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The Impact of Sovereign Debt on Growth: An Empirical Study on GIIPS versus JUUSD Countries

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Abstract:

This study aims at concluding the general debt impact on economic growth for two different groups of countries during the period (1993-2013). Results showed negative impact of public debt on economic growth on short and long terms. Impact percentage differs according to countries and interpretive variables that interpret the relationship.

Negative impact of debt starts from levels between 60-90% of gross domestic product on long term; its impact becomes bigger on long and short terms when percentage is higher than 90% of gross domestic product, whereas raise of public debt by 10% leads into decreasing economic growth by 1-2% in average.

Results showed that the variables which affect the economic growth the most are savings/ investment, population growth, long and short terms of nominal interest rate, current account balance, private credit, inflation, Government budget primary balance, and debt service. Study results also revealed that banking crisis and double crisis are the most negatively reflecting crisis on the economic growth.

Keywords: *Public debt, Economic growth, Deflation, Fiscal policy, monetary policy*

JEL Classification: *H63, O4, E2, E52*

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1. Introduction

Development of several industrial countries during the last centuries links to rise of deficit levels in public budget, which led into a significant rise in public debt, and the following deterioration in financial situations in those countries *(*Mencinger *et al.*, 2014). Before the Nineteenth century, debt accumulation in industrial countries was relatively slow mainly due to wars. French-British war between 1689-1697 led to rise of British public debt, public debt percentage raised in U.S.A as a result of American revolution, French debt also increased after 1878 as a result of the rise of public disbursement and colonial expansion (Checherita-Westphal and Rother, 2012).

In the beginning of nineteenth century a big rise in public debt happened and led into a significant rise in sovereign debt crisis in the world as a consequence of several reasons such as: interest rate decrease, liquidity decrease in markets due to investor's tendency to less liquidity assets which doesn't include risks. Between 1800-2008 Spain suffered thirteen sovereign debt crisis, France suffered eight crises, Austria and Hungary suffered seven crises, Portugal suffered six crises, and Greece suffered five crises (Mireinhart and Rogoff, 2009).

Economic and financial crisis contributed to public debt accumulation, when financial crisis which started in less-quality financial institution market in U.S.A led into worst economic recession since 1930 in all advanced economies. Public debt in Euro zone rose up between 2007-2009 by 20%, deficit raised by 814% for the same period (from 0.07% in 2007 to -6.4 % in 2009) while economic growth for the same period regressed by 250% from (3% in 2007 to - 4.5 % in 2009). As a result of financial deficit rise, revenue decrease, launching financial stimulation packages, and strong commitment by governments to help stumbling banks in fear of inability to pay off their debt, classifications of financial solvency got worse in several Euro zone countries. That led into a quick transfer from Subprime Mortgages Crisis into sovereign debt crisis started in autumn 2009 in Greece. Soon it spread into other countries such as, Ireland, Portugal, Spain, cypress, Italy. Then, European economy entered the worst state of recession since the beginning of the twentieth century.

A study conducted by Haytham Ewaida (2015) showed that economic growth in Euro zone decelerate severely between (2010-2013) when gross domestic product declined by 18% , price index decreased by 19%, and public debt increased by 11% for the same period. Policies on the level of EU were carried out to address the crisis through financial rescue plans for stumbling countries, with conditioned financing for those countries through financial austerity policies, structural reforms in order to improve competitive ability. Positive influence of these measures usually links in the long run to decrease government disbursement in order to get rid of debt burden and increase growth horizons. However, these policies will have negative impact on production, ability to adapt economically in the future, which could lead into a long period of economic recession (Dreger and Reimers, 2013).

Debt crisis led to revival of academic and political concern with economic growth impact on public debt. The controversial relationship which links public debt levels and economic growth started to come back. The important question is: Does rise of public debt restrict economic growth? This question is important for policy that will be adopted, because if the answer is yes that means (expansionary fiscal policy which increases debt levels will lead into decreasing levels of economic growth on long run). Yes –answer to this question means negation of positive impact of fiscal stimulation on euro zone economies. This forces policy makers to review their policies (dominant belief became that public debt leads into decreasing economic growth on long run). This cope up with results of the increasing empirical literature which shows that there is negative linear and non-linear relationship between public debt and economic growth in advanced and emerging economies as well (Ugo and Presbitero, 2012). This study aims at investigating the potential linear relationship between public debt percentage and real gross domestic product growth for two groups of countries. The first group includes five- Euro zone countries, which suffer a severe sovereign debt crisis, received financial aids, and followed several programs of financial restructuring and austerity. They are (Greece, Portugal, Ireland, Spain, and Italy) Cyprus was excluded due to its small economies.

***Figure 1**: Real Economic growth Rate (Annul %) Group one (1993-2013)*

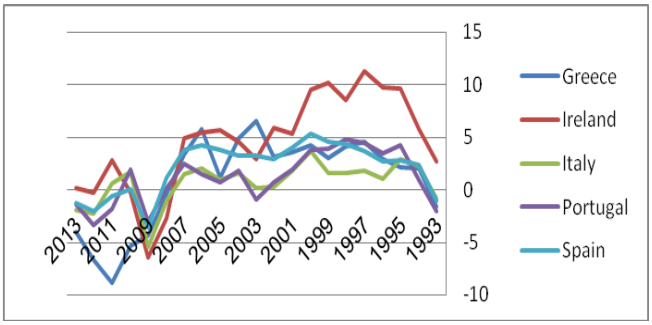
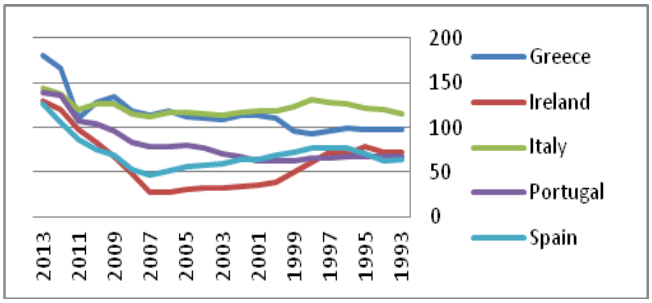


***Figure 2**: General government gross financial liabilities %GDP Group one (1993-2013)*



***Sources:** OCED 2016. Real Economic growth Rate and public debt as percentage from GDP Statistical Data, Available at http://www.oecd.org Visit date 25/5/2016. Author Estimation.*

The second group includes five countries outside Euro-zone, which suffer relatively from high public debt levels. They are (Japan, Britain, America, Denmark, and Sweden). Japan has the highest debt percentage all over the world. Comparing the two groups is important to show the actual effect of public debt on economic growth. Comparison helps in isolating the effect of a group of variables (currency union, economy size, competitiveness, and geographical location) on relationship between public debt and economic growth.

Figure 3: *Real Economic growth Rate (Annul %) Group Tow (1993-2013).*

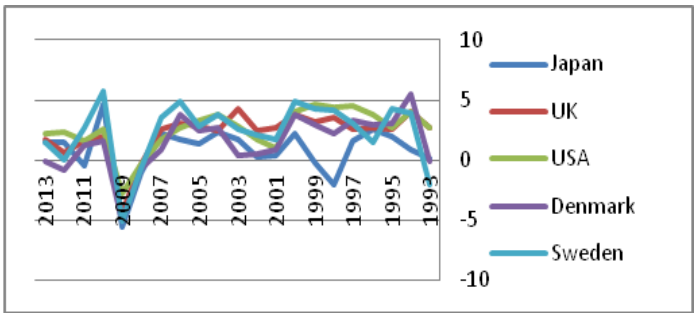
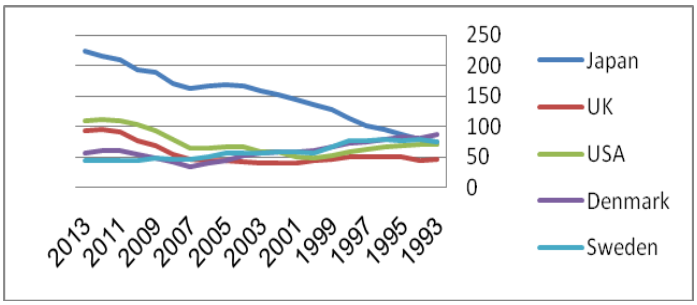


Figure 4: *General government gross financial liabilities, % GDP Group Tow (1993-2013)*



Sources: *OCED 2016. Real Economic growth Rate and public debt as percentage from GDP Statistical Data, Available at http://www.oecd.org Visit date 25/5/2016. Author Estimation.*

The article is organized as follows: Section one: Introduction. Section two: Reviews the Empirical and Theoretical Literature. Section three: Methodology and Data. Section four: Empirical Conclusions. Section five: Final Conclusions.

