CHAPTER 6

# Debt and Social Security

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## 6.1 Introduction

The fiscal deficit of several countries around the world reached its highest point in early 2007 when the global financial crisis began to approach one country after another. The result of this economic volatility is the excessive debt growth of the countries that have entered this crisis in recent years. Several countries are still suffering from the effects of the crisis today, searching the right formula to exit this unpleasant situation.

In the aftermath of the most recent (2008) financial crisis and its subsequent debt crisis, several countries have realized the effect that social security had in their sovereign debt and have tried to find measures to contain it. Of course the contribution of social security to the country debt very much depends on the system each country operates and the

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(in)dependence of social security from the government budget. The mix in some countries became even more explosive due to the increase in unemployment, the decrease in social security contribution and the drop in the fertility and replacement rate. The debate is vivid both in the United States and in the European countries, as the authorities and the practitioners argue whether Social Security adds to the country debt. At the same time, one needs to recall that social security (almost independently from the system in force) is one of the top investors—lenders of the country as it puts the majority of its accumulated funds into government bonds. In this chapter we seek evidence of the contribution of social security to the debt of the countries, especially the ones that faced serious debt burden over the last decade with the use of a series of econometric models (pooled OLS, fixed effects and random effects). We realize that the relationship between debt and social security appears to be quite robust and may be one of the most important issues that certain countries still may have to face. Although several researchers have investigated the variables that affect government debt, few of them have examined the determinants of private debt and its impact on the global economy, especially in the context of social security and pensions. This chapter attempts to capture the link between public debt or private debt and a series of pension and social security proxies, and there lies its contribution to the field. The novelties of the study are the consideration of a series of countries (and not a single one), the breadth of the pension and social security variables introduced, the simultaneous investigation of public and private debt, as well as the employment of a series of econometric models.

## 6.2 Literature Review

The available literature is separated in three main strands; the research that deals with public debt; the studies that treat private debt; and finally the papers that tackle social security along with public and private debt.

### *6.2.1 Public Debt*

Three main features have been noted in the literature considering public debt management. Giavazzi and Pagano (1990) and Calvo and Guidotti (1990) have identified and modelized efficiently the problem of variation of fiscal policies. A different approach has been proposed by Barro (2003) who tried to structure the public debt in a way where the tax

revenue could be appropriately decreased given that public expending works exogenously in an applicable environment. Furthermore, Missale et al. (2002), as well as Giavazzi and Missale (2004), attempt to tackle the stability of the public debt over Gross Domestic Product (GDP). All three approaches end up in similar conclusions: the optimized strategy for public debt management should be followed by an increase in the average maturity and the partial indexation of public debt.

On the other hand, Georges (2006) contradicts with many authors and suggests that a short maturity of the public debt is on average cheaper and can imply less risk to the public budget. Through an analysis that considers the effect of several maturity frameworks on interest rate and on primary surplus for Canada, Georges (2006) observed that when both effects are considered, the trade-off between cost and risk can decrease.

As Wolswijk and de Haan (2006) have noted, following the creation of the Eurozone, a combination of a decrease in the foreign exchange risk, increases in the maturity of the public debt, use of derivatives (swaps) and inflation-linked government bonds, was observed. Although this strategy has not been enough to prevent the harmful effect of the crisis of 2007 in the European countries, Anderson et al. (2010) based on a sample of 24 emerging economies, pointed out that the improvement in the public debt management (particularly the increase in the maturity of the public debt) moderated the impact of the crisis in those countries.

### *6.2.2 Private Debt*

According to Myers (1984), firms facing high costs of asymmetric information will use external funds only when internally generated funds are not adequate. If external funds are required, the firm will issue the "safest" security first—the one whose value changes least when inside information is revealed to the market—first debt and then, only as a last resort, equity. Because private debt lenders are better informed through monitoring and screening, and are usually senior (Welch, 1997) and collateralized (Rajan & Winton, 1995), it is hypothesized that private debt will be a safer instrument than arm's length debt, holding constant the degree of information asymmetry between the firm and the outside market. Thus, firms with higher levels of asymmetric information, and a higher probability of default, will issue private debt before public debt. As the degree of asymmetric information decreases, the scale of safety becomes less important, and the debt choice for firms with lower asymmetry will be determined by

other factors—e.g. transactions costs, the flexibility of covenants (Gilson & Warner, 1997), credit quality (Diamond, 1991) and the possibility of rent extraction by banks (Rajan, 1992).

Bank debt and non-bank private debt differ in terms of regulatory requirements, maturity, placement structure and the concentration and identity of debtholders. This regulation allows companies to market debt directly to private institutional investors rather than going through the more time-consuming public securities issuance process. Carleton and Kwan (1995) describe non-bank private loans as tightly held and relatively illiquid. In addition, non-bank private loans tend to have lower flotation costs than public issues and have custom-designed covenants.

