Debt-to-GDP Changes and the Great Recession: European Periphery versus European Core

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Abstract: In this paper, we use simple accounting schemes and counterfactual experiments, to compare the sources of the changes in the public debt to GDP across countries of the European Periphery (Greece, Italy, Spain, Portugal and Ireland), the European Core (Germany, and France) and the other G7 countries (Japan, UK, Canada and the USA), in two periods- 2000 to 2007 and 2008 to 2015. In general, debt- to-GDP rose in all countries in the latter period. But, the effects of total or primary fiscal deficits, inflation and real growth on the respective Debt-to-GDP changes were different across countries in both of these periods. Most importantly, relatively low inflation and real growth caused Debt-to-GDP to increase substantially in the European Periphery countries except Ireland, and Japan, where countercyclical fiscal policies during and for a few years after the Great Recession were unsuccessful and led to moderate Debt-to-GDP increases in the European Core, Ireland, and the Anglo Saxon countries, where countercyclical fiscal policies, although different, worked out fine, during the same period. This is puzzling for the Euro Area, where monetary policy is common and fiscal policies were restricted by austerity or sovereign debt restructuring programs.

Keywords*:* Public debt, Inflation, Real Growth, Euro Area

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1. Introduction

Both in academic and policy debates, most references to public debt are made in terms of the public debt to GDP ratio (henceforth, "Debt-to-GDP"). For example, Debt-to-GDP is the focal point in analyzing public debt sustainability and government solvency and the Maastricht Treaty, one of the pillars of the Euro Area (henceforth EA), sets targets for public debt and public debt changes with reference to Debt-to-GDP. It is, therefore, important to measure and analyze the sources of debt to GDP changes, in general. In particular for the EA, given the common monetary policy and the common restrictions on fiscal policy, it is important to compare the sources of Debt-to-GDP changes of member countries and understand the causes behind any disparities. Moreover, the study of the sources of Debt-to-GDP ratio has received extra attention recently due to the Great Recession.[1] That is, for a long time before the Great Recession a more or less steady nominal GDP growth confined attention to the Debt-to-GDP numerator and the budget deficits. But, the Great Recession came to change this, as three quarters of the OECD countries experienced a nominal recession.[2] And, policy influential economists (see for example Rogoff (2008, 2010), Blanchard et al. (2010), and Ball (2012)) advised for higher inflation rates to lower the real value of debt during the Great Recession and its aftermath. This nominal recession also hit the Euro Area as a whole and especially the "EA Periphery" (i.e., Greece, Ireland, Italy, Spain and Portugal), where the coexistence of little (or even negative) real growth with little inflation (or even deflation) increased Debt-to-GDP also through the denominator. This is of course raises an interesting issue for the EA, where Debt-to-GDP targets focus on the numerator and essentially ignore the denominator. However, this issue has been almost ignored in the conduct of monetary policy and the design of fiscal policy in the EA, despite the fact that actual inflation has been either negative or well below the 2% threshold and despite the fact that inflation rates varied considerably across countries during the Great Recession and for several years thereafter. The depth and duration of the recession activated instead a debate on the conduct of fiscal policy in bad times and especially the appropriateness of the policy of austerity.[3]

[1] By Great Recession, here, we mean the sharp decline in the level of economic activity that occurred in 2008 and 2009 in the USA and spread out to most of the rest of the world, thereafter.

[2] See e.g., Fiorito (2013).

[3] By policy of austerity, here, we mean a situation where government aims to reduce the structural deficit (i.e., the deficit adjusted for the business cycle). envisioned by the so-called six pack rules. See, e.g., Alesina et al (2014). For a concise definition of the Six Pack rules, see http://www.europarl.europa.eu/ftu/pdf/en/FTU_2.6.6.pdf

The purpose of this paper is threefold. First, it is to measure the sources of Debt-to-GDP changes in selected EA countries and compare them to other major economies. Second, it is to use these measurements in order to shed some light on the reasons these sources differ across countries. Third, it is to examine the implications of the reasons the sources of Debt-to-GDP changes differ across countries for the conduct of fiscal and monetary policy in the EA.

We use annual data from the European Periphery, the "EA Core" countries (i.e., France and Germany) as well as the rest of G7 countries (i.e., Japan, the UK, Canada and the USA), to study the sources of Debt-to-GDP changes in the 2000-07 and 2008-15 periods, from a macro-accounting perspective. The selection of countries reflects our intention to compare the EA Periphery to the EA Core countries. The other G7 economies are used as a benchmark. The 2008-15 period includes the Great Recession years (i.e., 2008 and 2009) and the six years that followed, where real growth was negative or relatively weak, especially when compared to the 2000-2007 period.[4] The latter period was simply chosen for comparison purposes and, in particular, to assess the country-specific impact of the Great Recession on Debt-to-GDP. The macro-accounting perspective (i.e., an adaptation of the standard budget constraint of macro textbooks) used focuses on inflation, real growth, the primary fiscal deficit and the interest payments on outstanding debt. Clearly, by doing so, we ignore issues pertaining to the composition (e.g., currency, inflation protection, etc.), maturity, interest structure and holders (e.g., foreign or domestic, private or public agents) of debt. In particular, we use a macro-accounting decomposition of Debt-to GDP changes to obtain simple stylized facts on the sources of these changes across counties and periods. Further, we use this decomposition to carry out several counterfactual experiments, so as to get a quantitative assessment of the contribution of the sources (i.e., inflation, real growth and total or primary fiscal deficits) of Debt-to-GDP changes. In these experiments, we obtain numerical values of what would had happened to Debt-to-GDP at the end of a period, if instead of its actual value, inflation, for example, was 2% for some time before this period, but all other sources assumed their historical values over that time. It should be stated at the outset, that in so doing we abstract from source independence and causal implications that would had necessitated assumptions about the determination of interest rates, the Fisher effect, fiscal policy multipliers and the relation between deficits and inflation. For that matter, our work should be viewed as simple stylized facts analysis that provides "food for thought," that touches upon various theory and policy issues.

[4] See the Hodrick-Prescott Filter decompositions in Figures A.1 in the Appendix. Note that, for all countries in the sample, the business cycle component of the filter is negative at least until 2013.

Both simple stylized facts and counterfactual experiments point out that, in general, debt- to-GDP rose in all countries in the 2008-15 period. But, the effects of primary deficits, inflation and real growth on the respective Debt-to-GDP changes were different across countries. Most importantly, relatively low inflation and real growth caused Debt-to-GDP to increase substantially in the European Periphery countries except Ireland, where countercyclical fiscal policies during and for a few years after the Great Recession were unsuccessful. In Germany, Ireland, and the Anglo Saxon countries, where countercyclical fiscal policies, although different, worked out fine, during the same period moderated Debt-to-GDP increases were detected. This is puzzling for the Euro Area, where monetary policy is common and fiscal policies were restricted by austerity, as in the case of Germany and Italy or sovereign debt restructuring programs as in the case of the European Periphery countries.

The plan of this paper has as follows: Section 2 gives a brief literature review. In Section 3 we provide a discussion of the Eurozone rescue programmes. Section 4 examines the behavior of real and nominal GDP, Debt-to-GDP, and the sources of Debt-to-GDP changes, based on a simple macro-accounting scheme. Based on this scheme, in Section 5, we use counterfactual experiments to measure the effect each one of the sources would have on Debt-to-GDP, over a given period, if it had followed a different path than the one it actually followed during this period, while all other sources continue to assume their historical values, whereas section 6 concludes with a discussion of the implications of our findings for the design of monetary and fiscal policy in the EA. At the end of the paper there is an appendix with data sources, the constructed data, and some further data analysis, including the correlation properties of the sources of Debt-to-GDP changes in each country.

2. Review of literature

The empirical literature on the sources of changes to the Debt-to-GDP ratio is rather fragmented. Most studies are for the United States[5]. To the best of our knowledge, this is the first paper that seeks to compare the effects of a comprehensive list of sources of changes to the Debt-to-GDP ratio across countries. There is an extensive literature on the effects of inflation on the real value of the public debt or the on the Debt-to-GDP ratio that touches, more or less, superficially on the other possible contributors of the Debt-to-GDP changes. However, this literature is important for our purposes for it

[5] Giannitsarou and Scott (2011) and Akitoby et al. (2014), that consider the G7 except France and the G7, respectively, been the two notable exceptions.

deals with all the theoretical issues in our analysis and most of the empirical ones, as well. The papers in this literature could be divided in three groups, depending on the methodology used to assess the pertinent effects of inflation: descriptive or informal, partial equilibrium and general equilibrium analysis. Papers in the first group include the above mentioned papers by Rogoff (2008, 2010), Blanchard et al. (2010), and Ball (2012) that, in general, have advised for higher inflation rates to lower the real value of debt, in the Great Recession and its aftermath.

Papers in the second group include papers that measure, simulate, or estimate the effects of inflation on the Debt-to-GDP ratio. In a paper that is important for many reasons for what we do in this paper, Eisner and Pieper (1984) and Eisner (1986) consider the market value of debt and they introduce the concept of "net debt". The latter is defined as gross government debt minus high power money and the market value of government assets. Further, they obtain the interest payments associated with net debt residually, from the market value of net debt minus the primary government deficit. Their method to obtain government interest payments and the interest rate of government debt may be thought as a way to reconcile the standard government budget constraint with the data, given the fact that government deficit and the change in the value of debt are based on cash accounting and capital accounting procedures, respectively. Bohn (1992) applies a similar procedure in obtaining the interest rate of government debt, using exclusively gross government debt. Giannitsarou and Scott (2008) log-linearize around the steady state of a stationary transformation of the government budget constraint and solve it forward to express the ratio of the market value of government debt to the current primary government surplus, which they call "measure of fiscal imbalance", in terms of the expected future values of primary deficits, inflation, real growth and real interest rates. Then, they estimate a VAR of these variables to substitute the expected future values of primary deficits, inflation, real growth and real interest rates to express the measure of fiscal imbalance in terms of the current and lagged values of primary deficits, inflation, real growth, and real interest rates; and obtain the associated variance decomposition. Thus, they estimate how much of the observed variance in the measure of fiscal imbalance is due to changes in the primary deficit, inflation, real growth, and the real interest rate. Other than the need for the stationary transformation, despite the employment of the forward looking solution, the term structure of interest payments on government debt is not explicitly taken into consideration. The nominal interest rate in the government budget constraint is approximated using averages for the maturity and the yield curve of government bonds. Hall and Sargent (2011), consider indexed and nominal debt in the form of different maturity bonds. Current debt is defined as the sum of

the product of the number of each different maturity bond outstanding in the present period times the current price of the corresponding bond. They reconcile the government budget constraint with the data by constructing appropriately defined nominal interest rates for debt of different maturity. Then, they solve the government budget constraint forward to measure the effects on the Debt-to-GDP ratio of the primary deficit, inflation, real growth, and the constructed nominal interest rates. In so doing, they use a simple accounting method to measure these effects. In the post WWII US economy, inflation is found to have had a smaller impact on the reduction in the debt-to GDP than real growth. In this paper, we follow a similar procedure. Akitoby et al. (2014) incorporate seignorage in the government budget constraint and consider three types of debt: domestic currency denominated, foreign currency denominated, and inflation-indexed debt. On another dimension, they consider short, medium, and long term debt. They use data, circa 2012 to calibrate the parameters of their model for the G7 countries and then they simulate the effects of different constant inflation rates over the next five years, under two scenarios. In the first scenario they assume a full Fisher effect and in the second, they assume a partial Fisher effect. They find that, on the average, inflation reduces the Debt-to-GDP ratio, over the five-year period, only moderately.

