies in the build-up of the Spanish external imbalance. First, considerable attention has been given in the related literature to the potential role fiscal policy might play in the reduction of this imbalance. In this paper, the role of fiscal policy is analyzed by means of two counterfactual scenarios that try to measure what the external imbalance would have been if significantly tighter fiscal policies had been applied during the last decade. This restrictive fiscal policy is simulated through lower public expenditure growth than that observed in the data. Our results show that the role that a tightening of fiscal policy could have played in the reduction of the Spanish external imbalance would have been very limited and would have depended on the temporal dimension of this tightening. A transitory change in fiscal policy would

have reduced the economy's external imbalance only very slightly, by affecting public savings without significantly distorting private ones. Instead, a permanent fiscal tightening would have had a negative effect on the economy's net foreign assets as it would have distorted optimal decisions by forward looking agents and reduced private savings.

Second, we investigate the role played by labor and product market reforms in the correction of this imbalance. This is relevant insofar as the Spanish economy experienced a progressive increase in its prices and costs relative to those of its main competitors during the economic boom, which may have had an effect on net exports, and there is evidence that this rise in relative prices and wages is related to labor market rigidities and insufficient competition in some markets. Our results show that, if structural reforms in labor and product markets had been adopted in the Spanish economy over the period 1998-2008, the expansion of economic activity, investment and employment would have been more intense than the one observed over that period. The external competitiveness of the economy would have also improved relative to a non-reform scenario and the improvement in public accounts would have been larger. These reforms, however, would have implied a further deterioration of the Spanish external imbalance over the 1998-2008 period. Increased investment, once market distortions had been reduced, and reduced private savings, as households try to smooth their consumption anticipating lower taxes and a more efficient economy in the future, would be responsible for this further deterioration.

The framework set out in this paper has also been used to analyze the different policy options faced by the Spanish economy after the crisis. Several results are worth mentioning. First, even without the arrival of the crisis, in the medium- and long-run the Spanish economy would have entered into a phase of lower GDP growth where the external imbalance of the economy would have been reduced but where public accounts would have deteriorated. This process, mostly driven by the aging of the Spanish population, a factor that is common to most industrialized countries, has become more pronounced with global financial crisis. Second, the model highlights the relevance of fiscal policy and of structural reforms in the post-crisis scenario. Front-loading in fiscal consolidation would contribute to public accounts' sustainability and to mitigate the output losses induced by the crisis in the medium-term. In addition, policies aimed at improving competition help in reducing short- and medium-term

output losses, while inducing a positive long-run effect on the level of output. In light of the complementarities between these policies, the recovery of economic activity in Spain after the crisis could be more successful and less costly if they were implemented together.

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Appendix

Definition of equilibrium

The equilibrium of the model is a list of sequences of:

- prices $\{r_t,\ p_{H,t},\ p_{H,j,t},\ p_{F,t},\ p_{F,z,t},\ p_{K,t},\ p_{I,t},\ W_t,\ \tilde{w}_{i,t},\ w_{i,t}\}$,
- taxes $\left\{\tau_t^c,\ \tau_t^l,\ \tau_t^{ss},\ \tau_t^a,\ \tau_t^k\right\}$,
- transfers $\{b_t,\ ss_{i,n,t},\ tr_t, SS_t, TR_t\}$,
- and quantities $\{N_{i,n,t},\ c_{i,n,t},\ C_t,\ C_{H,t},\ C_{F,t},\ a_{i,n,t},\ A_t,\ h_{i,n,t},\ Y_t,\ Y_{H,t},\ y_{H,j,t},\ Y_{F,t},\ L_t,\ L_{i,t},\ L_{H,j,t},\ K_t,\ K_{H,j,t},\ I_t,\ I_{H,t},\ I_{F,t},\ G_t,\ G_{H,t},\ G_{F,t},\ D_t,\ X_t,\ Y_t^*\}$,

such that, at each point in time t:

- the age structure of the population follows the law of motions (1)-(3),
- agents maximize lifetime utility (4) subject to the period by period budget constraints (5),
- all firms maximize profits,
- accidental bequests are given by:

$$b_t = \frac{\sum_n \sum_{i=I_A}^{I} \mu_{i-1,n,t-1} a_{i,n,t} (1 - s_{i-1,t-1})}{(1 + np_{t-1}) \sum_n \sum_{i=I_A}^{I} \mu_{i,n,t}} \tag{31}$$

  where np_{t-1} is the population growth rate between periods $t-1$ and t,

- dividends received by households are equal to:

$$div_t = \frac{\int_0^1 \pi_{H,j,t}\ dj + \sum_{i=I_A}^{I_R-1} \pi_{L,i,t} + d_t}{\sum_n \sum_{i=I_A}^{I} N_{i,n,t}} \tag{32}$$

- the budget constraint of the government (27) is satisfied,

- labor markets clear:

$$L_{i,t} = \sum_{n} \mu_{i,n,t} h_{i,n,t} \tag{33}$$

$$L_t = \left[\sum_{i=I_A}^{I_R-1} \left(\frac{1}{I_R - I_A} \right)^{\frac{\lambda_t^l - 1}{\lambda_t^l}} (e_i L_{i,t})^{\frac{1}{\lambda_t^l}} \right]^{\lambda_t^l} \tag{34}$$

$$\int_0^1 L_{H,j,t}\, dj = L_t \tag{35}$$

- the market for physical capital clears:

$$K_t = \int_0^1 K_{H,j,t}\, dj \tag{36}$$

- the market for the composite of domestic intermediate goods clears:

$$Y_{H,t} = C_{H,t} + I_{H,t}\left(1 + S(\cdot)\right) + G_{H,t} + X_t \tag{37}$$

- and the aggregate budget constraint of the economy holds:

$$C_t + p_{I,t} I_t \left(1 + S(\cdot)\right) + G_t + DAC_t + FA_{t+1} - (1 + r_t) FA_t = p_{H,t} Y_{H,t} \tag{38}$$

where $FA_{t+1} = A_{t+1} - D_{t+1}$ denotes the net foreign asset position of the country at the end of period t and DAC_t is the dividends adjustment cost.

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