### *6.2.3 Social Security*

Several studies have analyzed public pension and population aging in economic growth models (e.g. Futagami & Nakajima, 2001; Meijdam & Verbon, 1997; Pecchenino & Pollard, 1997; Pecchenino & Utendorf, 1999). However, these studies do not consider a social security policy together with public debt. Gertler (1999), who modified the Blanchard (1985) and Weil (1989) framework in order to allow life-cycle behavior, analyzed social security as financed by public debt. However, his study assumed a perfect annuity market, and the analysis was therefore unable to capture the economic impact of a pension reform toward an actuarially fair scheme.

Ono (2003) develops an overlapping generations model of growth and aging according to the model suggested by Pecchenino and Pollard (1997), and then uses this framework to analyze the economic impact of social security financed by public debt. Ono (2003) argues that when an economy with an aging population is heavily burdened with social security payments and the government issues public debt to finance payments, the economy experiences a dynamically inefficient equilibrium characterized by excessive savings, i.e. overaccumulation of capital.

Werding (2006) shows that implicit pension debt related with pay-as-you-go public pension schemes, is an important driver of the long-term sustainability of general government finances. At the same time he realizes that unfunded pension schemes potentially have a negative effect on human capital accumulation and thus on future contributions.

Bovenberg and van Ewijk (2011) argue that more private retirement saving is necessary to maintain old-age incomes under a debt crisis that

dictate the cut of public pensions; and that private saving in pension funds may prove to be a stabilizer of sovereign debt markets.

Mendonça and Tiberto (2014) confirmed that the social security deficit significantly contributes to an increase in the public debt in the case of Brazil only. Regarding the effects on social security, it was observed that an increase in the level of formality in the economy reduces the deficit. In contrast, Mendonça and Tiberto (2014) show that a reduction in income inequality, a real increase in the minimum wage, and an increase in health benefits imply an increase in the social security deficit. Therefore, these variables play a crucial role in the search for an efficient social security management system and cannot be overlooked in ensuring fiscal sustainability.

Poufinas and Kouskouna (2016) discuss a potential way to rearrange social security contributions so that they alleviate the burden of the state and at the same time create value for the state and the society. They employ an actuarial model to split the contributions to defined benefit and defined contribution schemes. This facilitates the transition from defined benefit to defined contribution pension schemes in a way that optimizes the output for the beneficiaries. The same authors show, with the use of econometric models, that such a split may be beneficial for the growth of the country (Poufinas & Kouskouna, 2017).

The evolution and determinants of China's social security debt, its spread in the different provinces and its projection in the future is discussed in Li and Lin (2019). The authors recommend an increase in social security revenue through the reduction of contribution evasion; an increase in the (investment) return to the social security fund; a decrease in the social security expenditure via a reduction of the replacement rate, an increase of the retirement age and unification of the social security system within the country; and a shift to a defined contribution social security system.

The topic has been discussed also by governments and policymakers; Huston and Driessen (2020) realize that an increase in social security deficits will lead to an increase of the federal deficits. In addition, if social security begins to run deficits (as the Board of Trustees projects as of 2021), one way the government can finance it is by increasing publicly held debt, next to increasing revenues or reduce its spending elsewhere.

Going now to private debt, Hurst and Willen (2007) use a calibrated life-cycle model to show that when households are allowed to use (part of) their social security wealth to repay their debt or are fully excluded

from social security contributions (when young), then life-cycle planning becomes more effective.

Lin et al. (2019) examine the role of pensions in corporate debt to find a significant and robust relationship between corporate short-term debt ratio and pension liabilities. At the same time they realize that an increase in pension obligations results in an increase in the cost of debt. This effect can be mitigated by short-term debt.

## 6.3 Problem Description and Theoretical Background

The intuition behind the investigation of the influence of social security on debt stems from the effort of countries to contain their government debt at levels that can be sustained by their economic activities in total and in particular by their GDPs. High public debt to GDP can lead to distressed economies and can create problems to other aspects of the economic (and not only) lives of the countries. However, the same holds true with the private debt; high private debt to GDP may result in distressed households and enterprises, which can also lead to further problems for the interested parties, including the country as a whole.

The question that the countries try to answer is what measures to take so as to maintain primarily their public and secondarily their private debt (as a portion of their GDP) at amounts that they can serve. The contribution of social security benefits and in particular pension benefits and spending to debt has long been debated. It came once and again at the forefront during the latest economic crisis, during which in certain countries pension cuts were enforced as a means to sustain debt.

In our research, we try to find evidence of the link between public and private debt (as a percent of GDP) and social security metrics for the countries of interest. We do that with the use of certain econometric models that will be presented in the following sections. At the same time we incorporate in our models other macroeconomic variables that are known or believed to also influence the public and private debt.