Aizenman and Marion (2011) construct a stylistic dynamic general equilibrium model, but with a fixed real rate of interest. They model an economy with public debt overhung, where public debt is held by domestic and foreign economic agents and a fraction of it is indexed, while the rest is not. they distinguish between internal simple. The fiscal/monetary authority acts as a Ramsey planner in setting the inflation and tax rates. The model is calibrated for the US economy, circa 2009. Inflation is used to bring about a significant reduction in the real value of debt, even with maturities getting shorter. This is mainly due to the fact that debt to and the maturity y rates to government debt to the current primary government deficit surplus to estimate interest rates sum of the weighted bin capital accounting approach has been used in a number of other studies of the as

Recently, Krause and Moyen (2016) formulated a New Keynesian DSGE model, incorporating long-term bonds with stochastic maturity and learning about the inflation target of the monetary authority that follows a Taylor rule. They calibrate their model for the US economy and they find that inflation target changes have a significant effect on the real value of public debt, if they are essentially permanent.

In conclusion, the general picture that emerges from this literature is that inflation can reduce in theory and has in practice reduced the real value of public debt or the Debt-to-GDP ratio, up to a

degree. This degree depends on several factors and mainly on the fraction of debt that is denominated in foreign currency, the fraction of debt that is indexed for inflation, seignorage, the maturity structure of debt, the ability of the monetary authority to cause inflation, the way expectations about future inflation are formed, and the maturity structure of debt and the way it changes with inflation expectations and the risk of default. Most importantly, however, the literature on the effects of inflation on the real value of debt and the Debt-to-GDP ratio serves as an important background for placing properly the contribution of this paper.

3. The European Periphery Rescue Programs

The European debt crisis (often also referred to as the Euro Area crisis or the European sovereign debt crisis) is a multi-year debt crisis that has been taking place in the European Union since the end of 2009. Euro Area member states: Greece, Portugal, Ireland, Spain and Cyprus, were unable to repay or refinance their government debt or to bail out over-indebted banks under their national supervision without the assistance of third parties like other Euro Area countries, the European Central Bank (ECB), or the International Monetary Fund (IMF).

1. Greece

The Greek government-debt crisis (also known as the Greek Depression) is the sovereign debt crisis faced by Greece in the aftermath of the financial crisis of 2007–08. The Greek crisis started in late 2009, triggered by the turmoil of the Great Recession, structural weaknesses in the Greek economy, and revelations that previous data on government debt levels and deficits had been undercounted by the Greek government.

This led to a crisis of confidence, indicated by a widening of bond yield spreads and rising cost of risk insurance on credit default swaps compared to the other Euro Area countries, particularly Germany. The government enacted a dozen rounds of tax increases, spending cuts, and reforms from 2010 to 2016, which at times triggered local riots and nation-wide protests. Despite these efforts, the country required bailout loans in 2010, 2012, and 2015 from the International Monetary Fund, Euro group, and European Central Bank, and negotiated a 50% "haircut" on debt owned by the private sector in 2011. After a popular referendum which rejected further austerity measures required for the third bailout, and after

closure of banks across the country (which lasted for several weeks), on 30 June 2015, Greece became the first developed country to fail to make an IMF loan repayment. At that time, debt levels had reached €323bn or some €30,000 per capita.

2. Portugal

Portugal has suffered from low GDP and productivity growth for more than a decade before the outbreak of the recent crisis. Potential output growth has been on a steady downward trend, with competitiveness being undermined by rising unit labour costs and deep-rooted structural problems. As a consequence of persistent current account deficits, Portugal has accumulated a high external debt, which is reflected in high household, corporate and fiscal debts. On the positive side, Portugal did not witness a property boom and bust, nor were banks exposed to toxic assets. Therefore, the financial sector has weathered the first phase of the financial crisis relatively well.

The period before the request for financial assistance was marked by unfavourable developments in public finances and a worsening economic outlook. This led to a deterioration of confidence and rising market pressures on Portuguese debt, accentuated by the negative developments in euro area sovereign bond markets. Amidst consecutive downgrading by credit rating agencies of Portuguese sovereign bonds, the country became unable to refinance itself at rates compatible with long-term fiscal sustainability. In parallel, the banking sector, which is heavily dependent on external financing, was increasingly cut off from international market funding and had to step up reliance on the Eurosystem for funding.

Following a request by Portugal on 7 April 2011, the Troika consisting of the European Commission, ECB and IMF negotiated an Economic Adjustment Programme, aimed at restoring confidence, enabling the return of the economy to sustainable growth, and safeguarding financial stability in Portugal, the euro area and the EU. The Programme was agreed by the European Council on 30 May 2011 and the IMF board on 20 May. It covers the period 2011-2014. Its financial package will cover up to EUR 78 billion for possible fiscal financing needs and support to the banking system. One third (up to EUR 26 billion) will be financed by the European Union under the European Financial Stabilisation Mechanism (EFSM), another third by the European Financial Stability Facility (EFSF), and the final third by the IMF under an Extended Fund Facility. The programme foresees comprehensive action on three fronts.

First, a credible and balanced fiscal consolidation strategy, supported by structural fiscal measures and better fiscal control over Public-Private-Partnerships (PPPs) and state-owned enterprises (SOEs), aiming at putting the gross public debt-to-GDP ratio on a firm downward path in the medium term. The authorities are committed to reducing the deficit to 3% of GDP by 2013.

Second, efforts to safeguard the financial sector through market-based mechanisms supported by back-up facilities. Central aspects here are measures to foster a gradual and orderly deleveraging, strengthened capitalisation of banks, reinforced banking supervision and the sale or unwinding of the BPN bank.

Third, deep and frontloaded structural reforms to boost potential growth, create jobs, and improve competitiveness. In particular, the Programme contains reforms of the labour market, the judicial system, network industries and housing and services sectors, with a view to strengthening the economy's growth potential, improving competitiveness and facilitating economic adjustment.

An important feature of the programme is the aim to mitigate negative social impacts, while addressing fiscal, banking and structural imbalances at the same time. In particular, tax increases and benefit reforms are designed such as to minimise the impact on the lowest income groups.

3.Ireland

The turnaround in Ireland’s economic fortunes in recent years is perhaps the most dramatic of any country in the euro area. As recently as 2007, Ireland was seen by many as top of the European class in its economic achievements. A long period of high rates of economic growth and low unemployment had been combined with budget surpluses. The country appeared well placed to cope with any economic slowdown as it had a gross debt - GDP ratio in 2007 of 25% and a sovereign wealth fund worth about €5,000 a head. However, the subsequent crash – involving a housing market collapse, soaring unemployment and a full - scale banking crisis – proved too difficult for the Irish government to manage on its own. In 2010, Ireland agreed to an adjustment program with the EU and IMF. Today, Ireland is poised to exit this program and, while economic conditions remain poor and unemployment elevated, the country is again being cited regularly as an example for other countries in severe economic difficulties.

4. Spain

The 2008-present Spanish financial crisis, also known as the Great Recession in Spain or the Great Spanish Depression began in 2008 during the world financial crisis of 2007–08. In 2012 it made Spain a late participant in the European sovereign debt crisis when the country was unable to bailout its financial sector and had to apply for a €100 billion rescue package provided by the European Stability Mechanism (ESM).

The main cause of Spain's crisis was the housing bubble and the accompanying unsustainably high GDP growth rate. The ballooning tax revenues from the booming property investment and construction sectors kept the Spanish government's revenue in surplus, despite strong increases in expenditure, until 2007. The Spanish government supported the critical development by relaxing supervision of the financial sector and thereby allowing the banks to violate International Accounting Standards Board standards. The banks in Spain were able to hide losses and earnings volatility, mislead regulators, analysts, and investors, and thereby finance the Spanish real estate bubble. The results of the crisis were devastating for Spain, including a strong economic downturn, a severe increase in unemployment, and bankruptcies of major companies.

Even though some fundamental problems in the Spanish economy were already evident far ahead of the crisis, Spain continued the path of unsustainable property led growth when the ruling party changed in 2004. In these early times Spain had already a huge trade deficit, a loss of competitiveness against its main trading partners, an above-average inflation rate, house price increases, and a growing family indebtedness. During the third quarter of 2008 the national GDP contracted for the first time in 15 years, and, in February 2009, Spain (and other European economies) officially entered recession. The economy contracted 3.7% in 2009 and again in 2010 by 0.1%. It grew by 0.7% in 2011. By the 1st quarter of 2012, Spain was officially in recession once again. The Spanish government forecast a 1.7% drop for 2012.

The provision of up to €100 billion of rescue loans from euro zone funds was agreed by eurozone finance ministers on 9 June 2012. As of October 2012, the so-called Troika (European Commission, ECB and IMF) is in negotiations with Spain to establish an economic recovery program required for providing additional financial loans from ESM. In addition to applying for a €100 billion bank

recapitalization package in June 2012, Spain negotiated financial support from a "Precautionary Conditioned Credit Line" (PCCL) package. If Spain applies and receives a PCCL package, irrespectively to what extent it subsequently decides to draw on this established credit line, this would at the same time immediately qualify the country to receive "free" additional financial support from ECB, in the form of some unlimited yield-lowering bond purchases.

The turning point for the Spanish sovereign debt crisis occurred on 26 July 2012, when ECB President Mario Draghi said that the ECB was "ready to do whatever it takes to preserve the euro". Announced on 6 September 2012, the ECB's Outright Monetary Transactions (OMT) program of unlimited purchases of short-term sovereign debt put the ECB's balance sheet behind the pledge. Speculative runs against Spanish sovereign debt were discouraged and 10-year bond yields stayed below the 6% level, approaching the 5% level by the end of 2012.

4. Stylized Facts and the Sources of Debt-to-GDP Changes

Given the problem at hand, the available data are few because of the annual frequency which, however, is still preferable evaluating NIPA government data in detail. Before reporting the Debt-to-GDP ratio changes and their sources, we first present the real and nominal GDP changes, to ascertain the magnitude of the economic losses hitting each country during and after the Great Recession.

As shown in Table 1, there are great differences in real growth between 2000-7 and 2008-15. All countries experienced robust growth in 2000-7. This growth was higher in the Anglo Saxon countries and in the EA Periphery, except Italy and Portugal. In the 2008-15 period, both average and cumulative output losses look impressive for the EA Periphery except Ireland. On the contrary, the European Core, Ireland, and the Anglo Saxon countries, after the initial output losses in 2008 and/or 2009, rebounded relatively fast to positive, but relatively low, real growth.[6]

The real novelty of the Great Recession is the fall in nominal GDP that characterized all countries considered here. In fact, for Japan and the EA Periphery nominal output declined for a number of years after 2009 (i.e., Greece (2009-2015), Ireland (2008-2010), Italy (2009, 2011, 2012), Japan (2008, 2009, 2011), Portugal (2009, 2011, 2012) and Spain (2009, 2011-2013)). This is manifested, in Table 1, by the fact that nominal growth differences between the 2000-7 and the 2008-15 are greater than the corresponding real growth differences. The only notable exceptions are Germany and Japan but for

[6] See, again, the Hodrick-Prescott filter decompositions in Figure A.1, in the Appendix.

different reasons. In the case of Japan the reason is the relatively low inflation in 2000-7 and in the case of Germany is the relatively high inflation in the 2008-15 period.