2. Literature Review

There is scarcity in economic literature concerning relationship between public debt levels and economic growth in advanced countries economies in general and Euro-zone in special. Most theoretical and empirical studies tackled that relationship in less developing countries, but it didn't tackle the economically advanced countries

although these analysis became very important in the advanced countries as a result of increasing financial pressures in Euro zone, significant rise in public debt percentage, and decrease in real economic growth levels.

2.1 Theoretical Literature

Over previous years, lots of literature was allocated to verify the relationship between levels of government debt and economic growth; there are three main different opinions on that relationship, the first is: based on the Keynesian approach which is based on stimulatory opinion; (i.e) expansionary financial policy will lead into rise in public budget deficit and public debt increase, as well as stimulation for effective overall demand, which will lead into stimulating consumption, investment, employment and economic growth (Szabo, 2013). This is the result of studies of Haavelmo (1945) and Baumol and Peston (1955). The second opinion is for Ricardo who suggests that there is no impact of deficit and public debt on economic growth; when financial stimulation starts, budget deficit and government debt increase. Consequently, countries start applying contractionary policy through increasing taxes that influence income and consumption levels, taking into consideration that this decrease in income levels and consumption will be compensated through increase in current government disbursement (Chang and Chiang, 2012). This was proven by the study of Barro (1989).

The third opinion contradicts with Keynesian and Ricardo theory; it is based on crowding out principle, and called neo-classical growth theory. It suggests that deficit rise and public debt will lead into reducing economic growth as a result of interest rate rise, investment reduction, and capital formation (expansionary financial policy enhances current consumption which leads into investment reduction. As a result interest rates will be raised and that leads into investment reduction, income reduction, and eventually slow growth). This was tackled by studies done by Solow (1956), Swan (1956), Modigliani (1961) and Denison (1962). Those aforementioned studies showed that government debt forms a burden on future generations in the form of income flow decrease; (i.e.) weak economic growth in the country overloaded with debt (Mencinger *et al.*, 2014; Boldeanu and Tache, 2016; Allegret *et al.*, 2016).

The effect of debt on economic growth is not limited with foreign debts; it also includes the internal debts. A study by Diamond (1965) proved that issuing internal debts to finance financial deficit, or for reducing cash flow causes high cost on economy. When Government Issues local debt, it affects the private investment; that's due to the use of private internal savings to finance these debts. Instead, those savings could have been used to lend the private sector. Using savings to finance debts caused increasing borrowing cost for private sector, decreasing demand on private investment, reducing capital accumulation, growth and prosperity reduction (Abbas and Christensen, 2007).

Negative impact of debt on economic growth is known as debt burden theory. In a study by Krugman (1988), debt burden is defined as financial benefits less than borrowed money. Cohen *(*1993) confirmed that relation between investment nominal value and borrowing resembles Laffer curve (if debt level increases after a threshold, expected value for debt recovery decreases). Sachs (1989) asserted that debt leads into deterioration of trade exchange rates, exaggeration in local currency value, and to economic growth regression (Zaman *et al.,* 2013; Thalassinos *et al.,* 2014; 2015a; 2015b).

Borensztein (1990) defined it as the situation when benefits of investment returns are very little as a result of liabilities of public debt services. The reason behind the rise of debt burden is the rise of debt services as a percentage of gross domestic product. That creates doubts in country's ability to pay off the debt, and triggers tax increase expectation in the future. Uncertainty of paying off debt will lead into flight of local and domestic investments. Increase in debt services percentage will lead into reducing growth because the opportunities of high debt countries to join credit market will decrease, and that will lead to rise in local interest rates, which will lead into crowding out private investment, decreasing investment values and growth decrease. In brief, debt burden theory suggests that debt rise is seen as a future tax on production because it limits current investment, and pushes the debtor to go into a track with less growth (Balcilar, 2012).

2.2 Empirical Literature

Several empirical studies investigated the relationship between public debt and economic growth, but most of them were about studying external debt and its impact on economic growth. Studies came in two groups; the first suggested that public external debt has positive impacts on economy. This trend was supported by Arrow and Kuz (1970) contributions. The studies concluded that debt accumulation leads into accumulation of material and human capital (through financing teaching) which eventually leads into enhancing productivity, raising the level of economic growth. Contributions of Rebelo (1995) Lucas (1988) showed that debt works as a motive for internal growth through influencing investment levels (increasing debt leads into rising public investment funding) which leads into increasing growth through improving productivity levels (Balcilar, 2012). Other empirical contributions which concluded that public debt has positive relationship with economic growth are the works by Abu Bakar and Hassan (2008) and Cohen (1992).

The second group suggests that external debt has negative impact on economy. Debtor countries won't have stimulation on local investment or local savings amidst the existence of public debt (accumulated debt reduces capital flow and investment) (i.e): public debt leads into reducing investment (public debt leads into capital flight and doesn't encourage private investment) as shown in studies by Deshpande (1997), Pattillo *et al.,* (2002), Salotti and Tcecroci (2012). Debt burden forms a problem in resources liberalization (Ezeabasili *et al.,* 2011), because liabilities of

paying off debt reduces imports, and that negatively reflects on gross domestic product growth. Low debt levels could have positive impact on gross domestic product as suggested by the study of Romero and Burkey (2011).

Negative impact of public debt on economies' growth doesn't happen on all levels, moderate levels of debt improves social welfare and enhance growth, but high levels of debt could lead into harms in economic growth Cecchetti *et al.,* (2011) levels of public debt impact on economic growth vary according to studies. Several studies proved that low levels of public debt have negative impact on economic growth, Study by Kumar and Woo (2010). Harmful impact of public debt starts from levels of 10% as a percentage of Gross Domestic Product whereas it was on levels of 15% in Reinhart *et al.,* (2012) study. at 20-60% level in Egert (2012), at 35% level in Corde *et al.,* (2005), and Clement *et al.,* (2003) studies. It reached 70% levels in Caner *et al.,* (2010), and Elmeskov and Sutherland (2012) studies. However, Methods Cechetti *et al.,* (2011) estimated debt threshold by 85% Dreger and Reimers (2013). In Reinhart and Rogoff (2009:2010) study, it raised to 90% levels in 95% level in Baum, Checherita-Westphal and Rother (2012), in 97% of gross domestic product in Elbadawi *et al.,* (1997) study and in 90-100% levels in Checherita-Westphal and Rother (2012) study.

The impact of public debt levels on economic growth differs according to the country. A study for Mencinger *et al.,* (2014), tackled European Union states suggests that negative impact of debt on economic growth reached 80% debt levels for ex-members of Euro-zone, whereas it was on 53-54% levels for recently- joining countries. Study for Szabo (2013) confirmed that in countries with old membership, debt increase by one percent as a percentage of gross domestic product leads into economic growth decelerate by 0.027 percentage point. However, countries that recently joined EU zone in 2004 were more affected; their decrease in growth reached 0.041 percentage point.

From empirical contributions which concluded that public debt has negative relationship with economic growth are Sachs (1989), Tornell and Velasco (1992), Pattillo *et al.,* (2002), Presbitero and Arnone (2010), Kumar and Woo (2010), Panizza and Presbitero (2012), Lof and Malinen (2014). In addition, empirical literature examined whether the relationship between public debt and economic grow is linear or non-linear. Sala-I-martin (1997) and Blavy (2006) figured out that the relation is linear. However, the following studies proved that the relationship between public debt and economic growth is non-linear (Smyth and Hsing, 1995; Elbadawi *et al.,* 1997; Clement *et al.,* 2003; Pattillo *et al.,* 2002; 2004; Cordella *et al.,* 2005; Reinhart *et al.,* 2012 and Dogan and Bilgili, 2014).

Those contributions indicated that non-linear relationship between public debt and economic growth goes through other interpretive variables through which the impact of public debt appears on economic growth, such as: (private investment, public investment, gross product of production factors, nominal and real interest rates on

long run (Checherita-Westpha and Rother, 2012). Another study by Kumar and Woo (2010) identified the factors as (average of study years, development of financial members, inflation, banking crisis, financial deficit). Whereas, contributions of Chang and Chiang (2012), and Badurina and Sertic (2014) suggested that impact channels on economic growth are: aggregate investment, economic openness, added value, variables of macro- economic (inflation, and unemployment).

3. Methodology and Data

The study seeks to verify the relationship between debt percentage to gross domestic product, and gross domestic product per capita growth rate (for annual and 5-year average growth rates) in two groups of countries. The first consists of countries with the highest debt in Euro-zone and suffer high sovereign debt crisis. They are (Greece, Ireland, Portugal, Spain, and Italy). The second group includes countries outside Euro-zone which suffer high public debt levels. They are (Japan, Britain, America, Denmark, and Sweden). Japan has the highest debt levels all over the world. Comparison is done to reveal the real impact of public debt on economic growth, and data is taken from AMECO, OCED, World Bank database. It will cover the period between 1993-2013 (Tables A1, A2). The sample was relatively restricted/ limited in order to reduce the heterogeneity which usually becomes a problem in regression measuring models. Multi step analysis approach will be used through using simple and multiple linear regression analysis for figuring out the impact of public debt on economic growth, taking into consideration the influence of conditions in the country during the period of analysis. To show the debt level which affect economic growth negatively, three levels of public debt were estimated (30%, 60%, 90%) from which 4 patterns (models) were derived.

