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Sovereign Debt and Economic Growth in the European Monetary Union

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Abstract

Specifically, this work aims to identify the magnitude by which government debt as a percentage of GDP has affected economic growth in the EMU. This topic is of importance to the EMU as debt crises such as the outstanding one in Greece are not unforeseeable in other highly indebted nations such as Italy, Ireland, Portugal, and Spain. Thus, relevant information on the magnitude by which increases in debt-to-GDP ratios are adversely affecting economic growth across the union is necessary. The claim that sovereign debt is in fact having a negative effect on economic growth in the EU makes reference to the work of Checherita and Rother (2010) of the European Central Bank. This study finds that elevated sovereign debt has a non-linear negative impact on GDP-per-capita growth starting at the 90%-100% threshold. Their research also suggests that the negative growth effect of high government debt might be linear starting at the 70%-80% threshold. The contribution of the research done here is to update and further the body of work on this topic by addressing the magnitude by which sovereign debt has affected economic growth in the EMU.

Keywords

sovereign debt, European Monetary Union (EMU), government debt

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I. Introduction

From the inception of the European Monetary Union, (EMU) the subject of sovereign debt has been of concern to economists and international policy makers in assessing the viability and efficiency of the euro area as a currency union. The recent European sovereign debt crises, potential exit of Greece, and increased international conversation regarding a Eurobond have make it evident that levels of sovereign debt in the EMU are foreground considerations for policy makers moving forward. According to the European Commission, total government debt as a percentage of GDP in the euro area rose to 92.9% in the first quarter of 2015. While this figure may seem daunting, its interpretation must be considered in the context of the EMU's macroeconomic design.

The 19 EMU member states are the first example of a multinational currency union to which Robert Mundell's (1961) theory of optimum currency area (OCA) may be applied. The essence of this theory is that if a currency area is to enjoy increased financial efficiency through a monetary union, (and also avoid negative consequences) its member states must hold common conditions in a number of variables such as labor mobility, capital mobility, price and wage flexibility, risk structure, and business cycle periodicity. Originally, OCA theory was strictly a theoretical construct. However, it was later expanded upon to the point that it became instrumental to producing the Euro convergence criteria of the 1992 Maastricht Treaty.

One criteria of the Maastricht Treaty is the amount of outstanding sovereign debt as a percentage of GDP a potential member may have. In order for a nation to enter the EMU, its percentage of gross government debt relative to GDP must be less than 60% in the year preceding. This condition is directly related to one of Mundell's original considerations, the similarity of risk structure in a currency union. Specifically, significant discrepancies in government debt across a currency union could induce variance in the risk structure that compromises investor sentiment towards the union as a whole.

Considering the convergence criterion for sovereign debt remaining less than 60% of GDP, it becomes reasonable to pose the question of whether or not the EMU can still be considered an optimal currency area when the aggregation of the union's public debt stands at 93.7% of GDP. To address this question in an empirical manner, one must simultaneously take into account the other euro convergence criteria, which will not be addressed here. Instead, this research will focus more directly on sovereign debt and its relationship with economic growth. Specifically, this work aims to identify the magnitude by which government debt as a percentage of GDP has affected economic growth in the EMU. This topic is of importance to the EMU as debt crises such as the outstanding one in Greece are not unforeseeable in other highly indebted nations such as Italy, Ireland, Portugal, and Spain. Thus, relevant information on the magnitude by which increases in debt-to-GDP ratios are adversely affecting economic growth across the union is necessary. The claim that sovereign debt is in fact having a negative effect on economic growth in the EU makes reference to the work of Checherita and Rother (2010) of the European Central Bank. This study finds that elevated sovereign debt has a non-linear negative impact on GDP-per-capita growth starting at the 90%-100% threshold. Their research also suggests that the negative growth effect of high government debt might be linear starting at the 70%-80% threshold. The contribution of the research done here is to update and further the body of work on this topic by addressing the magnitude by which sovereign debt has affected economic growth in the EMU.