Revealing this relationship can be beneficial to the respective authorities and policymakers, as they can decide on the social security and more specifically on the pension benefits they may want to maintain or alter or which other country figures they may want to improve so as to maintain the public and private debt at the desired levels. Countries that have

suffered the most during the latest economic crisis may have experienced higher debt levels compared to countries that have managed to weather the crisis more successfully. As a matter of fact high public and private debt compared to GDP could have been among the causes of heavier suffering. Consequently, tackling or avoiding a potential (new) crisis is in their interest; knowing in advance what to do is of key importance and it requires a global approach rather than the management of one or a few determinants—variables.

## 6.4 Data, Variables and Methodology

### *6.4.1 Data*

Our dataset consists of Australia, Austria, Belgium, Canada, Chile, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Israel, Italy, Japan, Korea, Latvia, Lithuania, Luxembourg, Mexico, Netherlands, New Zealand, Norway, Poland, Portugal, Slovak Republic, Slovenia, Spain, Sweden, Switzerland, Turkey, United Kingdom and the United States. These are essentially the OECD countries.

Our data source is the Organization for Economic Cooperation and Development—OECD (2019) for the public debt (general government gross debt as a % of GDP), the private debt (as a percent of GDP), the pension fund assets (autonomous—in million USD and as a share of GDP), the pension spending (public as a % of GDP), the social expenditure (as a % of GDP), the expenditure in health (current—as a share of GDP), as well as pension benefits (as a share of GDP) and contributions (as a share of GDP) for all countries except for the United States; for the latter the data comes from the Federal Reserve Bank of St. Louis (2019). It is the World Bank (2019) for the unemployment (rate—% of labor force), the inflation (rate—%), the GDP per capita (current USD) and the foreign direct investment—FDI (net inflows, current USD).

Our time series extends from 2001 to 2017, which is deemed a sufficient period for allowing us to draw reliable results.

### 6.4.2 *Descriptive Statistics*

The descriptive statistics of our dataset, i.e. the mean, the 50th percentile, the standard deviation, the variance, the number of observations, the range, the minimum value and the maximum value of the relevant metric are summarized in Table 6.1.

We observe that the inflation exhibits the biggest standard deviation compared with its mean (1.39 times), the benefits the second bigger (1.37 times), whereas the logarithm of the GDP the smallest (0.07 times).

The biggest correlation is that of the contributions with the benefits with a correlation coefficient of 0.891, whereas the smallest is the one of the pension spending with the pension fund assets with a correlation coefficient of −0.442 (Table 6.2).

### 6.4.3 *Variables*

As the purpose of our work is to find potential evidence of the link between debt and social security financials, the variables that are used as measures of debt are the public debt (general government gross debt as a % of GDP) and the private debt (as a % of GDP). These are our dependent variables. The social security metrics are measured by the pension fund assets (autonomous—in million USD and as a share of GDP), the pension spending (public as a % of GDP), the pension benefits (as a share of GDP) and contributions (as a share of GDP), as well as the social expenditure (as a % of GDP) and the expenditure in health (current – as a share of GDP). These are our independent variables. However, as the level of both public and private debt depends on other variables we use as control variables the unemployment (rate—% of labor force), the inflation (rate—%), the GDP per capita (current USD), and the foreign direct investment—FDI (net inflows, current USD), which all go on the independent variable side.

In our models we use the notation in Table 6.3.

**Table 6.1** Descriptive statistics

| *Descriptive statistics* | *BEN* | *CON* | *EXP* | *LEXP* | *LGDP* | *INF* | *PENS* | *PENA* | *PPS* | *PRD* | *SOC* | *UNEMP* | *PUD* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Mean | 1.461 | 2.118 | 8.337 | 23.03 | 10.21 | 2.576 | 30.60 | 10.50 | 7.217 | 199.8 | 19.56 | 7.799 | 58.91 |
| p50 | 0.367 | 0.927 | 8.254 | 23.16 | 10.37 | 2.116 | 9.299 | 10.57 | 6.807 | 193.1 | 19.49 | 6.953 | 48.51 |
| SD | 2.004 | 2.599 | 2.143 | 1.780 | 0.718 | 3.573 | 38.59 | 2.743 | 3.383 | 70.93 | 5.773 | 4.222 | 40.04 |
| Variance | 4.016 | 6.756 | 4.593 | 3.168 | 0.515 | 12.76 | 1489 | 7.525 | 11.45 | 5031 | 33.32 | 17.83 | 1603 |
| *N* | 484 | 502 | 612 | 570 | 612 | 612 | 578 | 577 | 552 | 558 | 607 | 537 | 612 |
| Range | 10.05 | 15.38 | 12.98 | 12.81 | 3.640 | 58.88 | 184.2 | 22.82 | 16.24 | 427.5 | 27.42 | 25.66 | 232.7 |
| Min | 0 | 0 | 4.139 | 14.51 | 8.045 | −4.478 | 0 | −6.215 | 0.844 | 61.62 | 4.793 | 1.805 | 3.664 |
| Max | 10.05 | 15.38 | 17.12 | 27.32 | 11.69 | 54.40 | 184.2 | 16.61 | 17.09 | 489.2 | 32.21 | 27.47 | 236.3 |