The empirical growth model[1] is based on a conditional convergence equation that relates the GDP per capita growth rate to the initial level of income per capita, the investment/saving-to- GDP rate the trade balance and the population growth rate. The model is augmented to include the level of gross government debt (as a share of

[1] *The empirical specification is derived from the neoclassical growth model of Solow, in which the Model developed based on Cobb - Douglass production function given by the form* $Y = F(K, L) = K^a L^{1-a}$ *, Where Y = output, K = Capital input ,L = Labor input ,a and 1-a are output elasticity's of capital and labor respectively., and "a" is a number between 0 and 1. The other important equation from the Solow growth model is the capital accumulation equation expressed in the form:-* $\acute{K} = sY - dK$ *Where* $\acute{K}$ *= change in capital stock, sY = gross investment ,dK = depreciation during the production process , And with mathematical manipulation Solow derives the capital accumulation equation in per worker terms i.e.* $\acute{k} = sy - (n+d)k$*, The Solow diagram can be drawn using the two key equations of the Solow model in terms of output per worker and capital per worker. These equations are y = ka and* $\acute{k} = sy - (n+d)\ k$ *The corresponding steady state quantity of capital per worker and steady state quantity of output per worker can be expressed: k* = (s/n+d) 1/(1-a), y* = (s/n+d)a/(1-a) Where:- k* = steady state quantity of capital per worker , y* = steady state quantity of output per worker.*

GDP). According to Sala-I-martin (1997), "economic theories are not enough to pin point the exact determinants of growth". As a solution for this problem they suggest a cross-sectional regression model of the form:

$$g = \alpha + \beta_1 x_1 + \beta_2 x_2 + \ldots + \beta_n x_n + \varepsilon \quad (1)$$

Where g is the vector of the rates of economic growth, and $x_1 \ldots, x_n$ are vectors of potential explanatory variables which can vary from researcher to researcher." "The methodology usually used by empirical growth analysts consists of simply "trying" the variables that are thought to be potentially important determinants of Growth" Earlier empirical studies of growth focused on regional or cross-country differences.

As noted in earlier studies, the process of estimation encounters the problems of heterogeneity[1] and endogeneity which give inconsistent and biased estimates with the pooled OLS estimator (Kumar and Woo, 2010; Pattillo *et al.*, 2002; 2004). Namely, the regression model using pooled OLS does not account for unobserved country specific effects that vary across countries. Thus, the result may be affected by an omitted variable bias (Pattillo *et al.*, 2002; 2004; Yilanci, 2012). Here, instead, we follow Islam (1995) and others in estimating panel data regressions with country specific fixed effects[2] (as well as time-specific fixed effects). This allows us to control the heterogeneity for unobserved country-specific effects and the unobservable error term and we follow Cecchetti *et al.*, (2011) to address endogeneity [3] by using lagged values of the debt-to-GDP ratio.

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[1] *The solution of the heterogeneity problem could be avoided by using a fixed effects (FE) panel regression that allows us to control all time-invariant country-specific factors, whether observable or unobservable. In previous empirical studies, they corrected the problem of heterogeneity by introducing a lagged explanatory variable of the initial level of GDP per capita in a dynamic panel specification. However, the presence of a fixed effects panel estimation is likely to impose a correlation between the lagged endogenous variable and the residuals, which makes the results of the coefficient of the lagged initial level of GDP per capita negatively biased (Pattillo et al., 2004).*

[2] *Country specific fixed to measure the impact of a change in one factor on growth within a country.*

[3] *The easiest way to describe the endogeneity problem and assess the likely direction of the bias is to use a simple bivariate model in which growth (G) is a function of debt (D):*

$$G = a + bD + u \quad (1)$$

and debt is a function of growth:

$$D = m + kG + v \quad (2)$$

The OLS estimator of b is then given by:

$$\hat{b} = \frac{b\sigma^2 u + K\sigma^2 u}{\sigma^2 u + k^2 \sigma^2 u} \quad (3)$$

and the bias of the OLS estimates is:

$$E(\hat{b}) - b = \frac{k(1-bk)}{\sigma^2 v/\sigma^2 u + k^2} \quad (4)$$

Equation (4) shows that OLS estimations are unbiased if k = 0 (i.e., if debt is not endogenous) or if, for some coincidence, bk = 1. If k is negative (as it is likely to be) and bk <

Another important aspect of our empirical analysis is that we use overlapping[1] Five-year forward of the per capita income growth rate, the use of five-year averages, common in the growth literature, reduces the potential effects of cyclical movements and allows us to focus on the long-term growth rate Bekaert *et al.,* (2005).

Turning to the details, we model the growth rate of per capita income for country i as

$$g_{i,(t+1,t+k)} = -\phi y_{i,t} + \beta' X_{i,t} + \mu_i + \gamma_t + \varepsilon_{i,t,t+k} \quad (2)$$

where

$$g_{i,(t+1,t+k)} = \frac{1}{K} \sum_{j=t+1}^{t+k}, \; g_{i,j} = \frac{1}{K} (y_{i,t+k} - y_{i,t}) \quad (3)$$

is the *k*-year forward average of annual growth rates between year *t+1* and *t+k* and *y* is the log of real per capita GDP. In our analysis, we set *k*=5. The regressors in equation (2) include: the log of real per capita GDP at time *t* (to capture the "catch-up effect" or conditional convergence of the economy to its steady state); a set of other regressors, *X*, thought to explain growth; country-specific dummies, μi; time-specific dummies meant to capture common effects across time, γt (eg global business cycle conditions that will affect all countries and so on); and residuals ε follows Cecchetti *et al.*, (2011).

3.1 Econometric Issues

We first start by looking at the bivariate linear relationship by estimating the following regression for growth and debt follow Egert (2012), where g is annual real GDP growth and debt stands for the government debt-to-GDP ratio. Equation (4) is estimated for a pooled panel[2] and with country fixed effects, Time Fixed effects

$$g_{i,(t+1,t+k)} = a + \beta\, Debt_{it} + \eta_i + V_t + \varepsilon_{it,t+k} \quad (4)$$

where:

1 (this is always the case if b is non-negative), OLS estimates are negatively biased, Please see Panizza and Presbitero (2012).

[1] It is important to note that, in order to minimize the potential for the endogeneity bias (and the problem of reverse causation), all regressors (with the exception of the population growth rate) on the right-hand side of (1) are predetermined with respect to the five-year forward average growth rate. Furthermore, the overlapping nature of the data imparts a moving-average process to the errors (Cecchetti et al., 2011).

[2] Instead of using cross-section methods to analyses the public debt effects on growth, we use panel data techniques to compute those dynamics on real per capita growth. One of the important advantages on using panel data estimation is to highlight the individual heterogeneity.

g i,(t+1,t+k) the economic growth for country i between year t and year t+1. k =5 tow different measures are used in the empirical estimation for depended variable: annual growth rate gi(t+1) ; 5 year cumulative growth rate gi(t+5), Debtit gross government debt as share of GDP, η_i Country dummies (Maastricht Treaty(MST), Stability and Growth Pact (SGP), Euro area creation date (Euro.C), Euro currency exchange (Euro.E) as dummies that take the value "1" for the specific year when the referred crises happen. V_t year dummies[1] are included to control for common shocks across countries that occurred over the period of the analysis (Currency Crisis (CC), stock market crisis (SC), Banking Crisis (BC), Tally crisis (TC)) dummies (the variable takes the value "1", if for each year the country is covered by such event)and $\varepsilon_{it,t+k}$ is the error term.

We then estimate threshold models, in which the effect of debt on growth depends on the level of debt a four-regime model account for all 3 thresholds proposed by Reinhart and Rogoff (2010): 30%, 60% and 90% of central government debt (Egert 2012). This four-regime model can be written as follows in equation (5):

$$g = \begin{cases} a_1+\beta_1 Deb_t+\varepsilon_t & if \quad Debt < 30\% \\ a_2+\beta_2 Deb_t+\varepsilon_t & if \quad Debt\ 30\% \le Debt < 60\% \\ a_3+\beta_3 Deb_t+\varepsilon_t & if \quad Debt\ 60\% \le Debt < 90\% \\ a_4+\beta_4 Deb_t+\varepsilon_t & if \quad Debt \ge 90\% \end{cases} \tag{5}$$

Finally, we use equation (2) with other control variables that we use in the estimation of the growth equation including: (i) Monetary indicators (i.e: Money supply growth rate , short term nominal interest rate, long term nominal interest rate); (ii) fiscal indicators (i.e. Government Expenditures as share of GDP, tax revenue as % of GDP, current balance, primary budget balance, total government budget balance) to allow more extensively for the possibility of fiscal policy affecting economic growth; (iii) indicators for human capital (i.e. school enrollment secondary (% gross), labor indicator (i.e. dependency ratio, activity rate) to see the direct effect of human capital and labor market with debt on economic growth; (iv) macroeconomic indicator (i.e. total debt services, output gap, private credit, inflation rate, unemployment rate, Foreign Direct Investment, real effective exchange rate, total factor productivity) to allow more extensively for the possibility of all this indicators affecting economic growth. The equation also contains country-fixed effects and year dummies.

