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Abstract

This paper aims at characterizing the Spanish debt consolidation process led between 1996 and 2007 in order to assess welfare and, in particular, the inequality effects involved. For that purpose we built a general equilibrium heterogeneous-agent model capable of exploring the relationship between fiscal policy variables and the endogenous cross-section distribution of income and wealth.

The results show a quite impressive positive welfare gain despite significant transition costs. The simulations point to an increase of inequality during the initial transition period, reversing to more compressed distributions as the economy evolves to its final steady state equilibrium. Overall, the welfare balance is slightly biased towards the wealthier. Furthermore empirical data, or the dynamics of some crucial variables during the consolidation period, lend support to the model simulation results.

JEL Classification: E17, E60, H60, I30.
Keywords: fiscal consolidation dynamics, European Union, heterogeneous agent model, Spain, inequality, welfare.
1 Introduction

The history of the Spanish public administration differs from most of the other western European economies, mainly due to the late establishment of a modern democratic regime based on free elections and on the market-based economy system. From this point of view, Spain’s recent experience is similar to other two Mediterranean countries: Portugal and Greece.

The recent evolution of the Spanish public finances can be divided in two periods, before and after the establishment of democracy. During the dictatorship of Franco, public expenditure grew slowly but steadily, impelled by the 1959 Stabilization Plan, which was a first attempt to open and liberalize the Spanish economy. Concerning the structure of expenditure growth, the major effort was related to public infrastructures and to the development of a social security system. This period was also characterized by strong economic growth (interrupted in 1973 with the first oil shock) and balanced budgets which led to a public debt-to-output-ratio of 12.5% in 1974.

Throughout the democratic period, we can distinguish a first phase between 1975 and 1985, corresponding to the development and consolidation of the welfare state, a second phase, with a first period of fiscal consolidation initiated with the CEE membership in 1985, interrupted by the economic and social crisis in the beginning of the 1990s, and a second fiscal consolidation process (1996-2007) which is focused in our paper. Between 1975 and 1985, during the transition to democracy, total public expenditure almost doubled from 23.5% to 41.6%, and public debt reached 43.7% of GDP. The climb resulted from a succession of strong deficits, low economic growth and also from the creation of the 17 autonomous regions and the corresponding decentralization of a significant part of the public expenditure. The first period of debt consolidation (1986-1988) was mostly revenue-based and led to

\[ \text{\footnote{The dictator Franco died in 20/11/1975, the first election occurred in 15/06/1977 and the new constitution was voted on the 27/12/1978.}} \]

\[ \text{\footnote{For a comprehensive review about the history of the Public Administration in Spain see I. Argimon et al. (1999) and Fernandez (2005).}} \]

\[ \text{\footnote{All policy measures taken during this period resulted from an ample agreement between the most representative political parties and trade unions about wages, employment and social security, signed in October 1977 and known as the Moncloa Pact.}} \]
a small reduction of debt-to-output ratio. However this fiscal adjustment period ended by 1989, due, first, to the incapacity of government to sustain the growing tendency of expenditure resulting from strong social protests and, second, to the economic crisis in the beginning of the 1990s. Budget deficit peaked at 7% of GDP in 1993 and the debt-to-output ratio reached 66.82% of GDP in 1996. The second period of consolidation (1996-2007), by its size and duration, represents an impressive case among the European Countries (UE). After a consolidation attempt in 1992, aborted in 1993, and having as horizon the European and Monetary Union membership, the Spanish authorities entailed an ambitious plan of reforms based on several structural aspects, namely a containment of social expenditure (by tightening eligibility criteria for several social benefit as unemployment and sickness compensation, among others), a reduction of the wage bill while maintaining high levels of public investment together with the implementation of legal and institutional changes aiming at higher budgetary discipline (European-Commission (2007)).

This paper aims at characterizing the debt consolidation processes put forward by the Spanish authorities between 1996 and 2007, in order to assess welfare and, in particular, the inequality effects involved. For that we built a general equilibrium heterogeneous-agent model capable of exploring the relationship between fiscal policy variables and the endogenous cross-section distribution of income and wealth.