*Note* BEN: Benefits as a share of GDP, CON: Contributions as a share of GDP, EXP: Current expenditure in health (all functions), LEXP: Foreign direct investment, net inflows (BoP, current US$), LGDP: GDP per capita (current US$), INF: Inflation, consumer prices (annual %), PENS: Pension funds (autonomous) Assets as a Share of GDP, PENA: Pension funds (autonomous) US Dollar, Millions, PPS: Pension spending Public, % of GD, PRD: Private Sector Debt, SOC: Social Expenditure as % GDP, UNEMP: Unemployment, total (% of total labor force) (national estimate), PUD: General government gross debt as %GDP (OECD, 2019)

*Source* Authors' calculations

**Table 6.2** Correlation matrix

| *Correlation matrix* | *PUD* | *PRD* | *BEN* | *CON* | *EXP* | *LEXP* | *LGDP* | *INF* | *PENA* | *PENS* | *PPS* | *SOC* | *UNEMP* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PUD | 1 | | | | | | | | | | | | |
| PRD | 0.0507 | 1 | | | | | | | | | | | |
| BEN | −0.0677 | 0.0988 | 1 | | | | | | | | | | |
| CON | −0.198 | 0.0410 | 0.891 | 1 | | | | | | | | | |
| EXP | 0.408 | 0.269 | 0.440 | 0.290 | 1 | | | | | | | | |
| LEXP | 0.133 | 0.367 | 0.283 | 0.176 | 0.401 | 1 | | | | | | | |
| LGDP | 0.192 | 0.673 | 0.396 | 0.304 | 0.612 | 0.396 | 1 | | | | | | |
| INF | −0.170 | −0.231 | −0.0762 | −0.0143 | −0.299 | −0.144 | −0.367 | 1 | | | | | |
| PENA | −0.0544 | 0.235 | 0.803 | 0.803 | 0.373 | 0.319 | 0.391 | −0.0782 | 1 | | | | |
| PENS | 0.203 | 0.235 | 0.569 | 0.468 | 0.533 | 0.628 | 0.443 | −0.243 | 0.593 | 1 | | | |
| PPS | 0.493 | −0.183 | −0.327 | −0.400 | 0.238 | −0.0552 | 0.0601 | −0.178 | −0.442 | −0.220 | 1 | | |
| SOC | 0.385 | 0.202 | −0.154 | −0.262 | 0.480 | 0.0829 | 0.460 | −0.309 | −0.219 | −0.0339 | 0.757 | 1 | |
| UNEMP | 0.226 | −0.254 | −0.224 | −0.259 | −0.116 | −0.217 | −0.360 | −0.0325 | −0.281 | −0.325 | 0.443 | 0.224 | 1 |

*Note* BEN: Benefits as a share of GDP, CON: Contributions as a share of GDP, EXP: Current expenditure in health (all functions), LEXP: Foreign direct investment, net inflows (BoP, current US$), LGDP: GDP per capita (current US$), INF: Inflation, consumer prices (annual %), PENS: Pension funds (autonomous) Assets as a Share of GDP, PENA: Pension funds (autonomous) US Dollar, Millions, PPS: Pension spending Public, % of GD, PRD: Private Sector Debt, SOC: Social Expenditure as % GDP, UNEMP: Unemployment, total (% of total labor force) (national estimate), PUD: General government gross debt as %GDP (OECD, 2019)

*Source* Authors' calculations

**Table 6.3** Notation

| *Indicator* | *Variable* | *Indicator* | *Variable* |
|---|---|---|---|
| BENEFITS | benefits | FDI | foreign direct investment |
| CONTRI~S | contributions | GDP | GDP per capita |
| PENSI~TS | assets (% of GDP) | INF | inflation |
| PENSI~S | assets (million USD) | UNEMP | unemployment |
| PENSIO~D | spending | PDEBT | public debt |
| EXP SO~L | social expenditure | PRDEBT | private debt |
| EXP HE~H | expenditure in health | | |

*Source* Created by the Authors

### *6.4.4 Methodology*

We regressed the public debt and private debt with the aforementioned social security metrics and macroeconomic variables to identify the potential impact of social security on debt and find potential evidence of whether the decrease of the social security spending or benefits can contribute to the reduction of debt.