We can write equation (2) as follows:

[1] *We use year dummies variables from Reinhart & Rogoff's (2009) database. Available at http://www.reinhartandrogoff.com/data.*

$$g_{i,(t+1,t+k)} = \beta_0 + \beta_1 In\ GDP_{i0} + \beta_2 Inv/Sav\ (\ Puplic,Private\ )\ .rate_{it} + \beta_3 POP.rate_{it} + \beta_4 TB_{it} + \beta_5 Debt_{it} + \beta_6 Monetary\ Control\ (\ Ms3_{it}\ ,\ S\text{-}n\text{-}interset.rate_{it}\ ,\ L\text{-}n\text{-}interset.rate_{it}\ ) + \beta_7 Fiscal\ Control\ (\ G.exp_{it}\ ,\ Tax.rate_{it}\ ,CB_{it}\ ,\ Primary.G.B_{it}\ ,\ Total.G.B_{it}\ ) + \beta_8 Human\ Capital\ and\ Labour\ Market\ control\ (\ Sh.en_{it}\ ,\ Dep.ratio_{it}\ ,\ Act.rate_{it}\ ) + \beta_9 Macroeconomic\ Control(\ TDS_{it}\ ,\ OPG_{it}\ ,\ PC_{it}\ ,\ Inf.rate_{it}\ ,\ Un.rate_{it}\ ,\ FDI_{it}\ ,\ REE_{it}\ ,\ TFP_{it}\ ) + \eta_i + V_t + \varepsilon_{it,t+k} \quad (6)$$

where

$g_{i,(t+1,t+k)}$ = the economic growth for country i between year t and year t+1. k =5 two different measures are used in the empirical estimation for depended variable;

$\beta 0$ = intercept;

$In(GDP)_{i0}$ = natural logarithm of the initial level of per capita GDP in 1993 for respective countries;

Inv/Sav_{it}= gross saving or investment as a share of GDP;

POP_{it} = population growth rate;

TB_{it} = trade balance (export-import);

$Debt_{it}$ = gross government debt as share of GDP;

Other controls = see description in the text above;

η_i = country fixed effects;

V_t = time fixed effects;

ε_{it} = error term.

4. Empirical Results

Before starting presenting results of empirical analysis, we have to stress the fact that high levels of public debt affect economic growth negatively in study sample of group one (The results across all models show a highly statistically significant linear relationship between the government debt ratio and per-capita GDP growth). Impact level differs according to the country being studied and the variables interpret that relationship.

Empirical results for simple linear regression equation show existence of negative impact of public debt on economic growth where the impact was -0.044% per each 1% of public debt (1% rise of public debt leads into 0.044% decrease in product) for the first group, and to -0.006% for the second, and to -.020% for both groups on short term (one-years forward of economic growth) with a highly statistically significant at 99%. However, we didn't find any statistic indication on long term (five-years forward of economic growth) for both groups. Results show that levels of negative impact of public debt on economic growth starts from 30-60% debt levels percentage from GDP, whereas, debt levels become influencing and have low statistic indication between 60-90% debt levels on the long run. However, impact becomes negative and with statistically significant at the level of 95% when public debt levels are higher than 90% for the first group, whereas, in the second group similar results didn't appear as shown in Table B.1. The results of analyzing the first model (that is based on the neoclassical growth model) showed that saving average is considered one of the variables which positively affecting economic growth for

the first group of states. While no statistical significance level of such relation was found in the second group of states. Growth in population has a negative influence on economic growth in both groups. Trade balance (economic openness) has a positive effect on the economic growth, and has statistically significant on both the long term and the short term in the second group. The expected negative coefficient for the initial real per capita GDP is obtained and, in most of the cases, that coefficient is statistically significant at 99% level. Influence factor value was -7.098 (increasing the initial real per capita GDP by 1% leads to drop in growth by 7%).This means that the first group countries used in our sample converge themselves for their own steady-state in the analysis span. These results came compatible with studies of Solow (1956) and Cass (1965), as shown in Table B.2.

The short term interest rates had positive effect on economic growth on the short term in the second model for the first group. Increase in short term interest rates leads to increase saving. All this leads to accumulating the capital, and pushes the levels of economic growth even forward. The rates of the long term interest had a negative impact on economic growth on the short term for the first group of states. The increase of interest rates pushes prices up and decreases investment, which leads to drop in the aggregate effective demand and income levels. These results agree with Afonso and Alves (2014) findings. The results also show that the liquid liabilities in percentage of GDP (M3) has a negative impact on economic growth as in table B.3, where the increase in money supply leads to decreasing interest rates and increasing investment and income, hence increasing demand on fund which leads into rise in prices, drop in aggregate demand, and decrease in income and economic growth. However, results in the second group were totally different as their economics are considered somehow different.

Results of analyzing the impact of fiscal changes on economic growth show that government Expenditure had negative effect on economic growth. The increase in spending leads to increase in income, more demand on fund, and causes rise in interest rates and significant decrease in investment and income which affects economic growth. This agrees with Sala-I-Martin (1992). Since there is no statistical indication for the variable, the government consumption was used in accordance with Chadha and Coricelli (1997), but it didn't give contradicting results, so it was not used as a measurement to government size.

Current account balance and Government budget primary balance has a positive impact on economic growth and has a highly statistically significant at 99%. While Government budget balance has a negative impact as in Table B. 4. This proves that the public debt service has negative impact on the long run. In spite of taxes (government revenues) positive impact on economic growth, statistical indication for this variable could not be found. This came in contradiction with many studies confirming a negative relation between taxes and growth because of its influence on saving and profits as mentioned in a study for Mencinger *et al.*, (2014).

The human capital indicator (number of student enrolled in high school) had a positive impact on economic growth on the long term and has statistical significance level of 90% for the first group, while this was not the case in the second group. The average of dependency for (both young and old), and participation in work force results came out as expected. Dependency had a negative impact, while the participation in workforce had a positive impact on economic growth (as in Table B. 5). The results for these two came opposite to expectations which needs more focus on the result in later studies, sustenance impact on economic growth was positive but activity average in labor market had a negative one.

The results of analyzing macroeconomic variables shows that public debt had a negative impact in the first group. Unfortunately, similar results with statistical significance level were not found in the second group. It also shows that private credit had negative impact on economic growth (a 1% rise of private credit means a 0.03% drop in economic growth, because the growth of private credit for family sector increases consumption patterns and does not lead into productive investment projects, which in its turn leads to instability and rise in external debt as in Sassi and Gasmi (2004). Results have also shown that unemployment and inflation had negative impact only on the first group. The rise in prices leads to a rise in interest which leads to a drop in investment and economic growth. High level of unemployment leads to drop in income levels, aggregate effective demand and economic growth. Real exchange rate had negative impacts on economic growth as in Table B.6. Finally, the results show that the most influencing institutional indicators on economic growth were Maastricht Treaty in 1993 and Start Monetary Union (Issuing euro currency) in 1999. While analysis showed that banking crisis followed by double crisis is the most dangerous crisis that influence economic growth as in Table B.7.

5. Conclusion and Other Areas of Research

The main objective of the study is to figure out the relationship between public debt and economic growth. Results of consecutive evaluation on a list of models showed a negative impact of public debt on economic growth on the short and the long term, whereas, impact percentage differs according to countries and different interpretive variables, i.e, (financial, monetary, macro-economics, labor, human capital, and institutional). The negative impact of the debt starts at 30-60% of GDP, and becomes of statistical significance level on levels higher than 90% of GDP. A 10% rise in public debt leads to a 1-2% drop in economy growth in average. The results showed that most affecting channels are saving/investment, economic growth, money supply, short and long term nominal interest rates, current account balance, Government budget primary balance, and debt services.