We use a dynastic heterogeneous-agent model that includes a continuum of infinitely-lived rational agents who are hit by idiosyncratic wage shocks in an incomplete capital market, following seminal works by Bewley (1983), Imrohoroglu (1989), Huggett (1993) and Aiyagari (1995), among others. The model, based on Aiyagari and McGrattan (1998) and Floden (2001), includes government and the corresponding dynamic budget constraint. Besides including taxes levied on labour and capital, we additionally decompose government expenditure into transfers to private sector, and productive and unproductive spending. While productive expenditure is included in the production function and, through this channel, increases the global productivity of the economy, unproductive spending is only utility-augmenting. The model
also includes optimizing firms endowed with a neoclassical Cobb-Douglas productive function and optimizing households that accumulate savings during “good times” while spending them during “bad times”.

The analysis of a debt consolidation process requires a transition between two steady states. Thus, besides steady-state analysis, transition paths are crucial for the computation of welfare effects and inequality. In order to simulate transition paths imposed by a debt consolidation strategy we follow the methodology of Rios-Rull (1999) and Quadrini et al. (2009). The simulations are conducted under an open economy framework, assuming the existence of a global market for assets, and hence, a common interest rate. This international mobility of capital implies that each country may have either a positive, negative or balanced foreign asset position.

Collecting Spanish data from the AMECO database, we apply the criteria proposed by Alesina and Perotti (1995) in order to detect the successful debt consolidation processes between 1990 and 2010. Secondly, consolidation episodes are identified as active if a permanent debt reduction results mainly from the control of the cyclically-adjusted primary deficit. Third, we further analyze the composition of the cyclically-adjusted primary deficit in order to detect the main sources of consolidation. Fourth and finally, we use our model to mimic the Spanish consolidation processes while assessing the welfare and inequality costs involved.

The paper is organized as follows. In section 2 we describe the model, and define the social (aggregate) welfare metric. The Spanish consolidation strategies are analyzed in section 3. We proceed with the simulations and discuss the main results in section 4, and conclude in section 5.

2 Model

The model is built from a standard growth model modified to include a role for government together with an uninsured idiosyncratic risk and liquidity/borrowing constraints. We rely on the original models of Aiyagari and McGrattan (1998) and Floden (2001) modified to break government expenditure into productive and unproductive. While the former is taken to be utility
augmenting through inclusion in the utility function, the productive expenditure is considered as input to the productive function. We also use a different approach for the calibration of the idiosyncratic shock.

We set up an open economy framework composed by two countries or regions, in which capital is assumed to flow freely across borders; labour, instead, is assumed not to flow across countries. Since, we want to analyse, in particular, fiscal consolidation processes in Spain, we take Spain as the domestic block, with a corresponding weight measured by the Spanish GDP over the EU15 GDP, $p$. Likewise, the foreign (“rest of the world”) block, with weight $(1 - p)$, includes all the other EU15 countries (EU15-1) and is assumed to act passively to the debt reduction process in Spain. Both blocks are identical except for the size and for the path of the fiscal policy instruments. Each country is composed by three types of agents: households, firms and government, who behave alike except for the consolidation effort (shocks delivering debt adjustment).

The model intends to provide an adequate analytical tool to assess welfare gains from consolidation processes. Moreover, since the model relies on an heterogeneous-agent framework, it will also be able to produce results in terms of inequality effects.

2.1 Households

There is a continuum of infinitely-lived agents of unit mass who receive after-tax wage payments, $\tilde{w}$, after-tax interest from savings, $\tilde{r} \tilde{a}$, and transfers, $tr$, from the government. Following Barro (1973), Floden (2001) and Floden (2003), we consider that, besides private consumption, $\tilde{c}$, and leisure, $l$, unproductive government spending, $g_u$, also contributes to households’ utility at decreasing returns depending on a parameter, $\vartheta$. In each period, agents are hit by idiosyncratic shocks, $e_t$, which determines the productivity level. Borrowing is allowed only up to a certain limit $\tilde{b}$ and complete capital markets are ruled out. This implies that agents have to ensure themselves by saving during “good times” ($\tilde{a}_{t+1} - \tilde{a}_t > 0$) while, during “bad times”, savings are negative ($\tilde{a}_{t+1} - \tilde{a}_t < 0$). Each agent is endowed with one unit of time
and solves the double problem of choosing between labor and leisure, and between consumption and saving.\footnote{In order to stabilize the model some variables have to be defined as a percentage of output (Y). Namely: $\tilde{w}_t = \frac{w_t}{Y_t}$, $\tilde{c}_t = \frac{c_t}{Y_t}$, $\tilde{a}_t = \frac{a_t}{Y_t}$, $tr_t = \frac{TR_t}{Y_t}$, $g_{ut} = \frac{G_{ut}}{Y_t}$, and $b_t = \frac{b_t}{Y_t}$.}