Now, Table 2 presents the average and cumulative Debt-to-GDP ratio changes in the two periods under consideration. As already mentioned, debt, here, refers to the gross debt of General Government. And, we use two measures of this debt. First OECD's Gross Debt (SNA08) for all countries and OECD's Gross Debt (Maastricht Definition) for the EA countries and the UK. There are two main differences between the Gross Debt (SNA08) and the Gross Debt (Maastricht Definition) measures of debt. The first difference is that the Maastricht debt does not include liabilities related to other accounts payable (comprising trade credits and advances), financial derivatives, and insurance technical reserves. The second difference concerns the valuation methodology. That is, the Maastricht definition evaluates debt at face value, which is equivalent to the amount that the government has to pay back to creditors at maturity. In contrast, the SNA08 debt employs market values. Maastricht debt is, thus, a better measure for assessing government refinancing needs, but the SNA08 debt captures more adequately the cost of buying back debt. For non-tradable debt instruments market valuation is not available, requiring imputation of prices by some alternative methods. Also, market valuation might be problematic for tradable instruments when markets are volatile and/or illiquid. Consequently, the SNA08 debt measure can be more volatile than the Maastricht measure. Identifying the exact contributions of the various factors to differences in debt levels according to the SNA08 and Maastricht debt measures is not straightforward.

For all countries, Debt-to-GDP ratio behaves quite differently in 2000-7 than in 2008-15. In particular, while in the former period, Debt-to-GDP ratio either falls (i.e., in the case of Canada, Ireland, Italy, and Spain), is nearly constant (i.e., in the case of the European Core), or rises modestly (i.e., in the case of Japan, Greece, Portugal, UK and the USA), it rises sharply in the latter period. In the EA, the smallest cumulative rises occur in the Germany (i.e., about 10 percentage points in Germany, using the Maastricht measure); and, the largest in the European Periphery (i.e., about 152, 121, 80 and 62 percentage points in Spain, Ireland, Portugal and Greece, respectively, using the Maastricht definition). France and Italy have moderate cumulative increases in the 2008-15 period (i.e., about 41 and 30 percentage points in France and Italy, resectively, using the Maastricht Definition). Finally, comparing the cumulative Debt-to-GDP increases in the 2008-15 period, we may clasify countries in three groups, having more than 15 percentage points difference: (a) Germany with the lowest such increase (i.e, about 15 percentage points), (b) countries with moderate increases (i.e., between 34 and 48 percentage points)

such as Japan, Italy, Canada, the UK and France) and countries with high increases (i.e, between 65 and 156 percentage points) such as Greece, the USA, Portugal, Ireland and Spain.[7, 8, 9] As it will be explained below, the observed increases in the debt-to-GDP ratio in the 2008-2015 period occurred for different reasons. And, nowhere were these reasons more different than in the case of Germany and the EA Periphery.

We turn next to the sources of Debt-to-GDP changes. To do this, we need an accounting scheme for the Debt-to-GDP ratio. The accounting scheme used is based on the arithmetic implied by the simplest government debt definition. This scheme is adopted in order to decompose Debt-to-GDP changes into a minimum number of clearly identifiable sources, based on mere accounting rather than on causal relations among variables. Thus, we consider the simplest intertemporal government budget constraint:

$$B_t - B_{t-1} = D_t \tag{1}$$

where B_t stands for gross public debt at the end of period t and D_t stands for the government budget deficit in period t. This deficit is measured here by OECD's General Government Net Lending series. Both, B_t and D_t variables are nominal (i.e., measured in current prices). But, as has been long recognized, increases (decreases) in the debt stock may differ – sometimes widely from the corresponding deficit (surplus) measurement, because debt flows are evaluated on a cash rather than on the accrual basis used in the (NIPA) national accounts. Moreover, there are other reasons for differences between these two variables. First, debt cash flows stem also from government transactions on non-financial assets such as land, buildings and so forth.[10] Second, changes in the debt stock may be due to national debt restructuring loans and other government loans such as those for the rescue of private banks, such as those obtained by the European Periphery countries after the Great Recession.

[7] Greece is group in the high rather than the moderate increase group for in 2012 had a percentage points reduction in its Debt-to-GDP, brought about by the the its First European Periphery Rescue Program. .

[8] Considering the EA countries, the Great Recession in general interrupts the convergence process measured on different variables by Estrada et al. (2013) and confirmed here, also, for the Debt-to-GDP ratio.

[9] It is interesting to note that in the same period the *private* debt-to-GDP ratio generally rises, also. As it has been pointed out by a number of policy analysts, the simultaneous rise of *private* debt before and during the crisis is important for assessing the overall deleveraging in the same period. See, e.g., Buiter and Rahbari (2011).

[10] The accounting and fiscal policy implications of the way of defining government deficit and debt were firstly outlined by Eisner and Pieper (1984). An authoritative modern study on the same issues is Robinson (2009).

For that matter, we shall define the "cash/accruals accounting discrepancy" E_t, as the difference between the change in the stock of public debt during a period and the government budget deficit in the same period:

$$E_t \equiv B_t - B_{t-1} - D_t \tag{2}$$

Total deficit is broken down in two components:

$$D_t \equiv D_t^P + i_t B_{t-1} \tag{3}$$

where D_t^P and $i_t B_{t-1}$ stand for the primary budget deficit and the interest payments on outstanding public debt, in period t, respectively. We shall refer to the interest rate, i_t, defined by (4), as the "effective interest rate" of public debt in period t. Clearly, this interest rate measure varies with the definition and measurement of public debt. Moreover, this representation of interest payments on outstanding public debt ignores interest payments paid on debt created during a period and abstracts from the issue of the interest rate structure of the bonds comprising public debt.[11]Furthermore, this interest rate is fundamentally different from the interest rate concept of macroeconomic models. [12]

Combining (2) and (3) gives the following law of motion of public debt:

$$B_t = (1 + i_t) B_{t-1} + D_t^P + E_t \tag{4}$$

Let Y_t and y_t stand for nominal and real GDP, respectively, so that, $Y_t \equiv P_t y_t$, where P_t stands for the GDP price deflator. Then, the law of motion of the Debt-to-GDP ratio, $b_t = B_t / Y_t$, can be expressed as follows:

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11 Data on this are available for the EA in Lojsch, Rodriguez-Vives and Slavik (2011).

12 For convenience, in macroeconomics models, the term structure of interest payments on public debt is, typically, ignored. The standard assumption in these models is that government issues one period bonds. Thus, at the beginning of every period government buys back the entire stock of outstanding public debt and issues the new stock of public debt. Then, when the underlying interest rate is determined becomes another assumption. Typically, it is determined at the same time debt is issued. Thus, current period interest payments on outstanding debt are exogenous but all future period interest payments on outstanding debt are endogenous. Taking into account the term structure of interest payments of bonds that, typically, mature several years from their issue, makes, of course, future interest payments on outstanding public debt are partially predetermined. For our purposes, this issue is important, for it relates to the relationship between current interest rate payments and past inflation expectations.

$$b_t \equiv \frac{(1+i_t)}{(1+\pi_t)(1+\lambda_t)} b_{t-1} + d_t^p + e_t \quad (5)$$

where: λ_t stands for the real growth rate, $\lambda_t = \left[{(y_t - y_{t-1})}/{y_{t-1}} \right]$ and π_t, stands for the inflation rate, $\pi_t = \left[{(P_t - P_{t-1})}/{P_{t-1}} \right]$, $d_t = \left({D_t^p}/{Y_t} \right)$ is the primary deficit share of GDP and $e_t = \left({E_t}/{Y_t} \right)$ is the cash/accruals accounting discrepancy share of GDP. The latter variable combines all possible discrepancies between government debt changes and government balance deficits as they are measured in practice and should not be interpreted as a zero mean, white noise residual. We shall refer to the variables in the RHS of Eq. (5), other than the Debt-to-GDP at the end of the last period, as the sources of Debt-to-GDP changes. Thus, Debt-to-GDP ratio increases with the GDP share of primary deficit, the GDP share of cash/accrual accounting discrepancy, and the effective interest rate on existing government debt. And, it decreases with the real growth and inflation rates.

The first three columns of Table 3 present the averages of the real growth rate, the inflation rate, and the primary deficit share of GDP, in the 2000-2007 and the 2008-2015. The last four columns of Table 3 report the averages of the effective interest rate and the GDP share of the cash/accrual accounting discrepancy, using the SNA08 and the Maastricht measures. Turning now to the stylized facts of the sources of Debt-to-GDP changes, summarized in Table 3, we observe the following:

Real Growth

As already mentioned, all countries are characterized by real growth in the 2000-7 period. In particular, real growth was strong in the Anglo Saxon countries and the EA Periphery, except Portugal, during this period.[13] On the contrary, in all countries real growth is either negative or positive but relatively weak, in the 2008-15. Average real growth rates in 2008-15 were negative in Italy and the EA Periphery, except in Ireland. The only countries where the average growth rate of the 2008-15 period is more than 50% of the corresponding rate of the 2000-7 period are Canada and Germany. What, is not reflected, due to averaging, in Table 3 are the differences in the way countries came out of the Great Recession. As it turns out, this has an important implication for the behavior of the Debt-to-GDP across countries in the entire 2008-15 period.

[13] This is clearly illustrated in the graphs of the long term growth component of the Hodrick – Prescott filter in Figures A.1 the Appendix.

Inflation

All countries, with the exception of Japan, are characterized by inflation in the 2000-7 period. In fact, all other countries have an average inflation rate in excess of the 2% threshold, with the exception of France (i.e., 1.97%) and, again, Germany (i.e., 0.89%). In all countries, inflation is lower in the 2008-15 period, with the exception of Japan and Germany (i.e., 1.48%). However, although in the Anglo Saxon countries, average inflation rate in the 2008-15 period was less than 40% smaller than the respective rate of the 2000-7 period, it was several times smaller in the in the EA Periphery. In other words, the inflation drop in the EA periphery was (across countries and periods) relatively large. But, in Germany, not only the average inflation rate of the 2008-15 period was higher than the corresponding rate of the 2000-7 period, but the German average inflation rate of the 2008-15 period was much higher than the corresponding rate of all EA Periphery countries.