An obvious impact of such findings is that the issue of public debt that faces advanced economies especially in the first group of states (Greece, Ireland, Italy, Spain, and Portugal) is worse than what was expected. While second group states

(Japan, UK, USA, Denmark, and Sweden) were merely influenced. This does not mean that the later must keep public debt at high levels (especially USA and Japan), because political and economic decision makers are not aware when exactly unexpected shock would occur and influence economic growth. Hence these countries must follow policies that help lessen public debt. While public debt is something non-grata, governments compete to rise it in order to stimulate aggregate demand. Public debt should not only be on the agenda of politicians and academics in these countries' economies, but these economies must also consider finding ways to activate the positive economic activity. The best practice is to lessen the risks of speculation on sovereign debt bonds in financial markets, increase private sector lending cost, as well as decrease government aids with activation of direct support among economically marginalized groups of society.

We believe our findings are important as a result of recent discussions on the already applied and must be applied financial policies especially in Euro zone, USA, Japan and EU generally. These policies came as a result of social austerity in first group (as policy during economic recession). Negative relationship between public debt and economic growth should not be used as a plea for supporting the tendency of controlling public financial situations in those countries, because targeting debt to promote growth is not a vital option, the right option lies in decreasing levels of public debt as not to cause harm to growth and to keep focus on other important channels that positively affect economic growth as saving and investment.

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Appendix A

Table A.1: *Data description and sources*

Variable abbrev.	Variable name/description	Source
$Inv.rate_{it}$	Gross fixed capital formation: total economy (% GDP)	AMECO
$Sav.rate_{it}$	Gross saving: general government (% GDP)	AMECO
TB_{it}	Trade balance at current prices (National accounts) (UXGS) (Export-import)	AMECO
$Total.G.B_{it}$	Government budget balance (Percentage of GDP at market prices (excessive deficit procedure))	AMECO
$Primary.G.B_{it}$	Government budget primary balance(excluding interest: Percentage of GDP at market prices (excessive deficit procedure))	AMECO
TDS_{it}	Total dept services Percentage of GDP at market prices (excessive deficit procedure))	AMECO
TFP_{it}	Total factor productivity: total economy (ZVGDF)	AMECO
$L\text{-}n\text{-}interest.rate_{it}$	Nominal long-term interest rates (ILN)	AMECO
$S\text{-}n\text{-}interest.rate_{it}$	Nominal short-term interest rates (ISN)	AMECO
$g_{i,(t+1,t+k)}$	The economic growth for country i between year t and year t+1	OECD
$In\ GDP_{i0}$	GDP per capita at current prices and current PPPs, US dollars	OECD
$POP.rate_{it}$	Population (hist5) All ages, growth rate	OECD
$Debt_{it}$	General government gross financial liabilities, as a percentage of GDP	OECD
$Ms3_{it}$	Liquid Liabilities M3 as a percentage of GDP	OECD
$Inf._{rate_{it}}$	(counsumer price all item) growth in the same period of the previous year	OECD
$G.exp_{it}$	Total expenditure of general government, percentage of GDP	OECD
G_con_{it}	General government consumption expenditure, percentage of GDP	OECD
$Tax.rate_{it}$	Total taxes, percentage of GDP	OECD
CB_{it}	current balance as percentage from GDP	OECD
$Dep.ratio_{it}$	Age (-15 & +65) Dependency Ratio (All ages)	OECD
$Act.rate_{it}$	labour force participation rates total	OECD
$Un._{rate_{it}}$	Unemployment rate	OECD
OPG_{it}	Output gaps: deviations of actual GDP from potential GDP as % of potential GDP	OECD
FDI_{it}	Foreign direct investment, net inflows (% of GDP)	World bank
REE_{it}	Real effective exchange rate index (2010 = 100)	World Bank
PC_{it}	Domestic credit provided by financial sector (% of GDP)	World Bank
$Sh.en_{it}$	School enrollment, secondary (% gross)	World Bank

Note*: Sources of basic data are the European Commission's AMECO database and the Organization for Economic Co- operation and Development database(OECD),the World Bank's World Development Indicators (WDI),****Note****: year dummies included (21) 1993-2013, and country dummies included(10).*

Table A.2: *Summary of Descriptive Statistics*

Variables	*N*	*Minimum*	*Maximum*	*Mean*	*Std.*
$g_{i,(t+1,t+k)}$	210	-8.870	11.270	1.885	2.968
$In\ GDP_{i0}$	210	12533.990	52985.480	29552.583	8887.693
$Inv.rate_{it}$	210	11.210	31.050	21.585	3.393
$Sav.rate_{it}$	210	5.040	33.600	20.414	5.335
$POP.rate_{it}$	210	-1.780	3.380	0.541	0.596
TB_{it}	210	-614.050	82.630	-31.884	120.132
$Debt_{it}$	210	27.540	224.240	84.789	38.471
$S\text{-}n\text{-}interest.rate_{it}$	210	0.050	24.560	3.930	3.634
$L\text{-}n\text{-}interest.rate_{it}$	210	0.720	23.270	5.463	3.332
$Ms3_{it}$	210	39.760	239.200	95.843	48.687
$G.exp_{it}$	210	31.060	70.080	45.182	7.496
$G.con_{it}$	210	14.000	28.060	19.450	3.428
$Tax.rate_{it}$	210	16.020	47.850	27.064	9.168
CB_{it}	210	-14.390	8.860	-1.126	4.510
$Primary.G.B_{it}$	210	-29.430	7.010	-0.226	4.392
$Total.G.B_{it}$	210	-32.420	5.020	-4.063	4.473
$Act.rate_{it}$	210	58.770	83.630	74.011	6.882
$Dep.ratio_{it}$	210	30.250	37.930	33.471	1.452
$Sh.en_{it}$	210	82.280	999.000	123.639	122.963
TDS_{it}	210	0.810	12.600	3.837	2.234
OPG_{it}	210	-14.150	9.460	-0.122	3.616
PC_{it}	210	46.260	366.530	154.715	69.960
$Inf_{.}rate_{it}$	210	-4.500	14.400	2.357	1.931
$Un_{.}rate_{it}$	210	2.540	27.250	8.513	4.697
FDI_{it}	210	-5.700	25.680	3.331	5.076
REE_{it}	210	80.330	132.510	100.251	9.757
TFP_{it}	210	75.360	111.920	97.033	6.455

Appendix B

Table B.1: *Debt linear effect on real GDP growth rate Four regime*

variables	*Group one* *Greece, Ireland, Italy, Portugal, Spain*				*Group Tow* *Japan, UK, USA, Denmark, Sweden*				*Tow groups* *Greece, Ireland, Italy, Portugal, Spain Japan, UK, USA, Denmark, Sweden*			
Dependent variable GDP pc growth	*OLS-P*		*OLS-F*		*OLS-P*		*OLS-F*		*OLS-P*		*OLS-F*	
	Annual	*Five year*	*Annual*	*Five year*	*Annual*	*Five year*	*Annual*	*Five year*	*Annual*	*Five year*	*Annual*	*Five year*
$Debt_{it}$	-.044***	0.008	-.045***	0.01	-.006***	0.001	-.005***	0.002	-.020***	0.004	-.018***	0.005
	(0.010)	(0.011)	(0.010)	(0.011)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
$Debt_{it}<30$	31.49	12.788										
	(0.000)	(0.000)										
$60< Debt_{it}>30$	-0.11	-0.032	-0.126	0.001	0.05	0.058	0.046	0.056	-0.036	0.037	-0.051	0.04
	(0.108)	(0.102)	(0.098)	(0.094)	(0.055)	(0.059)	(0.007)	(0.059)	(0.049)	(0.048)	(0.047)	(0.047)
$90< Debt_{it}>60$	-0.103	-0.059	-.121*	-0.039	0.054	0.006	.062*	0.009	-0.026	-0.028	-0.026	-0.024
	(0.082)	(0.086)	(0.081)	(0.090)	(0.042)	(0.043)	(0.035)	(0.045)	(0.047)	(0.043)	(0.045)	(0.044)
$Debt_{it}>90$	-.056**	.064*	-.052**	.067**	0	-0.005	0.002	-0.007	-0.008	-0.005	0.011	0.013
	(0.026)	(0.032)	(0.025)	(0.033)	(0.009)	(0.011)	(0.009)	(0.011)	(0.011)	(0.011)	(0.013)	(0.013)
η_i			2.234***	2.140***			1.408***	0.452			1.821***	1.276*
			(0.783)	(0.916)			(0.511)	(0.561)			(0.482)	(0.526)
V_t			-2.112***	-0.399			-1.262***	0.383			-1.509***	-0.074
			(0.643)	(0.763)			(0.477)	(0.523)			(0.414)	(0.452)
Observation	105	105	105	105	103	105	105	105	210	210	210	210
R Square	0.157	0.006	0.278	0.059	0.016	0.001	0.139	0.013	0.065	0.003	0.168	0.031
F-statistic	18.960	0.549	12.845	2.022	1.704	0.074	5.379	0.425	14.425	0.510	13.826	2.133
fd	103	99	103	99	103	99	103	99	208	204	208	204