In particular, for each country, each household solves the following optimization problem:

$$\max_{\tilde{c}_t, l_t, \tilde{a}_{t+1}} \mathbb{E} \left[ \sum_{t=0}^\infty \beta^t (Y_t)^{1-\mu} (u_1(\tilde{c}_t, l_t) + \vartheta u_2(g_{ut})) | \tilde{a}_0, e_0 \right]$$  \hspace{1cm} (2.1)

Subject to:

$$\tilde{c}_t + \tilde{a}_{t+1} = \tilde{w}_t (1 - l_t)e_t + (1 + r_t)\tilde{a}_t + tr_t , \quad \tilde{c}_t \geq 0, \quad \tilde{a}_t \geq -\tilde{b}$$ \hspace{1cm} (2.2)

The household’s instant utility functions are specified as:

$$u_1(\tilde{c}_t, l_t) = \frac{\tilde{c}_t^{1-\mu} \exp(- (1-\mu)\zeta (1-l_t)^{1+\gamma})}{1-\mu}$$  \hspace{1cm} (2.3)

where $\mu$ represents the degree of risk aversion, $\zeta$ is constant related to average labor supply, and $\frac{1}{\gamma}$ represents the labor supply elasticity, and

$$u_2(g_{ua}) = \frac{g_{ua}^{1-\mu}}{1-\mu}$$ \hspace{1cm} (2.4)

The productivity shock, $e_t$, is an idiosyncratic shock that evolves stochastically over time according to the following process: the natural logarithm of $e_t$ is represented by an AR(1) process with a serial correlation coefficient $\rho$ and a standard deviation $\sigma$:

$$\log(e_t) = \rho \log(e_{t-1}) + \epsilon_t$$ \hspace{1cm} (2.5)

2.2 Firms

Firms are characterized by a neoclassic production function. Output in each country, $Y$, is produced using capital, $K$, labour, $N$, and productive government spending, $G_p$.
\[ Y_t = F(K_t, N_t, G_{pt}) = (K_t)^\alpha (N_t)^{1-\alpha} (G_{pt})^\eta \] (2.6)

Productive government spending is identified with the share of public gross investment on output, in line with Barro (1990) and Auschauer (1989), and enters as an input to private production.\(^7\)

The parameters \( \alpha \) and \( \eta \) represent, respectively, the output elasticities relative to private capital and to productive government expenditure. The production function exhibits constant returns to scale over private inputs but increasing returns over all inputs. Assuming competitive markets of goods and inputs, private factors are paid according to their marginal productivity and output is exhaustively distributed. Thus:

\[ \tilde{w}_t = (1 - \tau_t) F_N(K_t, N_t, G_{pt}) Y_t \] (2.7)

\[ \bar{r}_t = (1 - \tau_t)(F_K(K_t, N_t, G_{pt}) - \delta) \] (2.8)

where \( \tau \) is a proportional income tax rate levied in each country on labour and capital and \( \delta \) is the depreciation rate of capital. We must point that the pre-tax level of interest rate, \( r \), is fixed in the international capital market.

### 2.3 Government

Government promotes both productive and unproductive expenditures, collects taxes and pays lump-sum transfers to households, facing the following budget constraint in real terms:

\[ g_{ut} + g_{pt} + tr_t + (\bar{r}_t + 1)d_t - d_{t+1} = \tau_t(1 - \delta k_t) \] (2.9)

where, \( g_{pt} \), \( k_t \) and \( d_t \) represent respectively, public gross investment (productive expenditure), private capital and government debt as a percentage.
of output.

2.4 Asset market equilibrium

Finally, expression (2.10) represents the international asset market clearing condition when the output-weighed sum of aggregate asset holdings in each country \( i \), \( \pi^i \), equals the output-weighed sum of private capital demand plus public debt of both countries (domestic country together with “the rest of the world” block). As before, all variables are expressed as a percentage of output.

\[
\sum_i p_i \pi^i_t = \sum_i p_i (k^i_t + d^i_t), \quad i = 1, 2. \tag{2.10}
\]

2.5 Solving the model

The analysis of a debt consolidation process requires moving between two steady states. In order to simulate the transition paths imposed by the Spanish debt consolidation strategy we closely follow Quadrini et al. (2009), Ljungqvist and Sargent (2004), Rios-Rull (1999) and Auerbach and Kotlikoff (1987).