For that we employed three models. The first one is the ordinary least squares (OLS) regression, whereas the remaining two are panel data models, namely the fixed effects and the random effects regressions.

Before proceeding to unit root and cointegration tests we test for cross-section dependence. We use the cross-section dependence test (CD test) proposed by Pesaran (2004). CD test strongly rejects the null hypothesis of cross-section independence for all the sample variables. In face of this evidence, we proceed to test for unit roots using the so-called "second generation" tests for unit roots in panel data that are robust to cross-section dependence (see Pesaran, 2015). To examine the stationarity properties of the variables in our models we use the second generation panel unit root tests developed by Maddala and Wu (1999) and Pesaran (2003) both suitable for unbalanced panel data set and cross-section dependence. The null hypothesis of a unit root (non-stationarity) cannot be rejected for all the sample variables. This means that the variables contain a unit root (e.g. integrated of order one) as expected by the visual inspection of their time series. In order to investigate whether a long-run equilibrium relationship exists among the sample variables we implement Pedroni's (1999) ADF-based and PP-based cointegration tests

as well as Kao's (1999) ADF-based tests. Both tests suggest the rejection of the null hypothesis of no cointegration null at any significance level.

#### 6.4.4.1 OLS

We used a multivariate OLS regression on our data using Stata to calculate the coefficients and error terms for public debt and private debt.

$$\begin{aligned}\text{PDEBT} = {} & a + \beta_1 \cdot \text{BENEFITS} + \beta_2 \cdot \text{CONTRI}\sim\text{S} + \beta_3 \cdot \text{EXP HE}\sim\text{H} \\ & + \beta_4 \cdot \text{LogFDI} + \beta_5 \cdot \text{LogGDP} + \beta_6 \cdot \cdot \text{INF} \\ & + \beta_7 \cdot \text{PENSI}\sim\text{TS} + \beta_8 \cdot \text{LogPENSI}\sim\text{S} + \beta_9 \cdot \text{PENSIO}\sim\text{D} \\ & + \beta_{10} \cdot \text{EXP SO}\sim\text{L} + \beta_{11} \cdot \text{UNEMP} + \varepsilon\end{aligned}$$

and

$$\begin{aligned}\text{PRDEBT} = {} & a + \beta_1 \cdot \text{BENEFITS} + \beta_2 \cdot \text{CONTRI}\sim\text{S} + \beta_3 \cdot \text{EXP HE}\sim\text{H} \\ & + \beta_4 \cdot \text{LogFDI} + \beta_5 \cdot \text{LogGDP} + \beta_6 \cdot \cdot \text{INF} \\ & + \beta_7 \cdot \text{PENSI}\sim\text{TS} + \beta_8 \cdot \text{LogPENSI}\sim\text{S} + \beta_9 \cdot \text{PENSIO}\sim\text{D} \\ & + \beta_{10} \cdot \text{EXP SO}\sim\text{L} + \beta_{11} \cdot \text{UNEMP} + \varepsilon\end{aligned}$$

#### 6.4.4.2 Fixed Effects

The fixed effects model is simply a linear regression model in which the intercept terms vary over the individual units $i$, i.e.

$$y_{it} = a_i + x_{it}^{'}\beta + \varepsilon_{it}, \quad \varepsilon_{it} \sim IID\left(0, \sigma_\varepsilon^2\right)$$

where it is usually assumed that all $x_{it}$ are independent of all $\varepsilon_{it}$. We can write this in the usual regression framework by including a dummy variable for each unit $i$ in the model (Verbeek, 2008). That is,

$$y_{it} = \sum_{j=1}^{N} a_j d_{ij} x_{it}^{'}\beta + \varepsilon_{it}$$

where $d_{ij} = 0$ when $i = j$ and 0 elsewhere. We have also assumed the strictly exogenous regressors case in the conditional moments (see Wooldridge, 1995). We have not assumed equal-sized groups in the panel.

The vector $\beta$ is a set of parameters of primary interest, $\alpha_i$ is the group-specific heterogeneity. We have included time-specific effects but, they are only tangential in what follows. Since the number of periods is usually fairly small, these can usually be accommodated simply by adding a set of time-specific dummy variables to the model. Our interest here is in the case in which $N$ is too large to do likewise for the group effects.