Primary Deficit

In the 2000-7 period and on the average, Japan, Canada, Portugal, and the USA run primary surpluses, the UK and the European Core had, roughly, balanced primary budgets, and the European Periphery, except Portugal run moderate (i.e, between 1.3% and 2.5% of GDP) primary deficits. Thus, since in the 2000-7 period GDP was rising in all countries, we may surmise that discretionary fiscal policy in this period was countercyclical in Japan, Canada, Portugal, and the USA; neutral in the UK and the European Core; and procyclical in the European Periphery, except Portugal. In the 2000-7 peeriod, things were more complicated. As it turns out, the time aggregation of Table 3 is no longer helpful, here. For that matter, the analysis that follows is based on the annual data presented in Tables A.1 of the Appendix. During the Great Recession years (i.e., 2008 and 2009), all countries engaged in expansionary discretionary fiscal policy, with the exception of Germany and Italy in 2008. Cross checking these figures with the corresponding figures of GDP growth, it turns out that all countries in their respective recession years engaged in countercyclical discretionary fiscal policy, with the exception of Italy in 2008. After the Great Recession, all countries engaged in expansionary discretionary fiscal policy, with the exception of Germany and Italy. To figure out whether these policies were countercyclical or procyclical we may distinguish countries in three groups. First, countries that successfully faced the Great Recession, in the sense on reverting to positive real growth, thereafter. As it turns out, all these countries had a positive average real growth rate in the During/After the Great Recession period. It follows, that the countries in this group are Canada, the USA, France,

Germany and Ireland. Hence, discretionary fiscal policy after the Great recession was procyclical in Canada, the USA, France and Ireland and countercyclical in Germany. Second, countries that did not successfully faced the Great Recession, in the sense of having a negative average real growth rate in the During/After the Great Recession period. The countries in the second Group are Italy and the EA Periphery countries, except Ireland. It follows that all the EA Periphery countries were pursuing a countercyclical fiscal policy, while, surprisingly, Italy followed a procyclical discretionary fiscal policy, even when real output was declining.[14] The third group consists of the remaining countries. That is, countries that had at least one year after with negative real growth, after the Great Recession, but their average real growth rate in the During/After period was not negative. The UK and Japan are the only two countries in the third group. The cyclicality of discretionary fiscal policy in these countries in not straightforward, but it is, in general, procyclical and resembles the behavior of the countries in the first group, except, of course, Germany. [15] [16] We may conclude therefore, that all countries faced the Great Recession with countercyclical fiscal policy that obviously contributed to the increase in the Debt-to-GDP ratio, but after the Great Recession, in the EA Periphery except Ireland, there were countries were their Debt-to-GDP increases were relatively large, because of unsuccessful countercyclical discretionary fiscal policies. In Ireland, as with the other countries except, Germany and Italy, there were relatively increases in Debt-to-GDP as they had successful countercyclical fiscal policies during

[14] Following on Footnote 16, a fact that presumably explains the apparent paradox that Italy is here, along with Germany, the only country running a *primary surplus* in most of the crisis years is that the Before the large inherited debt severely constrained fiscal policy. Further, the deficit size increased in the 2008-15 period less than elsewhere because of the EA surveillance and also of Italy's reluctance to be formally involved - as Spain, among the countries here - in an excess deficit procedure (EDP). Overall, the impression is not only of a limited counter-cyclicality of fiscal policy because of the large debt burden but also of a lagging policy response with respect to the other EU countries which appears confronting the 2009 shock. This probably reflects the limits of fiscal automatism, given the inhibited possibility of facing exceptional (or at least unusual) events as recessions are.

[15] Among the countries in the sample, Italy has a special position not only for having one of the highest Debt-to-GDP in the 2008-15 years, but also for exceeding the symbolic 100% threshold even *before* the big crisis began. This probably explains why in the first period an effort was made to slightly reduce the debt ratio that, in the second, increased *less* than in all the other countries in the sample with the exception of Germany. The high-debt heritage certainly reduced the available fiscal space (Ostry et al., 2010), severely limiting the possibility of contrasting the Great Recession within the EA framework. As a result, almost no fiscal discretion seems working in the 2008-15 years, characterized not only - as in most OECD countries - by a negative real growth in 2009, but also by a *nominal* recession in the 2012-13 biennium.

[16] Using the Hodrick-Prescott filter decomposition of output data in its smooth growth and its business cycle components, it seems that discretionary fiscal policy in Germany and Italy, was countercyclical in the During and several years after the Great Recession.

the recession, followed by cautious procyclical policies after the recession. min the case of the Anglo Saxon ratio increased relatively a lwo groups of countries that.[17]

Effective Interest Rate

Finally, when it comes to effective interest rates, they have a positive effect on Debt-to-GDP changes. From columns 4 and 5 of Table 3, it follows that for all countries, effective interest rates were higher in the BGRP than in the DAGRP. However, the differences between these two periods, across countries seem rather small. For instance, the average effective interest rates, using the SNA08 measure, in the During/After the Great Recession period are no smaller than 70% of their BGRP counterparts, with the exception of Germany (61%), the USA (62%), and Greece (66%). But, Greece had three massive debt restructuring programs that set low interest rates for its outstanding debt, Thus, it seems that this type of inertia of effective interest rates, reflects the fact that interest payments on outstanding debt are largely predermined. It is also, interesting to note that (nominal) effective interest rates do not follow, in general, the drop in inflation. In fact the correlation between effective interest rates and inflation, from 2000 to 2015: is negative in Canada, Germany, Japan and UK, positive but insignificant at the 10% level of significance in Ireland, Italy, Portugal and Spain, and positive and significant only in France and Greece. But the positive interest rates-inflation correlation in Greece is an artifact. This is because the interest rates were set by the debt restructuring programs (see Section 3).

Increase, 10-years bond yields decrease in the US, in the UK, in Germany and in France. The yield slightly rises in Spain only, showing once more that market perception of sovereign risk is, indeed, a complicated issue. During the crisis, the 10-year government yield declines more than inflation does (Tables 3.1-3.6) and the *real* interest rate generally falls (US, UK, Germany, France). This does not hold in Italy and in Spain where the real rate rises[18]. There are, however, several differences to be noticed. In Germany (Fig. 3), since 2000 the Debt-to-GDP increase was of 1/3 only, being about constant in the 2008-13 years (Table 3.3). Moreover, while the slope increase is very steep between 2009 and the 2010 peak, the debt ratio is initially maintained and then slightly reduced. Accordingly, Germany's SDI index becomes positive after 2009, making the average 2008-13 index only just

[17] In the US, in fact, the primary deficit not only rises more when recession peaks but is also faster in decreasing once recovery is achieved. In the UK, primary deficit strongly rises in the 2009 recession peak, decreases in the next two years to increase again in 2012 and 2013 when real GDP growth is still low.

[18] This evidence may also confirm some divide between the Northern-European 'core' and the Southern-European 'periphery' since, in the same period, the real rate rises also in Portugal and, especially, in Greece.

negative though smaller in absolute value than it was in the 2000-07 period. This is an atypical result since Germany is here the only country for which the SDI index (Table 3.5) improves in the second part of the sample, though this occurs without obtaining a positive value. In France the debt ratio falls between 2006 and 2008 (Table 3.4) but the increase is more pronounced in the crisis years and its slope is not reduced at the end of the sample as in Germany. Overall, in the first period the SDI index is better than in Germany though the comparison reverses in the 2008-13 years in which France displays an average, null, real GDP growth Italy's case (Table 3.5) is peculiar, being here the only country in which the government debt ratio was *already* large in the first part of the sample. Yet, the effort of reducing the ratio in the pre-crisis period was frustrated in the recession years by a nominal GDP growth which on the average was about null, being (as also in Spain) even *negative* in three years. As a result, the Debt-to-GDP ratio strongly rises in 2009 (Fig. 5), then reducing but maintaining its growth because a *nominal* recession occurred also in 2012 and 2013. A side consequence is that, except for 2000, the SDI index is always negative and displays also a worse average value in the crisis years. Conversely, Spain is here the country in which the debt ratio decreased more in the 2000-07 period (Table 3.6) to rise even more in the crisis years as Fig. 6 shows in the most impressive way. Actually, Figure 6 for Spain displays a peculiar V-shaped pattern which is also reflected in the *always* positive SDI index in the first part of the sample and in the *always* negative SDI value in the second: in no other case here the debt ratio first decreased and then increased so rapidly, highlighting how the Great Recession created a problem that was missing before.

Remarkably, effective interest rates are smaller in the during and post Great Recession period vs the pre Great Recession period, despite the substantial increases in Debt-to-GDP ratios in the former period. In fact, this is also true for the effective real rates, obtained from subtracting the inflation rate from the nominal effective interest rate. We take this to suggest that real rates were very even if one was to subtract the inflation rates from the and Post Great Recession period on share end of the current period of last period's Debt-to-GDP ratio. (This applies also to the *Sustainable Debt Index* (SDI) which is calculated in the Appendix as the difference between the real GDP growth and the real interest rate[19] in each country.

[19] Obviously, stability requires a positive number.

Cash/Accruals Accounting Discrepancy

The cash/ accruals accounting discrepancy is a relatively minor contributor to Debt-to-GDP ratio changes, except in some profound cases. These cases are the following: (a) TO BE WRITTEN Actually, the greater ratio in the 2008-13 years reflects also the major role exerted in the UK, with respect to the US, by the variable (**Other)** that here summarizes all remaining, unknown, sources behind Debt-to-GDP % changes. Also, in Germany, the *largest* portion of the 2008-13 debt changes belongs to the residual component (**Other**) which, again, is difficult to be interpreted without further details

The analysis, based on the preceding tables and the data in the Appendix provide only descriptive information that cannot assess the importance of every source behind the Debt-to-GDP ratio changes. To provide a quantitative evaluation of the contribution of each one of the sources of Debt-to-GDP changes it will be convenient to approximate (4), by:

$$b_t - b_{t-1} = i_t b_{t-1} - \pi_t b_{t-1} - \lambda_t b_{t-1} + d_t^p + e_t \qquad (5)$$

Then, we can identify the terms in the LHS of (5) as the contributions of effective interest rates, inflation, real growth, primary deficit and the cash/ accruals accounting discrepancy to Debt-to-GDP changes, respectively. Tables 4 and 5 present these contributions in terms of GDP percentage points for SNA Debt and Maastricht Debt, respectively. Obviously and predictably, given In the 2000-7 period and in most countries the major contributor to

5. Counterfactual Experiments

The preceding stylized facts illustrate what actually happened. But can we say anything about what it could have happened to the Debt-to-GDP ratio if different policies were followed? This task is made available here, using the methodology of counterfactual experiments, to calculate the contribution or the weight of each component in all countries in the two periods.[20] First, we shall employ the Eq. (3) to

[20] In an earlier paper, Fiorito (2016) presented results based on the squared Debt-to-GDP ratio changes. This method ignores positive or negative changes, making interpretations difficult.

examine the effect on the Debt to GDP ratio of inflation, real growth, total deficit share of GDP the cash/accrual accounting discrepancy, in the two periods under investigation. As already mentioned, we shall employ the method of counterfactual experiments. That is, in any one experiment, we set any one of the variables, except b_{t-1}, in the RHS of (3) equal to zero, to compute the corresponding government debt to GDP ratio that would had materialized if this variable was zero, instead of its historical value, and all other variables in the RHS of (3) take their historical values. We repeat this step for as many periods desired, using for the Debt-to-GDP ratio of the previews period the Debt-to-GDP ratio obtained in the previews step. For example, to compute the counterfactual change in the Debt- to-GDP ratio that would had materialized if the inflation rate, π_{t+j}, was set equal to zero, for $j = 0, 1,\ldots,\tau$, we use:

$$\tilde{b}_{t+j}\Big|^{\pi} = \frac{1}{1+\lambda_t}\tilde{b}_{t+j-1}\Big|^{\pi} + d_t + e_t \qquad (7)$$

Recursively, starting from $\tilde{b}_{t-1}\Big|^{\pi} = b_{t-1}$. Then, we can express the percentage change in the government debt to GDP ratio change brought about by actual inflation from period t to period $t+\tau$ as:

$$\tilde{\delta}^{\pi} = \frac{b_{t+\tau} - \tilde{b}_{t+\tau}\Big|^{\pi}}{\tilde{b}_{t+\tau}\Big|^{\pi}} \qquad (8)$$

Likewise, we compute $\tilde{\delta}^{\lambda}$, $\tilde{\delta}^{d}$, and $\tilde{\delta}^{e}$. Finally, we can compare the corresponding $\tilde{\delta}s$ for a certain time period, τ, before and after a certain point in time, to compare the effect of time period. And, we can compare the corresponding $\tilde{\delta}s$ across countries in any given period. This way, the cumulative changes in Debt-to-GDP can be decomposed into the portions belonging to the 'policy-induced sources, such as the total deficit share of GDP and the cash/accruals accounting discrepancy share of GDP and those reflecting the growth of nominal income components that also have some policy dependence, though less direct and more difficult to be measured in a neutral way.