We consider a planner who inherits at time \( t \) a predetermined state vector, including initial debt-to-output ratio, chooses a vector of control or decision variables for each period within a given horizon in order to reach a new state vector that includes a previously announced target for the debt-to-output ratio at the end of the planning period (Fuente (2000)). We present the expected life time utility maximization problem in a recursive form, using the principle of optimality and the Bellman equation as in Quadrini et al. (2009).

For each country, let \( \{r_t, \hat{w}_t\}_{t=0}^T \) be a deterministic sequence of prices (interest rate and wage). Let \( \{d_t, g_{ut}, g_{pt}, tr_t\}_{t=0}^T \) be a sequence of government policy. The optimal choice for the single agent is to maximise (2.1) subject to (2.2), (2.7), (2.8), (2.9) and (2.10).

The solution to the agent’s problem of each country delivers all agents de-
cision rules, namely for consumption, $\tilde{c}_t(e_t, \tilde{a}_t)$, leisure, $l_t(e_t, \tilde{a}_t)$, and savings, $\tilde{a}_{t+1}(e_t, \tilde{a}_t)$. These decision rules determine the evolution of the distribution of wealth over $e$ and $\tilde{a}$, denoted by $\lambda_t(e, \tilde{a})$.

**General equilibrium:** consider an initial steady state composed by a set of fiscal policy variables $\{d_0, g_{d0}, g_{pl0}, tr_0\}$, a vector of equilibrium prices, $\{r_0, \tilde{w}_0\}$, and a stationary distribution, $\lambda_0(e, \tilde{a})$ for each country.

The general equilibrium is defined by a sequence, for each country $i$, of: (i) government policies, $\{d_i^t, g_{ui}^t, g_{pt}^t, tr_i^t\}_{t=1}^{\infty}$; (ii) agents decisions, $\{\tilde{c}_i^t(\tilde{a}_i^t, e_t), l_i^t(\tilde{a}_i^t, e_t), \tilde{a}_{i+1}^t(\tilde{a}_i^t, e_t)\}_{t=1}^{\infty}$; (iii) prices, $\{r_t, \tilde{w}_i^t\}_{t=1}^{\infty}$ and (iv) distributions $\{\lambda_i^t(\tilde{a}_i^t, e_t)\}_{t=1}^{\infty}$. Such that (a) agent decisions solve (2.1); (b) government budget constraint is fulfilled; (c) assets and labour markets clear, $\sum_i p_i \int \tilde{a}_i^t d\lambda^i = \sum_i p_i (k_i^t(r) + d_i^t)$ and $\int e_t(1 - l_i^t) d\lambda^i = N^i$, for all $\{t, i\}$; and (d) the sequences of $\lambda_i^t(\tilde{a}_i^t, e_t)_{t=1}^{\infty}$ are consistent with the initial steady states, the agent decision rules and the idiosyncratic shock in each country $i$.

**Transition path:** the algorithm for solving the equilibrium transition path of the economy, given a particular parameterization, typically proceeds in three stages (Auerbach and Kotlikoff (1987)). First we solve for the long-run initial steady state of the economy (before the implementation of the fiscal consolidation strategy). Second, we solve for the long-run steady state towards which the economy will eventually converge after full-effects of the fiscal consolidation. Third, we solve for the transition path of the economy between the two steady states.

In particular, the algorithm for running the third step follows Rios-Rull (1999) and involves the following steps: (i) choose the sequences for the common interest rate and for wages in both countries in each period of transition period $r_t$ and $\tilde{w}_i^t (i = 1, 2)$; (ii) take the sequences $\tilde{w}_i^t (i = 1, 2)$ and $r_t$ and solve backwards the value functions to simulate the whole transition for the economy, updating the distributions according to agent’s decisions as to obtain sequences for aggregate asset demand and labour supply; (iii) adjust

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8 Remember that $r_0$ must be equal for both countries given that complete financial integration holds.
the sequences in order to clear asset and labour markets for each period of
the transition path; (iv) repeat steps (ii) and (iii) until the three sequences
converge and all markets clear.