Notes: **, ** and *** represent statistical significance at 10, 5 and 1 percent level respectively, The regressions are panel regressions with both country and period fixed effects, The dependent variable is the standard deviation of future annual growth rates of per capita GDP over the following one year and five years, Observations are overlapping, so robust standard errors are reported, Debt variables are shares of GDP, The White diagonal covariance matrix is used in order to assume residual heteroskedasticity,*

Source: *Authors' calculations.*

Table B.2: *Linear debt effect on real GDP growth rate and with Solow control variables (Model one results)*

Variables	*Group one*				*Group Tow*				*Tow groups*			
	Greece,Irland,Italy,Portugal,Spain				*Japan,UK,USA,Denmark,Sweden*				*Greece, Ireland, Italy, Portugal, Spain Japan, UK, USA, Denmark, Sweden*			
Dependent variable GDP pc growth	*OLS-P*		*OLS-F*		*OLS-P*		*OLS-F*		*OLS-P*		*OLS-F*	
	Annual	*Five year*	*Annual*	*Five year*	*Annual*	*Five year*	*Annual*	*Five year*	*Annual*	*Five year*	*Annual*	*Five year*
In GDP $_{i0}$	-7.098***	-5.761*	-5.777**	-5.795	8.853	1.277	6.144*	1.170	-1.947*	0.250	-2.174**	0.159
	(2.682)	(3.439)	(2.808)	(3.606)	(3.408)	(3.590)	(3.366)	(3.718)	(1.246)	(1.316)	(1.185)	(1.304)
Debt $_{it}$	-0.010	0.010	-0.014	0.013	-.012**	0.005	-0.008	0.005	-.016***	1.138	-.013***	0.002
	(0.016)	(0.020)	(0.016)	(0.021)	(0.005)	(0.006)	(0.005)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)
Sav.rate $_{it}$	.622***	0.178	.545***	0.159	-.158***	-.133**	-.140***	-.131**	.141***	-0.049	.121***	-0.054
	(0.100)	(0.128)	(0.110)	(0.142)	(0.048)	(0.052)	(0.047)	(0.053)	(0.049)	(0.052)	(0.047)	(0.052)
POP.rate $_{it}$	-1.613***	-1.376*	-1.364**	-1.188	-0.726	0.560	-0.590	0.566	-0.143	-0.430	0.109	-0.360
	(0.593)	(0.768)	(0.605)	(0.792)	(0.496)	(0.526)	(0.477)	(0.530)	(0.381)	(0.402)	(0.366)	(0.403)
TB_{it}	0.004	.034*	0.002	.032*	.006***	0.002	.004*	0.002	-0.003	0.000	-0.003	-0.001
	(0.015)	(0.019)	(0.015)	(0.019)	(0.002)	(0.003)	(0.002)	(0.003)	(0.381)	(0.002)	(0.002)	(0.002)
η_i			1.107	1.464			1.185**	0.439			1.818***	1.310**
			(0.732)	(0.950)			(0.511)	(0.560)			(0.482)	(0.533)
V_t			-0.816	0.291			-1.187**	0.380			-1.457***	-0.089
			(0.632)	(0.832)			(0.471)	(0.517)			(0.419)	(0.462)
Observation	105	105	105	105	105	105	105	105	210	210	210	210
R Square	0.432	0.108	0.451	0.136	0.131	0.093	0.22	0.105	0.103	0.016	0.198	0.045
F-statistic	14.926	2.278	11.258	2.064	2.946	1.935	3.870	1.546	4.663	0.641	7.100	1.330
Fd	103	99	103	99	103	103	99	99	208	204	208	204
DW-statistic	1.360	1.261	1.318	1.163	1.622	1.730	1.630	1.620	1.479	1.258	1.394	1.217

Notes*: *, ** and *** represent statistical significance at 10, 5 and 1 percent level respectively, The regressions are panel regressions with both country and period fixed effects, The dependent variable is the standard deviation of future annual growth rates of per capita GDP over the following one year and five years, Observations are overlapping, so robust standard errors are reported, Debt variables are shares of GDP, The White diagonal covariance matrix is used in order to assume residual heteroskedasticity, DW-statistic is the Durbin-Watson statistic.*

Source*: Authors' calculations.*

Table B.3: *Linear debt effect on real GDP growth rate and with Monetary control variables (model tow result)*

Variables	*Group one* *Greece,Irland,Italy,Portugal,Spain*				*Group Tow* *Japan, UK, USA, Denmark, Sweden*				*Tow groups* *Greece, Ireland, Italy, Portugal, Spain Japan, UK, USA, Denmark, Sweden*			
Dependent variable GDP pc growth	*OLS-P*		*OLS-F*		*OLS-P*		*OLS-F*		*OLS-P*		*OLS-F*	
	Annual	*Five year*	*Annual*	*Five year*	*Annual*	*Five year*	*Annual*	*Five year*	*Annual*	*Five year*	*Annual*	*Five year*
In GDP $_{i0}$	-0.193	0.000	0.375	-0.388	-0.052	0.274	-0.018	0.109	-0.379	1.790	-0.918	1.862**
	(2.126)	(2.192)	(3.747)	(2.147)	(0.978)	(2.009)	(1.792)	(1.994)	(0.946)	(0.929)	(0.912)	(0.927)
Debt $_{it}$	-.054***	-.031**	-.051***	-.030**	0.007	.015**	0.005	.017**	-.011**	0.004	-.012**	0.005
	(0.012)	(0.012)	(0.075)	(0.012)	(0.271)	(0.007)	(0.006)	(0.007)	(0.005)	(0.005)	(0.005)	(0.005)
S-n-interset.rate $_{it}$	.274***	-.221**	.249**	-.266***	-.407**	0.138	-.395**	0.112	.318***	-0.112	.283***	-.142*
	(0.098)	(0.101)	(0.056)	(0.012)	(0.024)	(0.198)	(0.174)	(0.197)	(0.082)	(0.080)	(0.079)	(0.081)
L-n-interset.rate $_{it}$	-.269**	.615***	-.283**	.652***	.806***	0.138	.706***	0.203	-.270***	0.458	-.294***	.474***
	(0.118)	(0.121)	(0.512)	(0.118)	0.000	(0.231)	(0.203)	(0.234)	(0.093)	(0.092)	(0.089)	(0.091)
Ms3 $_{it}$	-.043***	-.038***	-.034***	-.040***	-0.005	-.006*	-0.004	-.008**	-.008***	-0.004	-0.005	-0.006
	(0.010)	(0.012)	(0.054)	(0.012)	(0.202)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
η_i			1.411*	1.522*			1.129**	0.241			1.604***	1.002**
			(0.097)	(0.780)			(0.498)	(0.552)			(0.482)	(0.490)
V_t			-1.573**	0.990			-0.753	.980**			-1.505***	0.567
			(2.842)	(0.667)			(0.476)	(0.534)			(0.420)	(0.429)
Observation	105	105	105	105	105	105	105	105	210	210	210	210
R Square	0.358	0.351	0.408	0.399	0.206	0.095	0.262	0.129	0.142	0.187	0.226	0.213
df	103	99	103	99	103	99	103	99	208	204	208	204
F-statistic	10.913	10.167	9.433	8.734	5.073	1.964	4.861	1.947	6.732	9.184	8.387	7.637
DW-statistic	1.213	1.109	1.350	1.132	1.866	1.740	1.849	1.493	1.151	1.259	1.395	1.138

Notes*: *, ** and *** represent statistical significance at 10, 5 and 1 percent level respectively, The regressions are panel regressions with both country and period fixed effects, The dependent variable is the standard deviation of future annual growth rates of per capita GDP over the following one year and five years, Observations are overlapping, so robust standard errors are reported, Debt variables are shares of GDP, The White diagonal covariance matrix is used in order to assume residual heteroskedasticity, DW-statistic is the Durbin-Watson statistic.*

Source*: Authors' calculations.*

Table B.4: *Linear debt effect on real GDP growth rate and with Fiscal control Variables (model three results)*