Likewise, based on Eq. (6), rather than (3), we can conduct counterfactual experiments, involving the primary deficit and the effective interest rate, rather than the total deficit. For example, to compute the counterfactual change in the Debt-to-GDP ratio that would had materialized if the inflation rate, π_{t+j}, was set equal to zero, for $j = 0, 1,\ldots,\tau$, we use:

$$\hat{b}_{t+j}\Big|^{\pi} = \frac{1+i_t}{1+\lambda_t}\hat{b}_{t+j-1}\Big|^{\pi} + d_t^p + e_t \qquad (8)$$

Recursively, starting from $\hat{b}_{t-1}\Big|^{\pi} = b_{t-1}$. Then, we can express the percentage change in the Debt-to-GDP ratio change brought about by actual inflation from period t ro period $t+\tau$ as:

$$\hat{\delta}^{\pi} = \frac{b_{t+\tau} - \hat{b}_{t+\tau}\Big|^{\pi}}{\hat{b}_{t+\tau}\Big|^{\pi}} \qquad (9)$$

Likewise, we compute $\hat{\delta}^{\lambda}$, $\hat{\delta}^{d}$, and $\hat{\delta}^{e}$, based on the decomposition of sources of Debt-to-GDP changes of Eq. (6).

Now, before turning to the data, we should address a possible objection to the proposed methodology of counterfactual experiments. That is, whether such counterfactual analysis is valid, if the explanatory variables in the RHS of (3) or (6) are not independent to each other. There are two lines of defense: The first line of defense involves the obvious issue of source independence, which was already mentioned. First note that even if we accept that these variables are not independent to each other, a counterfactual experiment is still valid, if the assumed values in the experiment are feasible. For example, if these variables are related to each other and for a certain realization of the exogenous variables, it is possible for the assumed values of the endogenous variables to emerge. Of course, without an explicit model and explicit assumptions it is impossible to determine how likely or unlikely is such a counterfactual event. Second, even if the explanatory variables in the RHS of (3) or (6) are not independent to each other, their relationship, may not be "very clear" statistically. This is sometimes articulated by requiring that there is no significant correlation between the variables involved. It is shown in the Appendix that the variables in the RHS of (3) or (6) are practically uncorrelated in most cases (i.e., countries) in the sixteen years period we examine.

The second line of defense of the counterfactual experiments methodology is based on precisely the opposite point of view from the deterministic or stochastic independence between the sources. For, if one is certain of, or, at any rate, wants to examine a particular relationship between the sources, he/she could simply incorporate it in the analysis. For example, consider the simplest form of the Fisher equation: $1+i_t = (1+r_t)(1+\pi_t)$, where r_t is the effective real rate on public debt. The latter can be

computed from (4) and the Fisher equation.[21] Then, the counterfactual analysis can be performed conditional on the validity of the Fisher equation, from: $b_t = \frac{(1+r_t)}{(1+\lambda_t)} b_{t-1} + d_t^p + e_t$. The same could be said for the Taylor rule, or the primary deficit multiplier in the various stages of the business cycle, etc.[22]

In fact, some of these conditional counterfactual experiments we find them interesting and we consider them, below.

Tables 4, 4M, 5 and 5M report the results of the counterfactual experiments. The first two of these tables are based on the accounting scheme or decomposition of Debt-to-GDP changes of Equation (3) that involves the total deficit share of GDP. And, the last two of these tables are based on the decomposition of Debt-to-GDP changes of Equation (8) that involves the primary deficit share of GDP. Recall that the decomposition based on Equation (3) is simpler, involves no assumption on the structure of interest payments on government debt, but does not distinguish between discretionary and non discretionary fiscal policy. The exact opposites are true for the decomposition based on Equation (8). In Tables 4 and 5, we use the SNA Debt measure and in Tables 4M and 5M we use the Maastricht Debt measure.

It will expedite the presentation to point out first, that the results presented below apply to both decompositions of Debt-to-GDP changes and, when it is pertinent, to both measures of public debt.

Another way to say the same thing, of course, is that our results are robust to the method of decomposition of Debt-to-GDP changes, as well as the measure of public debt. Nevertheless,

Thus, the general picture that emerges from all these exercises (i.e., tables), is that the effect of real growth was to lower Debt-to-GDP in the BGRP. This effect was very strong in the Anglo-Saxon

[21] This is done in Tables A.3 in the Appendix.

[22] WE NEED SOMETHING ON FISHER EFFECT AND TAYLOR'S RULE HERE. The implied multiplier disputes, however, basically rest on estimating the effects of *purchases* that in most of the OECD countries are about 1/5 of total outlays and it is dubious that the remaining 4/5 of government spending is discretionary enough (Coricelli and Fiorito, 2013) to produce well defined multipliers. Thus, the high or low multipliers may rather reflect something else and this is probably why estimates differ so much in the literature Actually, the relevant literature is large and still growing (e.g. Ilzetzki, Mendoza and Vegh, 2012), though basically unable to reach fully shared results. This also makes useful surveys as those provided by Ramey (2011) and Parker (2011).

countries and the EU Periphery, except Portugal. The effect of real growth on GDP in the DAGRP was mixed. It was negative in Ireland, the Anglo Saxon countries the UK, and the EA Core, except Italy, as these countries came out of the Great Recession, relatively fast. That is, immediately after 2009 and remained in positive growth territory thereafter.[23] The most dramatic increases in Debt-to-GDP due to negative growth occurred in Italy and the EU Periphery countries except Ireland.

The effect on Debt-to-GDP of inflation was negative in both periods under consideration with the exception of Japan. However, this effect was much stronger in the BGRP than in the DAGRP in all countries, except Germany, were the opposite is true. In the BGRP, the countries that benefited the most from inflation, in the sense of having a lower Debt-to-GDP ratio than what they would have had if there was no inflation are the European Periphery countries, Italy, and the Anglo Saxon countries. But, in the DAGRP, the countries that benefited the most from inflation were Germany and, again, Italy and the Anglo Saxon countries. In fact, the countries that were hurt the most from relatively low inflation in the DAGRP, in the sense of having a higher Debt-to-GDP ratio than what they would have had if there was relatively high inflation were the European Periphery countries and France.[24] This important result can be further illustrated by means of another counterfactual experiment that involves a more familiar level of inflation, namely, the 2% target of the ECB and other monetary authorities. In Table 6, we present the percentage difference from the actual (historic) value of the Debt-to-GDP at the end of a given period of the Debt-to-GDP ratio that would had materialized, at the end of this period, if all variables were set to their historic values, but the inflation rate during the period was 2%. Considering, for example, the DAGRP and the decomposition of Debt-to-GDP changes involving the primary deficit, it is clear that the EU Periphery countries would have realized a Debt-to- GDP "significantly" lower than its actual value. In Greece, Spain, Ireland and Portugal this percentage difference is 14.92%, 9.73%, 7.53% and 6.51%, respectively. These percentage differences imply "significantly" lower levels of the Debt-to-GDP ratio in the DAGRP, for, in view of Table 2, they correspond to 202.16%, 69.5%, 34.41% and 73.47% of the of the actual change in the Debt–to-GDP ratio in Greece, Spain, Ireland and Portugal, respectively, during this period.

[23] See Tables A.1 for each country in the Appendix.
[24] Japan is ignored, here, for as already mentioned, the average inflation rate was negative in the During/After the Great Recession period.

Moreover, this was especially true for Maastricht debt. The results are stronger using the primary deficit decomposition as there is a compound effect related to the sustainability index effect.

Going back to the results of Tables 4, 4M, 5 and 5M and focusing on fiscal policy, the general conclusions are in line with the stylized facts of Table 3. The differences between the actual Debt-to-GDP ratio and the Debt-to-GDP ratio at the end of a given period and the Debt-to-GDP ratio that would had prevailed at the end of this period, if all variables in the RHS of Equation (3) (Equation (8)) were set equal to their historic values, but the total deficit (primary deficit) share of GDP was set equal to zero, vary widely, as each country pursued its own fiscal policy and, in most cases, this policy was different in the two periods under consideration. We find interesting three results.

The only countries that practiced austerity in the During/After the Great Recession period were Italy and especially Germany. Thus, Italy and Germany had a lower (Maastricht) Debt-to-GDP ratio at the end of 2015, than what they would have had if the primary deficit share of GDP was zero in the During/After the Great Recession period, by 4.93% and 8.74%, respectively. However, austerity did not help Italy much, as the Debt-to-GDP ratio at the end of 2008 was 33.06% higher than in the beginninof2008. For, as was previously shown, this ratio increased substantially due to relatively low real growth and inflation. On the other hand, austerity helped Germany, as the Debt-to-GDP ratio of this country increased only by 12.23% in the During/After the Great Recession period.

The effect of total deficit was to increase Debt-to-GDP ratio in the period before the Great Recession, in all countries except Canada, Ireland and Spain. And, this effect was positive and stronger, in most cases, During/After the Great Recession. The effect of deficit to GDP was more important using Maastricht debt. When it comes to the primary deficit decomposition the effect of primary deficit was positive in the period before the Great Recession in Canada, Germany, Ireland, Italy and Spain and negative in France, Greece, Japan, Portugal, UK and the USA. The same effect was positive in all countries except Italy and Germany in the period during/after the Great Recession. The contrast is more dramatic in the EU Periphery and the two EA Core countries. Again the effect using the primary deficit decomposition is bigger in absolute value in all cases due to sustainability index effect.)

6. Conclusions

This study evaluates for G7 countries and the EA periphery (i.e. Greece, Spain, Portugal, Ireland) OECD countries the sources of government debt increase during the Great Recession *vis-a'-vis* the years

immediately before. This is done adopting a purposely neutral approach, based on a simple accounting scheme decomposing annual Debt-to-GDP % changes into their numerator (deficit, discrepancies) and denominator (inflation, real growth), independent components.