#### *6.4.4.3 Random Effects*

It is commonly assumed in regression analysis (Verbeek, 2008) that all factors that affect the dependent variable, but that have not been included as regressors, can be appropriately summarized by a random error term. In our case, this leads to the assumption that the $\alpha_i$ are random factors, independently and identically distributed over individuals. Thus we write the random effects model as

$$y_{it} = \mu + a_i + x_{it}^{'}\beta + \varepsilon_{it}, \varepsilon_{it} \sim IID\left(0, \sigma_{\varepsilon}^2\right); \alpha_i \sim IID\left(0, \sigma_{\alpha}^2\right)$$

where $a_i + \varepsilon_{it}$ is treated as an error term consisting of two components: an individual specific component, which does not vary over time, and a remainder component, which is assumed to be uncorrelated over time. It is also assumed that $a_i$ and $\varepsilon_{it}$ are mutually independent and independent of $x_{js}$ (for all $j$ and $s$).

## 6.5 Regression Summary

The particulars of the regressions we ran appear in the following Tables 6.4 and 6.5 for the public and private debt respectively. The output of all three models, i.e. OLS, fixed and random effects is shown per dependent variable for comparison purposes also.

In Tables 6.4 and 6.5 for each of the independent variables, the first row indicates the coefficients, whereas the second row, where the numbers are put in the parentheses, indicates the standard deviation.

Their explanation is given in the next section and their implications are drafted in the section that follows it.

**Table 6.4** Public debt regression results

| *Public debt* | *OLS* | *Fixed effects* | *Random effects* |
|---|---|---|---|
| Benefits as a shar~P | 3.431** | 6.523** | 6.281** |
| | (1.61) | (2.83) | (2.71) |
| Contributions asa~P | −7.466*** | −4.341* | −4.540** |
| | (1.38) | (2.18) | (2.13) |
| Currentexpenditur~a | 3.305*** | 3.992 | 4.387 |
| | (0.83) | (3.02) | (2.67) |
| Log of Foreign dir~t | −3.006** | −0.518 | −0.504 |
| | (1.32) | (0.83) | (0.81) |
| Log GDP per capita | 8.894** | 2.558 | 2.276 |
| | (3.59) | (4.55) | (4.24) |
| Inflation, consume~u | 1.230 | 0.388 | 0.322 |
| | (0.89) | (0.58) | (0.57) |
| Pensionfunds (aut~t | 0.224*** | 0.141 | 0.144 |
| | (0.06) | (0.15) | (0.14) |
| lPENSION FUNDS | 3.562*** | 0.296 | 0.680 |
| | (1.33) | (0.66) | (0.77) |
| Pensionspending P~D | 7.388*** | 9.967*** | 9.161*** |
| | (0.95) | (3.06) | (2.56) |
| Social Expenditure~P | −2.468*** | −1.243 | −1.476 |
| | (0.60) | (1.48) | (1.27) |
| Unemployment, tota~ | 1.334*** | 1.505** | 1.661*** |
| | (0.46) | (0.66) | (0.61) |
| Constant | −42.45 | −55.64 | −53.24 |
| | (33.59) | (33.46) | (33.00) |
| *R*-sqr | 0.506 | 0.613 | |
| dfres | 330 | 33 | |
| BIC | 3245 | 2486 | |

*$p < 0.10$, **$p < 0.05$, ***$p < 0.01$
*Source* Authors' calculations

## 6.6 Results

### *6.6.1 Public Debt*

The OLS regression indicates that the public debt is positively correlated at all levels with the pension assets (as a % of GDP as well as logarithm of the amount), the pension spending, the health expenditure as well as the unemployment. It is positively correlated at the 5% significance level with the logarithm of GDP per capita and the pension benefits as a share of GDP. It is negatively correlated at all levels with the contributions

**Table 6.5** Private debt regression results

| *Private debt* | *OLS* | *Fixed effects* | *Random effects* |
|---|---|---|---|
| Benefits as a shar~P | −4.329* | −1.518 | −2.390 |
| | (2.24) | (2.16) | (2.16) |
| Contributions asa~P | −5.148** | −0.403 | −0.949 |
| | (2.00) | (2.08) | (1.98) |
| Currentexpenditur~a | −2.682 | −14.24 | −11.80 |
| | (1.88) | (11.04) | (9.32) |
| Log of Foreign dir~t | 4.082* | 0.580 | 0.372 |
| | (2.34) | (1.39) | (1.39) |
| Log GDP per capita | 69.620*** | 59.874*** | 61.666*** |
| | (9.14) | (12.30) | (12.07) |
| Inflation, consume~u | −0.456 | 0.551 | 0.254 |
| | (1.85) | (0.72) | (0.74) |
| Pensionfunds (aut~t | 0.462*** | 0.532** | 0.552*** |
| | (0.15) | (0.21) | (0.20) |
| lPENSION FUNDS | −3.780* | −0.323 | 0.119 |
| | (2.04) | (2.21) | (2.06) |
| Pensionspending P~D | −4.619*** | −1.716 | −4.898 |
| | (1.49) | (4.34) | (3.02) |
| Social Expenditure~P | 1.799** | 8.890* | 7.788** |
| | (0.89) | (4.66) | (3.29) |
| Unemployment, tota~ | 0.559 | 1.803* | 2.574*** |
| | (0.81) | (1.02) | (0.84) |
| Constant | −547.920*** | −497.613*** | −495.094*** |
| | (99.40) | (137.70) | (129.34) |
| *R*-sqr | 0.470 | 0.433 | |
| dfres | 287 | 32 | |
| BIC | 3255 | 2622 | |