2.6 Social welfare computation

The utilitarian social welfare, $U$, is defined as the solution of (2.1) across all
households (i.e, conforming the stationary distribution):

$$U = \int E_0 \sum_{t=0}^{\infty} \beta^t u(c_t, l_t, G_{ut}) \, d\lambda_t(a, e)$$  \hspace{1cm} (2.11)

Since the utility function is concave, the utilitarian social welfare is in-
fluenced by the distribution, and thus, higher inequality or uncertainty will
reduce welfare. Considering a policy change that moves an economy from
equilibrium A to equilibrium B, we define the welfare gain ($w_u > 0$) or loss
($w_u < 0$), in percentage of life-time consumption:

$$\int E_0 \sum_{t=0}^{\infty} \beta^t u((1+w_u)c_t^A, l_t^A, G_{ut}^A) \, d\lambda^A_t(a, e) = \int E_0 \sum_{t=0}^{\infty} \beta^t u(c_t^B, l_t^B, G_{ut}^B) \, d\lambda^B_t(a, e)$$  \hspace{1cm} (2.12)

2.7 Calibration

Preferences: $\mu$ is set at 1.5, a value of standard use in the literature. For $\gamma$
we follow, among others, Floden (2001) and set it to 2 which is equivalent to a
wage elasticity of labour supply equal to 0.5. The parameter $\zeta$ is set in order
to match an average labour supply of around 0.3 ($\zeta = 9.145$). Finally, for
the preferences towards public goods and services relative to private goods,
the baseline calibration sets $\vartheta = 0.1$.\footnote{10}

\footnote{9}{The solution is represented by a sequence of consumption and leisure to infinity \$\{c_t, l_t\}_{t=0}^{\infty}\$.}

\footnote{10}{It is not usual to find across the literature $g_u$ as an argument in the utility function. Moreover, for the few studies where it is considered there is no homogeneous value for the calibration. In our model, values larger than $\vartheta = 0.1$ are not compatible with meaningful values for policy variables observed in the EU nor in most of the developed countries.}
**Technology:** the production function is inspired in Barro (1990) to incorporate productive government spending. For our baseline model we follow Auschauer (1989) and set $\eta = 0.3$. For the capital share, $\alpha = 0.3$ (Aiyagari and McGrattan (1998) and Floden (2001)).

**Discount factor and interest rate:** according to our model, $r = \frac{\alpha}{k} - \delta$. We set $\delta = 7.5\%$ as in Aiyagari and McGrattan (1998) and D’Auria et al. (2010). The variable $k$ represents the capital-to-output ratio and the steady-state value is calibrated as to match the average value of the capital to output ratio of the EU15 countries (1990-2008). Thus, the steady-state value for the real interest rate yields 2.8%, in a yearly base which implies $\beta = 0.981$.

**Government:** governments are characterized by a set of fiscal indicators $\{d, tr, g_u, g_p\}$. Using the AMECO database, we calibrate policy variables as to match the Spanish consolidation episodes that occurred between 1996 and 2007. Specific values are released throughout section 3. For the countries weight, we set $p = 0.0787$ for Spain which represents the average Spanish output proportion in the GDP of the EU15 between 1990 and 2010 and $(1 - 0.0787)$ for the remain EU15 countries.

**Idiosyncratic shock:** following the procedure of Tauchen (1986), the idiosyncratic shock is replicated as a first order Markov chain specification with seven states to match a first order autoregressive representation as followed by, among others, Aiyagari (1994).

Aiyagari (1994), Aiyagari and McGrattan (1998) and Floden (2001) draw on empirical data for earnings and annual hours worked to set $\rho$ and $\sigma$. Due to unavailable empirical data, we follow a different procedure. As in Rios-Rull et al. (2003) we set both parameters as to match the existent inequality in Spain, as measured by the disposable income Gini index. According to the OECD, Stat, the disposable income Gini index varies between 0.35 and

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11 In a recent paper D’Auria et al. (2010) estimated $\alpha = 0.35$ for the EU15 over the period 1960-2003.

12 Source: AMECO database, $k = 2.9$ for the EU15.

13 See Table 2 below.
0.31 during the period 1991-2008. Thus we set \( \rho = 0.8 \) and \( \sigma = 0.27 \) which leads to a disposable income Gini index of around 0.33.