Such a simple scheme is basically adopted for two reasons: the first is avoiding controversial (and often inconclusive) debates on the way in which the Government Debt-to-GDP ratio reflects/affects the aggregate economy before assessing first major stylized facts of its formation. The second reason is instead related to the obvious – tough often neglected – recognition that a rising debt ratio cannot depend on the fiscal numerator only. In particular, the role of the GDP denominator clearly rises in recession times and especially when recession is also *nominal* as recent evidence, atypically, shows.

The sample is based on annual data for six OECD countries during the Great Recession (2008-13) and the preceding 2000-07 years to evaluate if and how last crisis affected the Government Debt-to-GDP ratio. The selected countries are the US and the UK on one side and the four biggest EZ economies (Germany, France, Italy and Spain), together amounting to about ¾ of the EZ area GDP but often individually labeled as belonging to its 'core' (Germany, France) and to the Mediterranean 'periphery' (Italy, Spain). In this vein, the EZ frame also matters for the choice of the pre-crisis years in which the common European currency was already adopted along with the deficit rule and the attention paid in any case to the government debt size.

Looking at the Debt-to-GDP graphs in Section 3, the Great Recession impact is apparently similar everywhere if the attention focuses on the timing rather than on the size and nature of the debt response. Conversely, disentangling in Section 4 between the sources of the Debt-to-GDP increase, the evidence shows that these sources were more or less large in the 2008-13 years but not always/only stemming from *deliberate* policies: actually, our results indicate that there was also – with the exception of Germany – a general reduction of the nominal GDP weight, due to the concurrent mix of low inflation and low or even negative real growth. In the crisis years, this mix made debt ratio changes more *asymmetric* than they were before since the fiscal numerator increase was no longer compensated by a denominator, almost naturally rising in both inflation and real GDP components. Thus, the Debt-to-GDP increase cannot be ascribed only to an excess of fiscal activism in critical times.

Further, in the crisis years debt decomposition shows that the deficit share rises – though differently – in all countries but Germany, where it was instead dominating in the 2000-07 period. Thus, during the Great Recession, changes in debt and deficit go together in all cases but Germany and – to a lesser

extent – Italy, i.e. in the only two countries exhibiting for different reasons a *primary surplus* in the crisis years.

In countries displaying instead a more standard counter-cyclical policy, changes in the debt ratio numerator prevail in the 2008-13 crisis years and the exit from crisis seems also starting before. This typically applies to the US economy if compared with the generally lagging EZ inertia. Prevailing deficit weights are also found in the UK and in Spain, a country subject to the EZ discipline but also to the possibility of postponing to 2016 the required correction. Conversely, in the remaining EZ area considered here, France could be placed into an intermediate position between Italy and Spain, though in France a moderate fiscal stabilization occurred also before.

Basically, decomposing by source the Debt-to-GDP % changes, three are the fiscal responses to the Great Recession that our results indicate:

1. There is a specific German response aiming at minimizing fiscal adjustment, probably because the crucial one occurred in the years before when the country had to face unification costs and reform programs that proved to be useful afterwards. While making reforms in good rather than in bad times seems reasonable *per se*, the cost of this strategy was, however, a modest real growth since the international recession occurred anyway.
2. As far as the other EZ countries are concerned, they actually differ but can be grouped for convenience to show fiscal policies ranging from debt-induced discipline (Italy) to several degrees of accommodation (Spain, France), allowed by the EZ rules. Yet, in all cases the 2009-13 debt ratio changes reflect an increasing deficit weight which is huge in Spain, big in France and moderate in Italy because of its debt-constrained fiscal policy.
3. The last response involves the US and, partially, the UK: here, the only two cases where the Great Recession induced debt changes reflecting a temporary, counter-cyclical, policy that neatly differs from the EZ mix of common inertia and ad hoc heterogeneity.

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Table 1- Average and Cumulative Real and Nominal GDP Percentage Changes: 2000-2007 and 2008-2015								
Country	Average Real GDP Changes		Cumulative Real GDP Changes		Average Nominal GDP Changes		Cumulative Nominal GDP Changes	
	2000-7	2008-15	2000-7	2008-15	2000-7	2008-15	2000-7	2008-15
Canada	0.0284	0.0149	0.1892	0.1237	0.0579	0.0301	0.4283	0.2015
France	0.0211	0.0050	0.1376	0.0375	0.0413	0.0145	0.3104	0.0927
Germany	0.0165	0.0087	0.1031	0.0599	0.0254	0.0235	0.1889	0.1818
Greece	0.0405	-0.0365	0.3186	-0.2595	0.0717	-0.0338	0.6434	-0.2732
Ireland	0.0607	0.0122	0.4518	0.1197	0.0995	0.0128	0.8199	0.1445
Italy	0.0150	-0.0106	0.0829	-0.0734	0.0406	0.0022	0.2965	0.0025
Japan	0.0152	0.0016	0.1030	0.0208	0.0020	-0.0030	0.0063	-0.0038
Portugal	0.0152	-0.0069	0.0867	-0.0571	0.0491	0.0031	0.3658	0.0028
Spain	0.0377	-0.0040	0.2771	-0.0436	0.0776	0.0003	0.6726	-0.0314
UK	0.0289	0.0092	0.2099	0.0792	0.0550	0.0292	0.4086	0.2194
USA	0.0265	0.0120	0.1842	0.1024	0.0520	0.0274	0.4436	0.2270
Source: OECD, Economic Outlook '99, June 2016								

Table 2 : Average and Cumulative Debt-to-GDP Changes: 2000-2007 and 2008-2015								
Country	Average Debt-to-GDP Changes (SNA08)		Average Debt-to-GDP Changes (Maastricht)		Cumulative Debt-to-GDP Changes (SNA08)		Cumulative Debt-to-GDP Changes (Maastricht)	
	2000-7	2008-15	2000-7	2008-15	2000-7	2008-15	2000-7	2008-15
Canada	-0.0328	0.0437	-	-	-0.1656	0.3768		
France	0.0043	0.0612	0.0090	0.0522	0.0522	0.4813	0.0980	0.4125
Germany	0.0091	0.0275	0.0074	0.0164	0.0741	0.1543	0.0800	0.0954
Greece	0.0237	0.0738	0.0058	0.0737	0.0293	0.5356	-0.0148	0.6187
Ireland	-0.0661	0.2188	-0.0777	0.2200	-0.2675	1.3986	-0.3371	1.2099
Italy	-0.0126	0.0481	-0.0117	0.0368	-0.0598	0.3986	-0.0492	0.2965
Japan	0.0309	0.0449	-	-	0.1932	0.3438		
Portugal	0.0289	0.0886	0.0379	0.0847	0.2591	0.8162	0.3602	0.7996
Spain	-0.0588	0.1400	-0.0652	0.1410	-0.3596	1.4672	-0.3873	1.5170
UK	0.0019	0.0966	0.0065	0.0975	-0.0005	0.6516	0.1192	0.7236
USA	0.0297	0.0753	-	-	0.3496	0.4461		
Source: OECD, Economic Outlook '99, June 2016								

Table 3: Means of Variables Affecting Debt-to-GDP Changes: 2000-2007 and 2008-2015														
Country	**Real growth**		**Inflation Rate**		**Primary Deficit**		**Effective Interest Rate (SNA08)**		**Effective Interest Rate (Maastricht)**		**Cash/Accrual Accounting Discrepancy (SNA08)**		**Cash/Accrual Accounting Discrepancy (Maastricht)**	
	2000-7	2008-15	2000-7	2008-15	2000-7	2008-15	20007	2008-15	2000-7	2008-15	2000-7	2008-15	2000-7	2008-15
Canada	0.0284	0.0149	0.0286	0.0148	-0.0282	0.0158	0.0217	0.0086	-	-	0.0284	0.0366	-	-
France	0.0211	0.0050	0.0197	0.0095	0.0016	0.0255	0.0343	0.0241	0.0419	0.0289	0.0064	0.0226	0.0034	0.0034
Germany	0.0165	0.0087	0.0089	0.0148	-0.0010	-0.0085	0.0401	0.0246	0.0412	0.0258	-0.0027	0.0269	-0.0041	0.0174
Greece	0.0405	-0.0365	0.0300	0.0029	0.0130	0.0532	0.0497	0.0331	0.0525	0.0323	0.0331	-0.0653	0.0109	-0.0648
Ireland	0.0607	0.0122	0.0364	-0.0003	-0.0250	0.0817	0.0309	0.0282	0.0344	0.0310	0.0209	0.0301	0.0167	0.0048
Italy	0.0150	-0.0106	0.0253	0.0130	-0.0156	-0.0083	0.0432	0.0348	0.0493	0.0387	0.0009	0.0300	-0.0021	0.0100
Japan	0.0152	0.0016	-0.0130	-0.0045	0.0491	0.0645	0.0034	0.0031	-	-	-0.0073	0.0110	-	-
Portugal	0.0152	-0.0069	0.0334	0.0100	0.0200	0.0316	0.0369	0.0325	0.0444	0.0359	0.0077	0.0278	0.0045	0.0115
Spain	0.0377	-0.0040	0.0385	0.0043	-0.0230	0.0572	0.0356	0.0278	0.0407	0.0317	0.0121	0.0166	0.0080	0.0025
UK	0.0289	0.0092	0.0253	0.0198	0.0030	0.0488	0.0354	0.0261	0.0489	0.0333	0.0076	0.0277	0.0015	0.0074
USA	0.0265	0.0120	0.0247	0.0152	0.0083	0.0557	0.0487	0.0302	-	-	0.0100	0.0051	-	-
Source: OECD, Economic Outlook '99, June 2016														

Table 4: Contributions to Debt-to-GDP Changes (Eq. (5), SNA08 Debt)

Country	Debt-to-GDP Cumulative Change		Effective Interest Rate		Inflation Rate		Real Growth		Primary Deficit		Cash/Accrual Accounting Discrepancy	
	2000-7	2008-15	2000-7	2008-15	2000-7	2008-15	2000-7	2008-15	2000-7	2008-15	2000-7	2008-15
Canada	-0.2188	0.2783	0.1408	0.0613	-0.1869	-0.1002	-0.1881	-0.1084	-0.2258	0.1267	0.2271	0.2928
France	0.0221	0.4518	0.2080	0.1845	-0.1202	-0.0718	-0.1289	-0.0465	0.0126	0.2042	0.0509	0.1809
Germany	0.0409	0.1452	0.2038	0.1497	-0.0453	-0.0937	-0.0868	-0.0618	-0.0082	-0.0681	-0.0326	0.1393
Greece	0.1850	0.6786	0.4348	0.3555	-0.2673	0.0038	-0.3574	0.3712	0.1043	0.4258	0.2652	-0.5223
Ireland	-0.2175	0.8780	0.0891	0.2076	-0.1105	-0.0619	-0.1781	-0.1812	-0.2002	0.6533	0.1676	0.2405
Italy	-0.1215	0.4848	0.3804	0.3384	-0.2383	-0.1299	-0.1432	0.0972	-0.1246	-0.0661	0.0069	0.2400
Japan	0.3450	0.6755	0.0379	0.0497	0.1577	0.0554	-0.1882	-0.0464	0.3926	0.5159	-0.0584	0.0877
Portugal	0.1563	0.7222	0.2049	0.2903	-0.1859	-0.0962	-0.0852	0.0480	0.1596	0.2525	0.0617	0.2224
Spain	-0.2622	0.7457	0.1660	0.1699	-0.1752	-0.0200	-0.1732	0.0025	-0.1841	0.4573	0.0971	0.1328
UK	0.0052	0.5720	0.1533	0.1852	-0.1367	-0.1117	-0.1530	-0.0224	0.0331	0.3835	0.0971	0.1328
USA	0.1257	0.4872	0.2230	0.2299	-0.1174	-0.1189	-0.1252	-0.1112	0.0664	0.4458	0.0801	0.0406