II. Literature Review

The relationship between sovereign debt and GDP per capita is entangled with several of the more prominent theoretical macroeconomic models. Public debt has both positive and negative effects on components of AS-AD, IS-LM, and Solow models as they pertain to GDP per capita. Thus, analyzing these effects in a multivariate context is important to establishing a robust theory of sovereign debt and economic growth.

This analysis begins with the seminal work of Modigliani (1961) exploring the effects of government debt in an aggregate growth model. Modigliani's work attempts not only to define the relationship between public debt and economic growth over time, but also to assess the burden of its transference in a multi-generational context. While his work on debt transference is seminal to the study of generational accounting, this review will focus primarily on the sign and magnitude of the relationship between debt and GDP components he establishes. Modigliani shows that as growth in debt occurs, respective linear reductions in net worth, over-life consumption, and capital formation follow within a single generation. In the context of macroeconomic theory, reductions in any of these variables have a negative effect on GDP.

Citing Modigliani, Diamond (1965) extends the theory of public debt by applying it in the context of a neoclassical growth model. Here the effects of reductions in capital stock are explicitly accounted for. Furthermore, Modigliani's conclusions are examined in the context of consumption decisions made by individuals. By doing this, Diamond shows that the reduction in capital stock is two-fold. There is a reduction in an individual's savings as well as a substitution of private capital for government debt in the individual's portfolio. This suggests the negative effects of debt are of greater magnitude than Modigliani suggests.

Further theoretical development comes from Friedman (1978) who extends but also critiques the conclusions of Modigliani and Diamond. Using a model based on real capital, money, and government bonds, Friedman shows that the portfolio effect described by Diamond is subject to the substitutability of assets in the public's aggregate portfolio. Because of this, the issuing of government debt may not always result in a "crowding out" effect, but in some cases may actually "crowd in" investment. In other words, the government's choice of debt instrument is of considerable importance to the effect debt will have on growth, a factor not accounted for by Modigliani or Diamond.

Possibly the most prominent empirical research regarding public debt in an international context is provided by Reinhart and Rogoff (2010) who attempt to define a systematic relationship between elevated debt levels, growth, and inflation. These findings are based on a panel data set of 44 countries spanning nearly 200 years. Reinhart and Rogoff make the important distinction of analyzing debt's effects based on threshold levels. Using this method, they find that countries with debt levels above 90% of GDP experience notably lower growth rates. Additionally, they find that the relationship between public debt and growth is similar across advanced and emerging markets. This finding is a point of significant controversy in other research.

Herndon et al. (2013) suggest that Reinhart and Rogoff's methodological processes inaccurately skew the results of 20 countries. This methodology is claimed to estimates lower GDP growth rates by approximately 2%. Instead, Herndon et al. find that the there is no dramatic difference in GDP growth levels above the 90% debt threshold. In addition, their research contests the similarity of effects across time and country, finding the relationship varies significantly with respect to these variables.

Research using similar methodology has been conducted in the EMU. Checherita and Rother (2010) of the European Central Bank apply the threshold regression model to a panel data set of twelve EMU countries dating back to 1970. They find that in the case of the euro area, the negative effects of high sovereign debt begin at the 70%-80% threshold and become non-linear at 90%-100%. The validity of this methodology has not been contested as in the case of Reinhart and Rogoff.

The methodology being employed in this research is pooled OLS regression and not threshold regression as is in the empirical works above. However, the work done in threshold regression remains important to the discussion in that levels of sovereign debt in the euro area are now within the 90% debt threshold, which has been suggested to have non-linear negative effects on growth. This research updates the analysis of Checherita and Rother by determining the magnitude of correlation between sovereign debt growth and GDP per capita growth in a modern context.