3 Identification of the consolidation strategies

In order to characterize debt consolidation processes, we proceed following the approach in the seminal paper by Alesina and Perotti (1995) which identifies “significant fiscal impulses” in OECD countries between 1960 and 1992, in order to study the determinants of “successful” budget consolidation processes. In particular, they define “significant” changes in fiscal policy stance using a cyclically adjusted measure of government primary balance and set several cut-off points. Moreover, a fiscal adjustment in year \( t \) is defined as “successful” if the gross debt/GDP ratio in year \( t + 3 \) is at least 5 percentage points lower than in year \( t \).

In our approach, we apply the criteria used by Alesina and Perotti (1995), but proceed backwards to detect all episodes of “successful” debt consolidation in Spain between 1990 and 2010. We start by identifying the periods where debt-to-output ratios are, at least, five percentage points below the value observed three years before. Then, we proceed with identifying the determinants leading to such positive debt dynamics - primary deficit, snow-ball and stock-flow adjustments (for more details on the definitions, see European-Commission (2009)). Consolidation episodes are identified as active if the reduction in the cyclically-adjusted primary deficit dominates. We further analyze the budget composition in order to detect the main sources of primary balance adjustment. Finally, we use our model to mimic each consolidation process while assessing the welfare costs involved.

Figure 1 shows the Spanish debt dynamics. The clear columns show the debt level and the dark columns show the debt variation \( (d_t - d_{t-3}) \). From 1990 to 2010, we identify nine successive episodes in which the successful criteria verifies, starting at 1996 and ending in 2007. From 1996 to 2007, the debt-to-output ratio decreases from 66.82\% to 36.24\%. 

In order to extract (active) fiscal consolidation processes, we decompose debt dynamics as usual (see, among others, European-Commission (2009)):

\[ D_t = D_{t-1} (1 + i_t) + PD_t + SF_t \]  

(3.1)

Where, \( D \) stands for government debt, \( PD \) for general government primary deficit, \( SF \) for the stock-flow adjustment and \( i \) for nominal interest rate paid by the government.

Equation (3.1) can be re-written in terms of debt-to-output dynamics as:

\[ \frac{D_t}{Y^n_t} - \frac{D_{t-1}}{Y^n_{t-1}} = \frac{D_{t-1}}{Y^n_{t-1}} \left( i_t - n_t \right) + \frac{PD_t}{Y^n_t} + \frac{SF_t}{Y^n_t} \]  

(3.2)

Where \( Y^n \) is GDP at current market prices and \( n \) stands for the corresponding growth rate. The first term of the right part in equation 3.2 refers to the snow-ball effect (SB).
Figure 2 shows, for each of the 9 successful consolidation periods the (3-year) debt decomposition into primary deficit (PD), snow-ball (SB) and stock-flow adjustments (SFA) as presented in equation 3.2. Table 1 presents the cumulative values of each effects (in % of GDP, including the cyclic- cal (PD(cycle)), and cyclically-adjusted (PD(adj)) components of primary deficit) for the whole consolidation period. According to the data presented we can identify the Spanish fiscal adjustment as an active consolidation process, since debt reduction process was mainly driven by the control over the cyclically-adjusted primary deficit. For a debt-to-output reduction of 30.58 percentage points, the cyclically-adjusted primary deficit accounts for a re- duction of 21.43 percentage points.

To characterize the cyclically-adjusted budget deficit reduction, the model considers a single instrument on the revenue side, the tax burden, and three instruments on the expenditure side: final consumption, social transfers other than in kind and gross capital formation, as in European-Commission (2009). Figure 3 exhibits accordingly the cyclically-adjusted actual evolution of each of the four fiscal instruments. Spending was adjusted for the cyclical component by applying the elasticity of total expenditure (excluding interest rate) relative to the cycle to all items. Similarly, for the tax burden, we used the total government revenue elasticity. Elasticities were calculated from the AMECO Database series. During the whole consolidation process, we can see a decrease in social transfers, along with a slight increase in public
investment. On the other side, the tax burden increased especially during the second-half part of the adjustment. Table 3 summarizes the initial (1996) and final (2007) values (% GDP) for each cyclically-adjusted primary deficit components and debt relative to the whole process.

<table>
<thead>
<tr>
<th>Country</th>
<th>Debt Reduction</th>
<th>PD(adj)</th>
<th>PD(cycle)</th>
<th>SB</th>
<th>SF</th>
</tr>
</thead>
</table>

Table 1: Contributions to the overall debt reduction - Spain.
Source: European-Commission (2009) and AMECO database.