*$p < 0.10$, **$p < 0.05$, ***$p < 0.01$
*Source* Authors' calculations

as a share of GDP and the social expenditure as a share of GDP. It is negatively correlated at the 5% level with the logarithm of the FDI. The remaining of the variables shows no statistical significance.

The fixed effects and random effects models show that the public debt is positively correlated with the pensions spending as a share of GDP at all levels and with the unemployment and the benefits as a share of GDP at the 5% level. As a matter of fact the random effects model indicates that the unemployment is statistically significant at all levels. The public debt is negatively correlated with the contributions as a share of GDP at

the 10% (fixed effects) or at the 5% (random effects) level. The rest of the variables have no statistical significance. Following the evaluation of the consistency of the fixed effects estimators, Hausman test privileges the selection of the fixed effects model against the random effects approach for the particular dataset.

### *6.6.2 Private Debt*

The OLS regression indicates that the private debt is positively correlated at all levels with the pension assets as a percent of GDP and the logarithm of the GDP per capita. It is positively correlated at the 5% level with the social expenditure and at the 10% level with the logarithm of FDI. It is negatively correlated at all levels with the pensions spending (as a share of GDP), at the 5% level with the contributions as a share of GDP and at the 10% level with the benefits (as a share of GDP), as well as the logarithm of the pension assets. The remaining of the variables exhibits no statistical significance.

The fixed effects and random effects models show that the private debt is positively correlated at all levels with the logarithm of the GDP per capita, at all levels (random effects) or at the 5% level (fixed effects) with the pension assets as a % of GDP, at the 5% level (random effects) or at the 10% level (fixed effects) with the social expenditure and at all levels (random effects) or at the 10% level (fixed effects) with the unemployment rate. The other variables seem to have no statistical significance. Similarly with the public debt fixed effects model has been preferred using the Hausman test for this particular dataset.

## 6.7 Result Interpretation and Implications

### *6.7.1 Public Debt*

Looking at public debt it seems that all OLS fixed and random effects subscribe to the point of view that the reduction of pension spending can contribute to the decrease of debt (as a percent of GDP), as the higher the spending the higher the public debt (as a percent to GDP). Thus, assuming a constant GDP, the debt is reduced in absolute figures with the decrease of pension spending.

Furthermore, both models consent to the impact of pension benefits; the higher the pension benefits, the higher the debt (as a percent

of GDP). Therefore, for a flat GDP, the decrease of benefits may have beneficial results to the level of public debt.

In addition, they are aligned also in the case of contributions; the higher the contributions, the lower the public debt (as a percent of GDP). Consequently, for a stable GDP, the increase of contributions (by the employers and the employees) assists in reducing the public debt.

All models yield the same output also with regard to unemployment; the higher the unemployment, the higher the public debt (as a percent of GDP). One potential interpretation is that during periods of higher unemployment the GDP drops, hence the public debt increases as a percent of GDP—even if it remains stable in absolute amounts.

The OLS model indicates that the higher the health expenditure the higher the public debt (as a percent of GDP). This is most likely due to the fact that increased health spending is supported by increased borrowing by the state.

The OLS model implies that higher pension assets (both as a percent of GDP and amount) result in higher public debt. This can be possibly interpreted by the fact that increased pension assets are backed by increased government debt.

The OLS model shows that the higher the social expenditure, the lower the debt as a percent of GDP. This is probably due to the fact that such provisions help sustain the GDP level at circumstances that adversely affect the welfare of the targeted households and individuals.

According to the OLS model, the higher the FDI, the lower the public debt to GDP ratio becomes, which is the expected direction. In addition, again as per the OLS model, the higher the GDP per capita, the higher the public debt to GDP ratio is. An interpretation we could offer for this result is that in times of higher GDP per capita countries live in euphoric environments and thus attempt increased borrowing, which potentially fosters the increased GDP per capita. Consequently the latter is somehow leveraged.

### *6.7.2 Private Debt*

Going now to private debt, we realize that it becomes higher (as a percent of GDP) as the pension funds assets grow higher as a percent of GDP, as verified by all models. This probably means that individuals feel more confident to seek lending, as they have secured a higher income (as implied by the higher pension fund assets) at their retirement years.