III. Data and Methodology

Data were collected from the World Bank's World Development Indicators (WDI) database. This database contains 1,343 aggregated series gathered from the regulatory institutions of 249 nations. Annual frequency is the given periodicity, as it is the highest frequency with which this data exists. Observations range from 1992, the signing of the Maastricht treaty, to 2012, the last observation. The Maastricht treaty is taken as a starting point because of its introduction of the 60% debt threshold criterion. In other words, this date marks the start of preparation for EMU acceptance in the context of sovereign debt. The data examines variables from nineteen nations over a twenty-year range. Thus, the data structure is cross-sectional time series or panel. This structure provides for a significantly larger sample size than using aggregates. The panel structure takes into account all 20 observations from each country and combines them into a pooled series, extending the potential sample size from 20 to 380.

All series are transformed into annual percentage growth rates. This means that instead of using stock values of each variable over time, annual percentage changes are observed. Additionally, this transformation induces stationarity, a necessary assumption for OLS estimation. Apart from this, the only additional transformation is the conversion of nominal GDP-to-capita to real GDP-per-capita using the GDP-deflator. This transformation removes the effects of inflation over time.

The dependent variable in this model is GDP-per-capita growth. The independent variable is the growth of Sovereign debt as a percentage of GDP. Growth in capital formation as weighted by GDP, population, prevalence of secondary education, and trade openness are also included as control variables in order to take into account other components of GDP growth.

The upward trend in the aggregated level of Sovereign debt for the 19 countries illustrates a 41.89% increase from 1992 to 2012. The average amount of debt during this time is 62.67%. The minimum can be observed in 2003 at 48.22% and the maximum in 2012 at 83.96%. As was stated in the introduction, current estimates suggest this debt has continued to rise as high as 93% this year. There are no significant outliers that need to be removed in either the nation specific data or euro area aggregation series. Thus, all observations are taken into account. Aggregate GDP per capita registered downward movement over this interval. The largest decrease occurred from 2007 to 2009 when growth fell to nearly -4%. This value is also the minimum of the series. The maximum can be observed in 2007 at 5%. The average GDP growth over this interval is 1.44%.

The strength of this data set is that it contains information on the relationship between sovereign debt and GDP-per-capita in three distinctly different macroeconomic contexts: the period of preparation for Euro Convergence, the commencement of the EU, and the period following the 2007 financial crisis. One limitation of this data is the absence of observations past 2012.

The statistical method employed in this research is pooled ordinary least squares regression. This method derives an estimation equation composed of pooled series for all 19 euro area members over time. Taking control variables into account, this model explains GDP-per-capita growth in the Euro Area as a function of a constant, weighted investment growth, population growth, secondary education growth, trade openness growth, growth in sovereign debt as a percentage of GDP, and an error term between. This estimation equation is provided below.

$$\%\Delta(GDP/P)it = \alpha + \beta it\%\Delta(I/GDP) - \chi\neg it\%\Delta(P) + \delta it\%\Delta(SE) + \varphi it\%\Delta(TO) - \gamma it\%\Delta(D/GDP) + \varepsilon it$$

In macroeconomic theory, investment is a positively related component of GDP and is thus suggested to have a positive coefficient. Population growth is suggested to have a negative correlation with GDP-per-capita in reference to the Solow model. Output per worker is on the Y-axis of the Solow model, or output divided by population. Thus, as population increases in the denominator, there will be a negative effect on GDP per capita. However, the argument can also be made that the positive effect induced by an increase in labor may actually be greater and cause a net increase in GDP. Thus, the suggested sign in the case of population is unclear. Secondary education is suggested to have a positive coefficient as increases in human capital positively affect productivity. Trade Openness is shown to have a positive relationship with GDP growth by Gries and Redlin (2015) and is thus suggested to have a positive coefficient in this context as well. Similarly, referencing the work of Checherita and Rother (2010) who

showed a negative relationship between sovereign debt and per-capita growth in the euro area, sovereign debt is predicted to have a negative coefficient.

One advantage of this model is its multiple control variables, which take into account other contributing factors to GDP-per-capita in order to place the coefficient of sovereign debt in proper context. However, this strength has a corresponding limitation in that the multiple control variables incur a larger adjusted R-squared penalty that could potentially inhibit explanatory power of the model as a whole.