Summing up, and according to the data in Figure 3 and Table 2, the Spanish consolidation is identified as a mixed strategy based on taxes (especially during the second half period) and a reallocation of social transfer towards public investment expenditure.

Figure 3: Spanish cyclically-adjusted primary deficit components (% of GDP) - tax burden and final consumption (left-hand scale); social transfer other than in kind and gross fixed capital formation (right-hand scale).
Source: European-Commission (2009) and AMECO database.
4 Assessment of the welfare and inequality impacts

After having identified and classified the Spanish consolidation episode, we proceed with the simulations using the model presented in section 2. Debt and fiscal instruments other than taxes are adjusted to match the described consolidation process.\textsuperscript{14} Tax rate is endogenous, adjusting to satisfy the government budget constraint. As for the “rest of the world” block, we use the average values for each fiscal variables of the EU15-1 countries for the same period.

Figure 5 depicts the impulse response of some of the main relevant macroeconomic variables to the simulated debt-consolidation effort. The dynamics of the macroeconomic and inequality variables depend strongly on the instruments used during the fiscal adjustment. As it can be seen, tax effort implies a decrease in the after-tax wage during the initial phase, depressing the disposable income (also affected by the social transfer cuts). Households work and save less pushing up the interest rate, which depresses the private capital level and leads to a temporary recession. In the second phase, the economy evolves towards its final steady state: interest and tax rates decrease, converging to a lower level relative to the initial steady state while disposable income, labour supply and consumption converge to higher levels.

Concerning capital flows, figure 4 illustrates the asset demand and supply adjustments that have occurred during the two different phases of debt

\begin{table}[h]
\centering
\begin{tabular}{|c|c|c|c|c|c|c|}
\hline
 & Initial values (1996) & & Final values (2007) & \\
\hline
 & $d_t$ & $tr_t$ & $g_u$ & $g_p$ & $d_t$ & $tr_t$ & $g_u$ & $g_p$ \\
\hline
 & 66.82 & 13.50 & 17.50 & 3.10 & 36.24 & 11.60 & 17.50 & 3.80 \\
\hline
\end{tabular}
\caption{Characterization of the Spanish consolidation strategy. Source: European-Commission (2009) and AMECO database.}
\end{table}

\textsuperscript{14}For each simulation we calibrate our model according to section 3 using the values presented in Table 2 for debt and fiscal instruments.
consolidation. The first phase of consolidation is dominated by a significant asset demand decline leading to an excess of asset supply and, thus, a decrease in net foreign asset position. Conversely, during the second phase, the combination of an increase in disposable income together with the accrued need for insurance due to social transfers cuts, leads to a growing demand for asset holdings that ends up exceeding the initial steady state level causing an excess of asset demand, supplied by foreign assets. Capital flows outward and Spain improves its net foreign asset position.

(a) Phase 1

(b) Phase 2

Figure 4: International asset market.
Table 3 summarizes for the period of debt consolidation, the overall welfare gains (transition plus steady-state), the magnitude of transition costs as a percentage of final relative to initial steady-state welfare gain, the Welfare Gain Intensity (WGI) and the Total Spending Cut (TSC). The WGI refers to the welfare gain per percentage point of debt reduction while TSC measures the combined reduction in social transfers and unproductive expenditure per percentage point of debt reduction. The Spanish fiscal adjustment implies a net improvement of life-time consumption about almost 20%. The transition
costs represent about 25% of the potential welfare gain. These costs are strongly associated with the tax effort and the corresponding disincentive effects on savings and labour supply. The values for the welfare gain intensity (WGI) and the total spending cut (TSC) are relatively small proving that this consolidation process was of a gradual nature.

<table>
<thead>
<tr>
<th>Debt Reduction</th>
<th>Welf. Gain</th>
<th>Trans Cost</th>
<th>WGI</th>
<th>TSC</th>
</tr>
</thead>
<tbody>
<tr>
<td>30.58 (1996-2007)</td>
<td>0.1936</td>
<td>25.4%</td>
<td>0.0063</td>
<td>0.06</td>
</tr>
</tbody>
</table>

Table 3: Welfare analysis.