The same holds true with the increase of social expenditure. Consequently, for a level GDP, the increase of social expenditure leads to an increase of private debt. This is probably due to the fact that individuals and households feel once and again confident borrowing, as they know that social provisions may kick in when their welfare is at risk.

All models indicate that the higher the GDP per capita the higher the private debt as a percent of GDP. This is probably attributed to the fact that the increased GDP per capita of a country makes the lending of its households and enterprises easier and thus private debt increases.

The OLS posts that the higher the pension spending, the lower the private debt to GDP ratio is, which is probably interpreted by the fact as retirees receive higher amounts they need to rely less on loans. The same is observed for the benefits. A similar rationale holds true; knowing that at the age of retirement the individuals will receive higher flows they need to rely less on debt.

The OLS shows that the increase of contributions reduces private debt as a percent of GDP; this is probably due to the fact that as individuals and enterprises contribute more they can withstand less borrowed funds. This is in line with the findings of Hurst and Willen (2007). The same is observed for the pension assets. A similar reasoning can be applied; increased pension assets are possibly partially due to increased money put in the fund by the individuals and the enterprises. Consequently they abstain from borrowing.

Based on OLS the increase of FDI increases the private debt (as a percent of GDP), which is probably due to the fact that increased investments allow individuals and enterprises to borrow more.

Finally, the fixed effects and the random effects models yield that the higher the unemployment the higher the private debt to GDP ratio. This is probably explained by the fact that in periods of increased unemployment the GDP drops, hence the ratio increases.

Our findings can be of value to the competent authorities and policy-makers that are looking for ways to control public or private debt. First of all, social security seems to have a more straightforward impact on the public debt as a portion of GDP. Consequently, containing the pension benefits, the pension spending and the health expenditure or increasing the contributions of the employees and the employers may help in better controlling the public debt. However, we have to admit that our study does not investigate the impact of such measures in other aspects of the lives of the affected individuals. As a result, countries may want to

consider the level of pension benefits and health expenditures made by the state in better controlling the public debt, weighing at the same time the consequences of reduced spending or increased contributions in their economy as a whole. Poufinas and Kouskouna (2016, 2017) offer solutions that can help alleviate the state from the burden without sacrificing the benefits and at the same time achieve a contribution to growth.

Private debt seems to be moving in a different path and the aforementioned actions will not necessarily steer private debt to the same direction. It is primarily the increase of contributions that leads to the reduction of public and private debt at the same time. It could also be the reduction of the pension fund assets as a % of GDP, but this is not desired as it would reduce the income of the retirees.

Furthermore, the decrease of unemployment seems to have beneficial impact to both private and public debt as a percent of GDP. In addition, a drop in the GDP per capita would have a similar result; however this is not recommended as it would most likely result in a reduced income for the individuals. These observations, next to the evidence found on the impact of social security on public and private debt, are probably not new; they are nevertheless confirmed by our work as well.

## 6.8 Conclusions

This chapter investigates the contribution of social security and in particular pensions as measured by pension assets, pension spending, pension benefits, contributions, health expenditure and social expenditure to public and private debt in the OECD countries with a series of econometric models. At the same time a series of macroeconomic variables is considered. The empirical evidence initially verifies standard conclusions at the relevant literature. The fact that debt, either government or private is related to the social security of each country is significantly testified by this study. More specifically though, we conclude that (at a significance level that depends on the model) public debt is positively correlated with pension assets, pension spending, pension benefits, health expenditure; it is negatively correlated with contributions and social expenditure. When it comes to macro-socioeconomic factors, public debt is positively correlated with unemployment, and (the logarithm of) GDP per capita; it is negatively correlated with the (logarithm of the) FDI. Inflation seems to have no statistical significance under any model. Turning to private debt, we find that (at a significance level that depends on the model) it is positively

correlated with the pension assets, the social expenditure; it is negatively correlated with pension spending, the contributions, the benefits and the (logarithm of the) pension assets. The health expenditure posts no statistical significance. With regard to the macroeconomic variables, we see that it is positively correlated with the (logarithm of the) GDP per capita, the (logarithm of the) FDI and unemployment. For all models, inflation is not statistically significant. Policymakers can put these findings at use in order to direct the pension and social security factors in such a way the public debt is contained. More specifically, the share of the state in pension benefits, pension spending and health expenditure needs to be reduced and the share of the employees and employers in contributions has to be increased in order to better control the public debt. The latter seems to also be beneficial for the containment of private debt—if desired. A reduction in unemployment seems to be helping both sovereign and private debt. Consequently, actions that will increase employment may have to be enforced for this reason as well. Some of them may come from demography, as the previous chapter indicates. As to future research, the debt-social security nexus can be further tested using principal component analysis by combining proxies for financial development and other social policy variables that affect the private and public debt respectively.

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