IV. Results

As stated previously, all variables are transformed into growth rates in order to compare changes over time as well as induce stationarity. Panel unit root tests are performed in order to verify this stationarity. The null hypothesis of presence of a unit root is rejected by the panel unit root test for all six variables at the 99% confidence level. Following this, regression coefficients are estimated for the following equation using Eviews statistical software.

$$\%\Delta(GDP/P)it = \alpha + \beta it\%\Delta(I/GDP) - \chi\neg it\%\Delta(P) + \delta it\%\Delta(SE) + \varphi it\%\Delta(T) - \gamma it\%\Delta(D/GDP) + \varepsilon it$$

Upon reviewing the p-values for secondary education and trade, it can be concluded that these two variables are not statistically significant and thus are not retained in the final estimation equation. Additionally, in order to decrease the probability of autocorrelation, a one period lag term of the dependent variable is included. Following these alterations, the constant and final estimation coefficients are estimated.

$$\%\Delta(GDP/P)it = 1.3269 + (.2349)\%\Delta(GDP/P)\,t\text{-}1 + (.2020)\%\Delta(I/GDP) + (-.8231)\%\Delta(P) + (-.03927)\%\Delta(D/GDP) + \varepsilon it$$

The estimation indicates that the mean value of GDP per capita growth across the EMU is 1.3269%. The sign and magnitude of the independent variables' effects on GDP per capita growth are also observable. The value of GDP per capita growth one year prior to observation is positively correlated with the present observation. Its coefficient, 0.2349, indicates that a 1% increase in GDP per capita growth in a given year increases GDP per capita growth by 0.2349% the following year. This variable is statistically significant at the 99% confidence level. Capital formation as weighted by GDP is also positively correlated with GDP per capita growth. The coefficient 0.2020 indicates that a 1% increase in capital formation growth increases GDP per capita growth by 0.2020%. This variable is significant at the 99% confidence level. Population growth is observed to have a negative correlation with GDP per capita growth. Its coefficient, -0.8231, indicates that a 1% increase in population growth reduces GDP per capita growth by 0.8231%. This variable is statistically significant at the 99% confidence level. Finally, growth in sovereign debt is negatively correlated with GDP per capita growth. The coefficient -0.0393 indicates that a 1% increase in sovereign debt growth reduces GDP per capita growth by 0.0393%. This relationship is also statistically significant at the 99% confidence interval.

It is important to observe the variance in magnitude of these coefficients. The coefficient of population growth is approximately .79% larger than the coefficient of sovereign debt growth. This can be explained by the fact that population is in the denominator of the dependent variable itself, whereas sovereign debt growth is not itself a component of GDP per capita. This variance is not observed in the positive coefficients, .2349 and .2020, which are similarly about .6% lower in absolute value than the coefficient of population growth.

The adjusted R-squared of this estimation equation is .7931, which indicates that approximately 79% of the variance in the GDP per capita growth rate can be explained by this model. The F-statistic, used to assess the overall statistical significance, is 146.2472, which rejects the null hypothesis of insignificance at the 99% confidence level. Residual diagnostic tests are performed to determine whether or not the coefficients are best linear unbiased estimations of the dependent variable. The Jarque-Bera statistic, 41.8793, indicates that the residuals are normally distributed at the 99% confidence interval. The means of concretely testing for heteroscedasticity are not available due to the structure of this data set. Thus, the estimated standard errors have been adjusted for robustness in the presence of heteroscedasticity.

V. Conclusions

The aim of this research has been to analyze the effect of sovereign debt growth on GDP per capita growth in the Euro Area over the interval 1992-2012. The methodology employed here is linear ordinary least squares regression. These findings indicate that both investment as weighted by GDP and a one period lag term of the dependent variable have positive effects on GDP per capita growth. These coefficients are .2020 and 0.2349 respectively. Population growth and sovereign debt growth are observed to have negative effects on GDP per capita growth. The coefficients of these variables are -.8231 and -.0393 respectively.

The theoretical models put forth by Modigliani (1961) suggest that capital formation is the mechanism by which sovereign debt growth negatively affects economic growth. In order to determine if this is the case in the euro area, this research would have to be combined with an analysis of the relationship between sovereign debt growth and capital formation. This is one logical extension of this research going forward.