Variables	*Group one* *Greece,Irland,Italy,Portugal,Spain*				*Group Tow* *Japan, UK, USA, Denmark, Sweden*				*Tow groups* *Greece, Ireland, Italy, Portugal, Spain* *Japan, UK, USA, Denmark, Sweden*			
Dependent variable GDP pc growth	*OLS-P*		*OLS-F*		*OLS-P*		*OLS-F*		*OLS-P*		*OLS-F*	
	Annual	*Five year*	*Annual*	*Five year*	*Annual*	*Five year*	*Annual*	*Five year*	*Annual*	*Five year*	*Annual*	*Five year*
In GDP $_{i0}$	-7.598***	-13.833***	-6.677**	-15.434***	-2.647	-1.373	-1.913	-1.478	-2.150**	1.058*	-2.112**	-1.830**
	(2.822)	(3.196)	(2.167)	(3.219)	(2.291)	(2.455)	(2.283)	(2.486)	(0.991)	(1.819)	(0.963)	(1.057)
Debt $_{it}$	-.027*	-0.021	-.028*	-0.014	-0.009	0.003	-0.009	0.005	-.023***	-0.009	-.022***	-0.007
	(0.017)	(0.018)	(0.017)	(0.018)	(0.007)	(0.008)	(0.007)	(0.008)	(0.006)	(0.007)	(0.006)	(0.007)
G.exp $_{it}$	-0.114	.397**	-0.134	.413**	-0.040	-0.023	-0.037	-0.034	-.148**	-0.039	-.146***	-0.046
	(0.162)	(0.177)	(0.159)	(0.174)	(0.058)	(0.062)	(0.058)	(0.062)	(0.059)	(0.063)	(0.057)	(0.063)
Tax.rate $_{it}$	0.130	0.017	0.160	-0.007	0.015	0.043	0.016	0.060	0.034	0.002	.038***	0.016
	(0.177)	(0.208)	(0.160)	(0.205)	(0.056)	(0.059)	(0.056)	(0.061)	(0.061)	(0.065)	(0.060)	(0.066)
CB $_{it}$	.354***	.616***	.307***	.676***	0.039	-0.050	0.020	-0.055	.200***	.246***	.168***	.238***
	(0.094)	(0.104)	(0.099)	(0.109)	(0.091)	(0.098)	(0.089)	(0.098)	(0.055)	(0.059)	(0.054)	(0.060)
Primary.G.B $_{it}$	.331**	0.185	.298**	0.166	.763***	.463**	.538**	.573**	.385***	.350***	.293***	.331***
	(0.139)	(0.163)	(0.148)	(0.162)	(0.203)	(0.224)	(0.220)	(0.249)	(0.092)	(0.100)	(0.093)	(0.104)
Total.G.B $_{it}$	-0.185	0.113	-0.202	0.187	-.832***	-.582**	-.627***	-.690**	-.373***	-.467***	-.308**	-.457***
	(0.236)	(0.264)	(0.242)	(0.260)	(0.228)	(0.248)	(0.239)	(0.265)	(0.128)	(0.138)	(0.125)	(0.139)
η_i			0.886	0.533			.929*	0.073			1.273***	0.705
			(0.737)	(0.792)			(0.544)	(0.585)			(0.474)	(0.521)
V_t			-0.661	1.498**			-.972*	0.942			-1.175***	0.303
			(0.650)	(0.690)			(0.502)	(0.552)			(0.406)	(0.447)
Observation	105	105	105	105	105	105	105	105	210	210	210	210
R Square	0.460	0.394	0.471	0.434	0.172	0.110	0.222	0.138	0.241	0.148	0.290	0.159
df	103	99	103	99	103	99	103	99	208	204	208	204
F-statistic	11.692	8.544	9.310	7.661	2.840	1.617	2.979	1.604	9.103	4.890	9.034	4.097
DW-statistic	1.221	1.117	1.238	1.107	1.776	1.757	1.667	1.301	1.261	1.283	1.269	1.161

Notes*: *, ** and *** represent statistical significance at 10, 5 and 1 percent level respectively, The regressions are panel regressions with both country and period fixed effects, The dependent variable is the standard deviation of future annual growth rates of per capita GDP over the following one year and five years, Observations are overlapping, so robust standard errors are reported, Debt variables are shares of GDP, The White diagonal covariance matrix is used in order to assume residual heteroskedasticity, DW-statistic is the Durbin-Watson statistic.*
Source*: Authors' calculations.*

Table B.5: *Linear debt effect on real GDP growth rate and with Labor and human capital control variables (Model four results)*

Variables	*Group one* *Greece,Irland,Italy,Portugal,Spain*				*Group Tow* *Japan, UK, USA, Denmark, Sweden*				*Tow groups* *Greece, Ireland, Italy, Portugal, Spain* *Japan, UK, USA, Denmark, Sweden*			
Dependent variable GDP pc growth	*OLS-P*		*OLS-F*		*OLS-P*		*OLS-F*		*OLS-P*		*OLS-F*	
	Annual	*Five year*	*Annual*	*Five year*	*Annual*	*Five year*	*Annual*	*Five year*	*Annual*	*Five year*	*Annual*	*Five year*
In GDP $_{i0}$	-8.282***	-10.533***	-6.801***	-10.011***	2.349	2.051	2.342	2.469	0.290	.121*	0.081	0.053
	(2.510)	(2.985)	(2.506)	(3.082)	(2.042)	(1.909)	(2.101)	(2.098)	(1.020)	(1.055)	(0.964)	(1.046)
Debt $_{it}$	-.068***	-.019*	-.068***	-0.017	-0.005	-0.003	-0.002	-0.002	-.024***	-0.005	-.021***	-0.004
	(0.011)	(0.013)	(0.011)	(0.013)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.006)	(0.005)	(0.006)
Act.rate $_{it}$	-.451***	-.416***	-.406***	-.386***	-.294**	-.294**	-0.147	-0.116	-.129***	-.112***	-.114***	-.099***
	(0.069)	(0.086)	(0.072)	(0.091)	(0.149)	(0.140)	(0.160)	(0.161)	(0.034)	(0.035)	(0.032)	(0.035)
Dep.ratio $_{it}$	.717***	1.074***	.634**	1.095***	.387**	.324**	.576***	.583*	.405***	.763***	.301**	.758***
	(0.258)	(0.302)	(0.251)	(0.304)	(0.175)	(0.164)	(0.180)	(0.180)	(0.150)	(0.157)	(0.144)	(0.158)
Sh.en $_{it}$	0.000	0.002	0.000	0.002	.015*	0.011	-0.005	-0.006	-.002**	.001***	-.003***	0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.009)	(0.008)	(0.009)	(0.009)	(0.001)	(0.001)	(0.001)	(0.001)
η_i			0.827	1.011		1.565***		0.705			1.751***	1.236**
			(0.710)	(0.858)		(0.534)		(0.587)			(0.483)	(0.524)
V_t			-1.610***	0.321		-1.355***		0.517			-1.601***	0.167
			(0.559)	(0.689)		(0.470)		(0.517)			(0.406)	(0.441)
Observation	105	105	105	105	105	105	105	105	210	210	210	210
R Square	0.452	0.281	0.498	0.295	0.091	0.224	0.111	0.136	0.159	0.122	0.257	0.148
df	103	99	103	99	103	99	103	99	208	204	208	204
F-statistic	16.143	7.359	13.585	5.511	1.896	3.845	2.265	1.995	7.559	5.456	9.795	4.820
DW-statistic	1.278	1.105	1.278	1.120	1.755	1.718	1.779	1.627	1.164	1.202	1.242	1.170

Notes*: *, ** and *** represent statistical significance at 10, 5 and 1 percent level respectively, The regressions are panel regressions with both country and period fixed effects, The dependent variable is the standard deviation of future annual growth rates of per capita GDP over the following one year and five years, Observations are overlapping, so robust standard errors are reported, Debt variables are shares of GDP, The White diagonal covariance matrix is used in order to assume residual heteroskedasticity, DW-statistic is the Durbin-Watson statistic.*

Source*: Authors' calculations*

Table B.6: *linear debt effect on real GDP growth rate and with Macroeconomic control variables (Model five results)*