Table 5: Contributions to Debt to DGP Changes
(Eq. (5), Maastricht Debt)

Country	Debt-to-GDP Cumulative Change		Effective Interest Rate		Inflation Rate		Real Growth		Primary Deficit		Cash/Accrual Accounting Discrepancy	
	2000-7	2008-15	2000-7	2008-15	2000-7	2008-15	2000-7	2008-15	2000-7	2008-15	2000-7	2008-15
France	0.0418	0.3173	0.2080	0.1845	-0.1202	-0.0718	-0.1289	-0.0465	0.0126	0.2042	0.0275	0.0271
Germany	0.0335	0.0776	0.2038	0.1497	-0.0439	-0.0880	-0.0843	-0.0587	-0.0082	-0.0681	-0.0326	0.1393
Greece	0.0425	0.7426	0.4348	0.3555	-0.2500	0.0096	-0.3369	0.4214	0.1043	0.4258	0.0871	-0.5188
Ireland	-0.2274	0.6988	0.0891	0.2076	-0.1014	-0.0556	-0.1612	-0.1612	-0.2002	0.6533	0.1336	0.0383
Italy	-0.0998	0.3299	0.3804	0.3384	-0.2090	-0.1170	-0.1255	0.0902	-0.1246	-0.0661	-0.0167	0.0797
Portugal	0.1739	0.6053	0.2049	0.2903	-0.1549	-0.0841	-0.0711	0.0501	0.1596	0.2525	0.0360	0.0918
Spain	-0.2544	0.6366	0.1660	0.1699	-0.1532	-0.0171	-0.1516	0.0039	-0.1841	0.4573	0.0637	0.0199
UK	0.0179	0.4565	0.1533	0.1852	-0.0983	-0.0862	-0.1121	-0.0147	0.0331	0.3835	0.0637	0.0199

Table 6: Percentage Differences of Counterfactual from Actual Debt-to-GDP at the End of the Experiment Period (Eq. (4) SNA08 Debt)								
Country	Inflation ($\tilde{\delta}^{\pi}$)		Real Growth ($\tilde{\delta}^{\lambda}$)		Primary Deficit ($\tilde{\delta}^{d}$)		Cash/Accrual Accounting Discrepancy ($\tilde{\delta}^{e}$)	
	2000-7	2008-15	2000-7	2008-15	2000-7	2008-15	2000-7	2008-15
Canada	-0.1353	0.0822	-0.1268	0.0694	-0.1380	0.3086	0.1704	0.0709
France	-0.1131	0.0482	-0.1052	0.0875	0.0244	0.1947	0.0387	0.1368
Germany	-0.0509	-0.0470	-0.0741	0.0372	0.0251	-0.0577	-0.0429	0.2281
Greece	-0.2490	0.2153	-0.3231	0.8450	0.1262	0.4792	0.0657	-0.9580
Ireland	-0.0634	0.0419	-0.1210	0.0063	-0.0976	0.7607	0.1384	0.0939
Italy	-0.2344	0.1008	-0.1002	0.2655	-0.0789	0.0558	0.0003	0.2415
Japan	0.1335	-0.0934	-0.1662	0.1632	0.3251	0.1135	-0.0484	0.0738
Portugal	-0.1763	0.0916	0.7592	0.6699	0.1463	0.1341	0.0522	0.1706
Spain	-0.1441	0.1424	-0.1277	0.1734	-0.1443	0.6697	0.0691	0.0508
UK	-0.0726	0.0026	-0.0757	0.1277	0.0599	0.4002	0.0125	0.1860
USA	-0.1114	0.0019	-0.1101	0.0212	0.0987	0.3670	0.0784	-0.0336

GERMANY_M											
Year	bt	it	πt	λt	dpt	e^t	it*bt-1	(πt*bt-1)	(λt*bt-1)	dpt	e^t
1999	0,6010										
2000	0,5876	0,0459	-0,0044	0,0320	-0,0355	0,0112	0,0276	0,0027	-0,0192	-0,0355	0,0109
2001	0,5750	0,0441	0,0127	0,0184	0,0055	-0,0259	0,0259	-0,0075	-0,0108	0,0055	-0,0261
2002	0,5913	0,0439	0,0135	0,0002	0,0139	-0,0154	0,0252	-0,0078	-0,0001	0,0139	-0,0156
2003	0,6283	0,0417	0,0121	-0,0073	0,0163	-0,0018	0,0247	-0,0072	0,0043	0,0163	-0,0019
2004	0,6490	0,0386	0,0109	0,0070	0,0130	-0,0058	0,0243	-0,0069	-0,0044	0,0130	-0,0060
2005	0,6701	0,0357	0,0062	0,0088	0,0103	-0,0035	0,0232	-0,0040	-0,0057	0,0103	-0,0037
2006	0,6632	0,0346	0,0031	0,0388	-0,0062	0,0028	0,0232	-0,0021	-0,0260	-0,0062	0,0029
2007	0,6345	0,0364	0,0169	0,0338	-0,0255	0,0053	0,0241	-0,0112	-0,0224	-0,0255	0,0057
2008	0,6502	0,0369	0,0083	0,0081	-0,0216	0,0241	0,0234	-0,0053	-0,0051	-0,0216	0,0239
2009	0,7249	0,0329	0,0176	-0,0557	0,0090	0,0166	0,0214	-0,0114	0,0362	0,0090	0,0185
2010	0,8118	0,0291	0,0075	0,0394	0,0213	0,0771	0,0211	-0,0055	-0,0286	0,0213	0,0777
2011	0,7843	0,0245	0,0108	0,0372	-0,0101	0,0001	0,0199	-0,0088	-0,0302	-0,0101	0,0009
2012	0,7958	0,0218	0,0150	0,0062	-0,0169	0,0267	0,0171	-0,0117	-0,0048	-0,0169	0,0266
2013	0,7709	0,0185	0,0209	0,0041	-0,0143	-0,0069	0,0148	-0,0166	-0,0032	-0,0143	-0,0068
2014	0,7458	0,0173	0,0174	0,0158	-0,0165	0,0026	0,0133	-0,0134	-0,0122	-0,0165	0,0030
2015	0,7122	0,0153	0,0206	0,0145	-0,0191	-0,0014	0,0114	-0,0153	-0,0108	-0,0191	-0,0009

Table 7: Percentage Differences of Counterfactual from Actual Debt-to-GDP at the End of the Experiment Period (Eq. (4), Maastriht Debt)

Country	Inflation ($\tilde{\delta}_t^{\pi}$)		Real Growth Rate ($\tilde{\delta}_t^{\lambda}$)		Primary Deficit ($\tilde{\delta}_t^{d}$)		……Cash/Accrual Accounting Discrepancy ($\tilde{\delta}_t^{e}$)	
	2000-7	2008-15	2000-7	2008-15	2000-7	2008-15	2000-7	2008-15
France	-0.0958	0.0400	-0.0898	0.0748	0.0241	0.1985	0.0247	0.0026
Germany	-0.0496	-0.0968	-0.0721	0.0378	0.0251	-0.0579	-0.0460	0.1678
Greece	-0.2351	0.2142	-0.3069	0.8872	0.1266	0.4735	0.0015	-0.6358
Ireland	-0.0593	0.0409	-0.1107	0.0097	-0.1000	0.7704	0.1060	-0.0647
Italy	-0.2110	0.0877	-0.0907	0.2444	-0.0823	0.0588	-0.0179	0.1070
Portugal	-0.1519	0.0757	-0.0534	0.1344	0.1494	0.1348	0.0399	0.0752
Spain	-0.1288	0.1280	-0.1143	0.1574	-0.1465	0.6792	0.0500	-0.0742
UK	-0.0554	-0.0024	-0.0603	0.1031	0.0575	0.4141	0.0055	0.0558

Table 8: Percentage Differences of Counterfactual, with 2% inflation, from Actual Debt-to-GDP at the End of the Experiment Period (Eq. (4))				
Country	**SNA08 Debt**		**Maastricht Debt**	
	2000-7	2008-15	2000-7	2008-15
Canada	-0.0630	0.0375		
France	0.0016	0.0739		
Germany	0.0962	0.0383		
Greece	-0.0671	0.1492		
Ireland	-0.1164	0.0753		
Italy	-0.0422	0.0534		
Japan	0.2756	0.1701		
Portugal	-0.0839	0.0651		
Spain	-0.1477	0.0973		
UK	-0.2066	-0.0862		
USA	-0.0349	0.0324		

Table 3.1 Interest Rates and the Sustainable Debt Index: Canada

Year	10year bond	λ_t	π_t	i_t	$r_t=i_t-\pi_t$	λ_t-r_t
1999	0,0554				0,0000	0,0000
2000	0,0593	0,0518	0,0434	0,0359	-0,0075	0,0593
2001	0,0548	0,0177	0,0166	0,0350	0,0184	-0,0007
2002	0,0529	0,0301	0,0124	0,0305	0,0181	0,0120
2003	0,0481	0,0180	0,0326	0,0224	-0,0102	0,0282
2004	0,0458	0,0309	0,0328	0,0199	-0,0129	0,0438
2005	0,0407	0,0320	0,0315	0,0137	-0,0177	0,0498
2006	0,0420	0,0262	0,0261	0,0081	-0,0180	0,0443
2007	0,0427	0,0206	0,0332	0,0078	-0,0254	0,0460
2008	0,0361	0,0100	0,0400	0,0042	-0,0359	0,0459
2009	0,0323	-0,0295	-0,0229	0,0147	0,0376	-0,0671
2010	0,0324	0,0308	0,0287	0,0106	-0,0181	0,0490
2011	0,0278	0,0314	0,0324	0,0075	-0,0249	0,0563
2012	0,0187	0,0175	0,0122	0,0081	-0,0041	0,0215
2013	0,0226	0,0222	0,0155	0,0074	-0,0081	0,0303
2014	0,0223	0,0247	0,0176	0,0059	-0,0117	0,0364
2015	0,0152	0,0117	-0,0053	0,0106	0,0159	-0,0041