Concerning inequality, both wealth and disposable income Gini indexes increase during the first phase due to the transfer cuts. In the second phase, as the economy evolves towards its final steady state, wealth and disposable Gini indexes decrease gradually to a final lower, steady-state levels (see Table 4). Thus, after an increase in inequality during transition, fiscal consolidation entails improvements in the distribution of both wealth and income. This effect can be explained by a mechanism operating through the labour market where the labour supply elasticity of wage is higher among the richer. With increase net wages, the substitution effect dominates for the richer, compressing the disposable income distribution. The improved wealth distribution results from the higher marginal propensity to save of the poorer.

However, if we take a broader measure like the welfare distribution of the fiscal adjustment, results are not as favorables. Figure 6 shows the welfare gain curve (solid line) across wealth (asset holding); it also shows the initial distribution of wealth (dashed line). The slight positive slope of the welfare gain curve indicates that the richer are the ones who benefit more from the consolidation episode. Viegas and Ribeiro (2011) have shown that the welfare distribution moves negatively with debt and positively with transfer and unproductive expenditures while productive expenditures are neutral. Decreasing social transfers as well as unproductive expenditures leads to a

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The potential welfare gain corresponds to the final steady-state level of welfare compared to the initial steady state, without taking account for the transition period.
worse welfare distribution. Differently, debt reduction should improve the welfare distribution. Apparently, in terms of welfare inequality, transfer and unproductive spending effects have dominated over the debt effect during the Spanish consolidation process: despite debt reduction, welfare inequality across wealth increased (despite the positive welfare gain for every household).

Figure 6: Welfare gains across wealth following debt consolidations.

The definition of welfare includes consumption, leisure and unproductive expenditures (public services). The global negative effect on the welfare distribution results from the dynamics of all these individual variables affecting welfare. As shown in Figure 5, both disposable income and wealth Gini indexes present an humped shaped curve before converging to lower final levels (see Table 4).

In order to make a simple test on the robustness of our results, we have collected data on actual disposable income Gini coefficient (Figure 7) and on the net foreign asset (NFA) position (Figure 8) for Spain, during the consolidation process. Although income distribution depends on the dynamics of multiple variables, some of which are missing from our model, the initial
humped shaped curve and the afterwards downward path to a lower level relative to the initial level seem to lend support to the prediction of our model. As inequality, capital flows also depend on many other factors which the model fails to capture. Nevertheless, the downward path of NFA in Figure 8 confirms the initial inward flow of capital and the depressed NFA position described above (see Figure 5). However empirical data fail to replicate the second phase when capital flows out, increasing above the initial level. Thus, the actual dynamics of the Gini coefficient and the NFA can be partially justified by the fiscal consolidation strategy.

<table>
<thead>
<tr>
<th>Initial S. State</th>
<th>Final S. State</th>
</tr>
</thead>
<tbody>
<tr>
<td>WG</td>
<td>IG</td>
</tr>
<tr>
<td>0.3384</td>
<td>0.3297</td>
</tr>
</tbody>
</table>

Table 4: Debt consolidation effects on inequality - Spain.
Notes: WG = Wealth Gini index; IG = Income Gini index.

Figure 7: Effective disposable income Gini coefficient (1996-2007).
Source: OECD.Stat.
5 Conclusion

By using a general equilibrium model with heterogeneous agents, we simulate the Spanish consolidation episode that occurred between 1996 and 2007 to assess the underlying welfare and inequality effects. We use the endogenous cross-section distribution to compute several inequality indexes and we also assess the aggregate welfare intensity measured as a percentage change of life-time consumption.

Our results show a quite impressive positive net welfare gain, representing almost 20% of life time consumption. However, the transition costs are also significant, reducing in more than 25% the potential (gross) welfare gain. According to our simulation the final output level increases 16.37% relative to the initial level. But the initial fiscal effort depresses strongly the economy: during the first phase, output decreases 16.17%, recovering the initial output level only after six years.

This upfront recession affects strongly the poorer, as it can be seen through the Gini indexes paths. However, the wealth and disposable income distributions become more compressed as the economy moves towards the final steady state equilibrium. Summing up, in terms of welfare there is a slight bias towards the wealthier, which means that consolidation costs were mostly supported by the poorer.

Finally, the empirical data observed during the consolidation period can
be partially explained by our debt-modeling process. The observed disposable income Gini index path reproduces the humped-shaped curve of the model. As for international flows of capital, the model reproduces the initial deterioration of the Spanish NFA position. However, data do not confirm (at least yet) the asset demand recovery and the reversal in the NFA position, which surpasses the initial steady state level as the economy evolves to the final steady-state equilibrium.

References