Variables	*Group one* *Greece,Irland,Italy,Portugal,Spain*				*Group Tow* *Japan, UK, USA, Denmark, Sweden*				*Tow groups* *Greece, Ireland, Italy, Portugal, Spain Japan, UK, USA, Denmark, Sweden*			
Dependent variable GDP pc growth	*OLS-P*		*OLS-F*		*OLS-P*		*OLS-F*		*OLS-P*		*OLS-F*	
	Annual	*Five year*	*Annual*	*Five year*	*Annual*	*Five year*	*Annual*	*Five year*	*Annual*	*Five year*	*Annual*	*Five year*
In GDP $_{i0}$	2.532	1.923	2.835**	1.700	4.078**	-2.312	4.362**	-2.589	0.515	2.443**	0.147	2.585**
	(0.000)	(2.02)	(1.62)	(1.99)	(2.23)	(2.63)	(2.22)	(2.63)	(1.09)	(1.03)	(1.06)	(1.02)
Debt $_{it}$	-.061***	-0.014	-.067***	-0.011	0.001	0.007	0.002	0.007	-.027***	-0.005	-.026***	-0.003
	(0.011)	(0.013)	(0.011)	(0.013)	(0.009)	(0.010)	(0.009)	(0.010)	(0.008)	(0.008)	(0.008)	(0.008)
TDS $_{it}$	-0.092	-0.263	0.032	-.338*	0.253	0.247	0.154	0.356	0.249	-0.095	0.221	-0.141
	(0.175)	(0.209)	(0.169)	(0.209)	(0.226)	(0.285)	(0.231)	(0.294)	(0.156)	(0.150)	(0.153)	(0.150)
OPG $_{it}$	-.278***	-.597***	-.234***	-.630***	-0.173	-0.221	-.133***	-0.224	-.131**	-.508***	-0.082	-.521***
	(0.085)	(0.101)	(0.082)	(0.102)	(0.125)	(0.149)	(0.127)	(0.152)	(0.074)	(0.071)	(0.073)	(0.071)
PC $_{it}$	-.038***	-.020**	-.031***	-.023**	-.015***	0.003	-.014***	0.003	-.011**	-0.004	-.009**	-0.005
	(0.009)	(0.011)	(0.008)	(0.011)	(0.006)	(0.007)	(0.006)	(0.007)	(0.005)	(0.004)	(0.004)	(0.004)
Inf.rate $_{it}$	-.500***	.383**	-.624***	.463**	-.698***	.42*6	-0.661	.384*	-.539***	.355**	-.534***	.389**
	(0.159)	(0.192)	(0.154)	(0.192)	(0.187)	(0.223)	(0.187)	(0.223)	(0.150)	(0.142)	(0.146)	(0.141)
Un.rate $_{it}$	-0.076	0.078	-.111**	0.084	0.005	0.191	0.059	0.173	-.135**	0.004	-.112**	0.007
	(0.062)	(0.079)	(0.060)	(0.078)	(0.165)	(0.191)	(0.167)	(0.194)	(0.056)	(0.053)	(0.054)	(0.052)
FDI $_{it}$	0.009	.122**	0.002	.124**	-0.026	.170***	-0.033	.175*	0.004	.114***	0.005	.113***
	(0.046)	(0.057)	(0.044)	(0.056)	(0.053)	(0.061)	(0.053)	(0.061)	(0.039)	(0.037)	(0.038)	(0.036)
REE $_{it}$	-.244***	-.156**	-.274***	-.132*	0.026	-0.006	0.027	-0.009	-.087***	-.060**	-.085***	-.056***
	(0.057)	(0.068)	(0.055)	(0.068)	(0.020)	(0.024)	(0.020)	.024))	(0.024)	(0.023)	(0.024)	(0.023)
η_i			-0.264	0.578			0.685	-0.042			1.239***	.794***
			(0.586)	(0.719)			(0.472)	.540))			(0.468)	(0.450)
V_t			-1.429***	1.087*			-0.541	.854*			-1.246***	.626*
			(0.466)	(0.580)			(0.429)	(0.499)			(0.401)	(0.385)
Observation	105	105	105	105	105	105	105	105	210	210	210	210
R Square	0.657	0.539	0.696	0.563	0.411	0.431	0.264	0.288	0.256	0.352	0.308	0.374
df	103	99	103	99	103	99	103	99	208	204	208	204
F-statistic	19.977	11.670	19.176	10.305	7.285	6.339	3.592	3.238	7.602	11.794	7.967	10.472
DW-statistic	1.130	1.190	1.163	1.115	1.680	1.633	1.898	1.667	1.391	1.201	1.848	1.174

Notes*: *, ** and *** represent statistical significance at 10, 5 and 1 percent level respectively, The regressions are panel regressions with both country and period fixed effects, The dependent variable is the standard deviation of future annual growth rates of per capita GDP over the following one year and five years, Observations are overlapping, so robust standard errors are reported, Debt variables are shares of GDP, The White diagonal covariance matrix is used in order to assume residual heteroskedasticity, DW-statistic is the Durbin-Watson statistic.*
Source*: Authors' calculations*

Table B.7: *Linear debt effect on real GDP growth rate and with Institutional & Crisis control variables (Model six results)*

Variables	*Group one Greece,Irland,Italy,Portugal,Spain*				*Group Tow Japan, UK, USA, Denmark, Sweden*				*Tow groups Greece, Ireland, Italy, Portugal, Spain Japan, UK, USA, Denmark, Sweden*			
Dependent variable GDP pc growth	*OLS-P*		*OLS-F*		*OLS-P*		*OLS-F*		*OLS-P*		*OLS-F*	
	Annual	*Five year*	*Annual*	*Five year*	*Annual*	*Five year*	*Annual*	*Five year*	*Annual*	*Five year*	*Annual*	*Five year*
In GDP $_{i0}$	1.683	-2.168	2.998	-1.353	1.535	0.819	1.535	0.819	0.488	-0.161	0.285	-0.272
	(2.051)	(0.012)	(2.037)	(2.594)	(1.622)	(0.998)	(1.622)	(2.036)	(0.843)	(0.980)	(0.854)	(0.998)
Debt $_{it}$	-.045***	0.017	-.048***	0.015	-0.004	0.002	-0.004	.002***	-.018***	0.005	-0.018	0.005
	(0.010)	(0.046)	(0.010)	(0.013)	(0.004)	(0.005)	(0.004)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
MST $_{it}$	0.185	3.475**	-1.155	2.697	1.762**	0.566	1.535	0.548	1.075	2.033**	-0.191	1.311
	(1.399)	(1.718)	(1.847)	(2.354)	(0.846)	(1.513)	(1.240)	(1.552)	(0.848)	(0.982)	(1.298)	(1.513)
SGP $_{it}$	-4.188	-2.363	-4.994	-2.904	0.677	-0.286	-0.004	-0.304	0.699	-0.347	-0.303	-0.914
	(3.595)	(4.402)	(3.480)	(4.433)	(0.843)	(1.360)	(1.231)	(1.541)	(0.963)	(1.115)	(1.167)	(1.360)
Euro.C $_{it}$	6.982**	3.970	5.578*	3.184	1.532*	1.318	-0.571	1.301	2.359***	1.768**	1.275	1.155
	(3.225)	(3.949)	(3.406)	(4.338)	(0.846)	(1.352)	(1.262)	(1.581)	(0.912)	(1.056)	(1.160)	(1.352)
Euro.E $_{it}$	-0.306	0.498	-1.311	-0.066	2.103**	0.018			1.011	0.462	-0.058	-0.153
	(1.607)	(1.967)	(2.082)	(2.652)	(0.933)	(1.169)			(0.923)	(1.069)	(1.393)	(1.624)
CC $_{it}$	2.559**	0.157	3.915**	1.013					2.714***	0.147	2.925***	0.259
	(1.143)	(1.403)	(1.252)	(1.595)					(0.957)	(1.108)	(0.998)	(1.164)
SC $_{it}$	0.016	1.805	1.807	2.921	-2.157***	0.048	-2.157***	0.048	-1.001***	0.652	-.966**	0.672
	(1.148)	(1.408)	(1.274)	(1.625)	(0.532)	(1.164)	(0.532)	(0.667)	(0.549)	(0.635)	(0.547)	(0.638)
BC $_{it}$	-2.565***	-0.769	-0.206	0.673	-1.087**	-0.576	-1.087***	-0.576	-1.952***	-0.766	-1.755***	-0.658
	(0.921)	(1.217)	(1.238)	(1.633)	(0.479)	(0.601)	(0.479)	(0.601)	(0.497)	(0.576)	(0.518)	(0.605)
TC $_{it}$	-2.267	-1.280	-4.383**	-2.595	-.780*	0.518			-0.778	0.304	-0.281	0.576
	(1.757)	(2.183)	(1.865)	(2.399)	(0.452)	(0.568)			(0.555)	(0.643)	(0.663)	(0.773)
η_i			2.082	1.238			2.103***	0.018			1.451	0.824
			(1.348)	(1.719)			(0.933)	(1.169)			(1.025)	(1.196)
V_t			-2.592**	-1.637			-.780*	0.518			-0.716	-0.390
			(1.012)	(1.290)			(0.933)	(0.568)			(0.562)	(0.656)
Observation	105	105	105	105	105	105	105	105	210	210	210	210
R Square	0.381	0.098	0.435	0.119	0.362	0.039	0.301	0.198	0.280	0.051	0.294	0.056
df	103	99	103	99	103	99	103	99	208	204	208	204
F-statistic	5.713	0.962	5.846	0.980	5.920	0.406	5.920	0.406	7.717	1.051	6.799	0.942
DW-statistic	1.213	1.150	1.125	1.225	1.782	1.464	1.583	1.464	1.314	1.301	1.222	1.180

Notes*: *, ** and *** represent statistical significance at 10, 5 and 1 percent level respectively, The regressions are panel regressions with both country and period fixed effects, The dependent variable is the standard deviation of future annual growth rates of per capita GDP over the following one year and five years, Observations are overlapping, so robust standard errors are reported, Debt variables are shares of GDP, The White diagonal covariance matrix is used in order to assume residual heteroskedasticity, DW-statistic is the Durbin-Watson statistic.*

Source*: Authors' calculations*