Table 3.2: Interest Rates and the Sustainble Debt Index: France

Year	10year bond	λ_t	π_t	i_t	i^M_t	$r_t = i_t - \pi_t$	$r^M_t=i^M_t-\pi_t$	λ_t-r_t	$\lambda_t-r^M_t$
1999	0,0461	-	-	-	-	0,0000	0,0000	0,0000	0,0000
2000	0,0539	0,0388	0,0154	0,0367	0,0448	0,0213	0,0293	0,0175	0,0094
2001	0,0494	0,0195	0,0200	0,0373	0,0458	0,0173	0,0258	0,0022	-0,0062
2002	0,0486	0,0112	0,0207	0,0378	0,0462	0,0171	0,0255	-0,0059	-0,0143
2003	0,0413	0,0082	0,0187	0,0343	0,0426	0,0156	0,0239	-0,0074	-0,0157
2004	0,0410	0,0279	0,0165	0,0332	0,0406	0,0168	0,0242	0,0111	0,0037
2005	0,0341	0,0161	0,0194	0,0313	0,0382	0,0119	0,0188	0,0041	-0,0027
2006	0,0380	0,0237	0,0216	0,0303	0,0368	0,0087	0,0152	0,0151	0,0086
2007	0,0430	0,0236	0,0256	0,0336	0,0401	0,0080	0,0145	0,0156	0,0091
2008	0,0423	0,0020	0,0238	0,0357	0,0420	0,0119	0,0182	-0,0100	-0,0162
2009	0,0365	-0,0294	0,0010	0,0265	0,0317	0,0255	0,0307	-0,0549	-0,0601
2010	0,0312	0,0197	0,0108	0,0251	0,0296	0,0143	0,0188	0,0053	0,0008
2011	0,0332	0,0208	0,0094	0,0263	0,0312	0,0169	0,0218	0,0039	-0,0010
2012	0,0254	0,0018	0,0116	0,0245	0,0290	0,0130	0,0174	-0,0111	-0,0156
2013	0,0220	0,0064	0,0078	0,0200	0,0246	0,0122	0,0168	-0,0058	-0,0104
2014	0,0167	0,0063	0,0048	0,0188	0,0226	0,0140	0,0178	-0,0077	-0,0115
2015	0,0084	0,0122	0,0069	0,0161	0,0204	0,0093	0,0135	0,0030	-0,0013

Table 3.3: Interest Rates and the Sustainable Debt Index: Germany

Year	10year bonds	λ_t	π_t	i_t	i_t^M	$r_t=i_t-\pi_t$	$r_t^M=i_t^M-\pi_t$	λ_t-r_t	$\lambda_t-r_t^M$
1999	0,0449	-	-	-	-	0,0000	0,0000	0,0000	0,0000
2000	0,0526	0,0320	-0,0044	0,0459	0,0460	0,0504	0,0504	-0,0184	-0,0184
2001	0,0480	0,0184	0,0127	0,0441	0,0448	0,0314	0,0322	-0,0130	-0,0138
2002	0,0478	0,0002	0,0135	0,0439	0,0449	0,0304	0,0314	-0,0302	-0,0312
2003	0,0407	-0,0073	0,0121	0,0417	0,0432	0,0296	0,0311	-0,0369	-0,0384
2004	0,0404	0,0070	0,0109	0,0386	0,0398	0,0277	0,0289	-0,0207	-0,0219
2005	0,0335	0,0088	0,0062	0,0357	0,0374	0,0295	0,0312	-0,0207	-0,0224
2006	0,0376	0,0388	0,0031	0,0346	0,0363	0,0315	0,0332	0,0073	0,0055
2007	0,0422	0,0338	0,0169	0,0364	0,0375	0,0194	0,0205	0,0144	0,0133
2008	0,0398	0,0081	0,0083	0,0369	0,0374	0,0286	0,0291	-0,0205	-0,0210
2009	0,0322	-0,0557	0,0176	0,0329	0,0345	0,0153	0,0169	-0,0709	-0,0726
2010	0,0274	0,0394	0,0075	0,0291	0,0304	0,0216	0,0228	0,0178	0,0166
2011	0,0261	0,0372	0,0108	0,0245	0,0255	0,0137	0,0147	0,0234	0,0225
2012	0,0150	0,0062	0,0150	0,0218	0,0233	0,0069	0,0083	-0,0007	-0,0022
2013	0,0157	0,0041	0,0209	0,0185	0,0201	-0,0024	-0,0008	0,0064	0,0048
2014	0,0116	0,0158	0,0174	0,0173	0,0183	-0,0001	0,0009	0,0159	0,0149
2015	0,0050	0,0145	0,0206	0,0153	0,0168	-0,0053	-0,0037	0,0197	0,0182

Table 3.4: Interest Rates and the Sustainable Debt Index: Greece

Year	10year bond	λ_t	π_t	i_t	i_t^M	$r_t=i_t-\pi_t$	$r_t^M=i_t^M-\pi_t$	λ_t-r_t	$\lambda_t-r_t^M$
1999	0,0631	-	-	-	-	0,0000	0,0000	0,0000	0,0000
2000	0,0611	0,0408	0,0164	0,0716	0,0698	0,0552	0,0533	-0,0143	-0,0125
2001	0,0530	0,0420	0,0325	0,0578	0,0616	0,0253	0,0291	0,0167	0,0129
2002	0,0512	0,0400	0,0325	0,0507	0,0541	0,0183	0,0217	0,0217	0,0184
2003	0,0427	0,0581	0,0335	0,0463	0,0500	0,0128	0,0165	0,0453	0,0417
2004	0,0426	0,0470	0,0349	0,0466	0,0499	0,0117	0,0150	0,0354	0,0320
2005	0,0359	0,0085	0,0202	0,0429	0,0459	0,0226	0,0257	-0,0141	-0,0172
2006	0,0407	0,0557	0,0349	0,0420	0,0438	0,0071	0,0089	0,0486	0,0468
2007	0,0450	0,0316	0,0350	0,0395	0,0446	0,0045	0,0096	0,0271	0,0220
2008	0,0480	-0,0022	0,0408	0,0417	0,0464	0,0009	0,0056	-0,0030	-0,0078
2009	0,0517	-0,0430	0,0279	0,0396	0,0430	0,0117	0,0151	-0,0547	-0,0581
2010	0,0909	-0,0549	0,0091	0,0388	0,0415	0,0298	0,0324	-0,0846	-0,0873
2011	0,1575	-0,0918	0,0059	0,0483	0,0428	0,0424	0,0369	-0,1342	-0,1287
2012	0,2250	-0,0733	-0,0028	0,0377	0,0240	0,0404	0,0268	-0,1137	-0,1000
2013	0,1005	-0,0311	-0,0288	0,0204	0,0212	0,0492	0,0500	-0,0803	-0,0811
2014	0,0693	0,0072	-0,0234	0,0202	0,0207	0,0436	0,0441	-0,0364	-0,0369
2015	0,0964	-0,0032	-0,0055	0,0184	0,0187	0,0239	0,0242	-0,0272	-0,0274

Table 3.5: Interest Rates and the Sustainable Debt Index: Ireland

Year	10year bond	λ_t	π_t	i_t	i_t^M	$r_t=i_t-\pi_t$	$r_t^M=i_t^M-\pi_t$	λ_t-r_t	$\lambda_t-r_t^M$
1999	0,0477	-	-	-	-	0,0000	0,0000	0,0000	0,0000
2000	0,0548	0,1022	0,0612	0,0378	0,0404	-0,0234	-0,0208	0,1256	0,1230
2001	0,0502	0,0587	0,0626	0,0315	0,0335	-0,0311	-0,0291	0,0898	0,0879
2002	0,0499	0,0595	0,0527	0,0355	0,0377	-0,0173	-0,0151	0,0767	0,0745
2003	0,0413	0,0385	0,0327	0,0340	0,0380	0,0013	0,0054	0,0372	0,0332
2004	0,0406	0,0443	0,0260	0,0310	0,0343	0,0050	0,0083	0,0394	0,0361
2005	0,0332	0,0635	0,0233	0,0294	0,0330	0,0062	0,0097	0,0574	0,0539
2006	0,0379	0,0632	0,0234	0,0250	0,0305	0,0016	0,0071	0,0617	0,0561
2007	0,0433	0,0553	0,0096	0,0233	0,0277	0,0137	0,0181	0,0417	0,0372
2008	0,0455	-0,0221	-0,0269	0,0233	0,0273	0,0502	0,0542	-0,0723	-0,0763
2009	0,0523	-0,0566	-0,0425	0,0269	0,0306	0,0693	0,0731	-0,1259	-0,1297
2010	0,0599	0,0038	-0,0231	0,0349	0,0389	0,0581	0,0620	-0,0543	-0,0583
2011	0,0958	0,0259	0,0204	0,0318	0,0314	0,0114	0,0110	0,0145	0,0149
2012	0,0599	0,0014	0,0036	0,0286	0,0293	0,0250	0,0257	-0,0235	-0,0243
2013	0,0383	0,0144	0,0116	0,0273	0,0301	0,0158	0,0185	-0,0013	-0,0041
2014	0,0226	0,0521	0,0014	0,0271	0,0303	0,0257	0,0289	0,0265	0,0232
2015	0,0111	0,0783	0,0530	0,0254	0,0299	-0,0276	-0,0231	0,1059	0,1014

Table 3.6: Interest Rates and the Sustainable Debt Index: Italy

Year	10year bond	λ_t	π_t	i_t	i_t^M	$r_t=i_t-\pi_t$	$r_t^M=i_t^M-\pi_t$	λ_t-r_t	$\lambda_t-r_t^M$
1999	0,0473	-	-	-	-	0,0000	0,0000	0,0000	0,0000
2000	0,0558	0,0397	0,0196	0,0501	0,0565	0,0305	0,0369	0,0092	0,0028
2001	0,0519	0,0158	0,0299	0,0511	0,0578	0,0212	0,0279	-0,0054	-0,0121
2002	0,0503	0,0025	0,0335	0,0459	0,0517	0,0123	0,0182	-0,0098	-0,0157
2003	0,0430	0,0024	0,0318	0,0421	0,0483	0,0103	0,0165	-0,0079	-0,0141
2004	0,0426	0,0137	0,0253	0,0407	0,0463	0,0154	0,0210	-0,0017	-0,0073
2005	0,0356	0,0115	0,0189	0,0384	0,0445	0,0195	0,0257	-0,0080	-0,0141
2006	0,0405	0,0210	0,0190	0,0371	0,0433	0,0181	0,0243	0,0029	-0,0033
2007	0,0449	0,0133	0,0243	0,0163	0,0185	-0,0080	-0,0058	0,0213	0,0191
2008	0,0468	-0,0107	0,0248	0,0263	0,0294	0,0015	0,0046	-0,0121	-0,0153
2009	0,0431	-0,0551	0,0196	0,0355	0,0397	0,0160	0,0202	-0,0711	-0,0753
2010	0,0404	0,0165	0,0032	0,0331	0,0374	0,0299	0,0342	-0,0133	-0,0177
2011	0,0542	0,0072	0,0147	0,0362	0,0395	0,0215	0,0248	-0,0143	-0,0176
2012	0,0549	-0,0286	0,0138	0,0412	0,0423	0,0274	0,0285	-0,0561	-0,0571
2013	0,0432	-0,0175	0,0123	0,0334	0,0375	0,0212	0,0253	-0,0387	-0,0428
2014	0,0289	-0,0027	0,0081	0,0306	0,0345	0,0225	0,0264	-0,0252	-0,0291
2015	0,0171	0,0064	0,0075	0,0255	0,0307	0,0180	0,0232	-0,0116	-0,0167