In regards to the relationship between Sovereign debt and GDP per capita growth, the negative relationship observed is consistent with Modigliani's seminal theoretical models as well as the empirical work of Checherita and Rother (2010). The results also serve as evidence in support of Rheinhart and Rogoff's (2010) claim that debt levels near the 90% threshold have negative effects on GDP per capita growth. The essential difference between this work and previous research is the choice of methodology. This study establishes the negative relationship using ordinary least squares as opposed to threshold regression. Because of this, it cannot be determined whether or not the magnitude of this negative relationship is consistent with the existing literature. However, it can be said that the negative relationship Checherita and Rother observed in the Euro Area in 2010 is still present.

There are multiple avenues of future research that could contribute to a better understand of the way debt is affecting economic growth in the euro area. One way would be to examine the same data using threshold regression methodology to further update the previous literature. Another would be to research whether or not Modigliani's theory that debt growth adversely affects economic growth through capital formation holds in this case. If a negative relationship were to be identified between these two variables, the combination of such a relationship with the one found in this research would validate the application of Modigliani's model. Finally, this same analysis could be applied to other collections of countries within specific geographical regions.

The established negative relationship between sovereign debt growth and GDP per capita growth found in this research could serve as supporting evidence for European Union policy makers who aim to decrease debt levels towards the 1992 OCA criterion levels. However, it should be noted that the magnitude by which this negative relationship exists has not been clarified in the context of debt thresholds and cannot be relevant to specific debt threshold criteria. Instead, it can be claimed that governments who have taken on elevated debt in an attempt to stimulate economic activity through added expenditure have been hindered by the negative relationship between debt and GDP.

Appendix:

Table 1

Estimation Results of Panel Regression Model of GDP per capita Growth
Bloomington-Normal, McLean County, IL
November 2015

Depend Variable: GDP per capita Growth, N = 257

Median GDP growth	1.3269***
	(7.2966)
One year lag of GDP Growth	0.2349***
	(6.9096)
Capital Formation Growth	0.2020***
	(19.3759)
Population Growth	-0.8231***
	(-2.6683)
Sovereign Debt Growth	-0.0393***
	(-5.5376)
Adjusted R-squared	0.7931
s.e. equation	1.8011
Residual Diagnostics test	
Normality	41.8793 a***

Significance at the 1%(***) level (t-values in parenthesis) a Values of Jarque-Bera statistical test for Normality

Table 2
Stationarity Tests
Panel unit root test: Summary
Sample: 1992 2015
Exogenous variables: Individual effects
User-specified lags: 1
Newey-West automatic bandwidth selection and Bartlett kernel

Variable	Statistic	p-value	Sections	Observations
%Δ(GDP/P)	-7.10960	0.0000	19	370
%Δ(I/GDP)	-9.43099	0.0000	19	371
%Δ(P)	2.53901	0.0056	19	396
%Δ(D/GDP)	-3.75015	0.0001	18	222

Figure 1

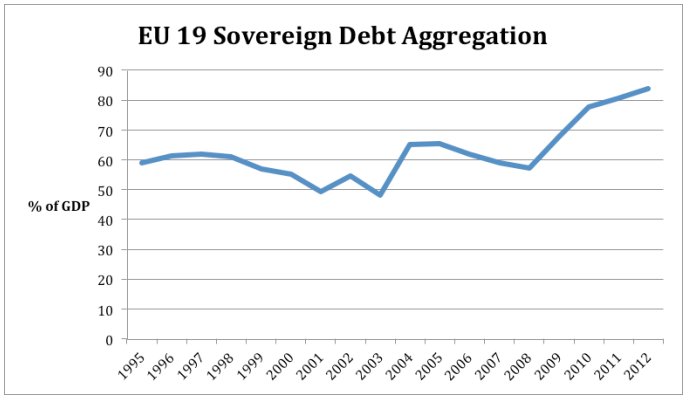


Figure 2

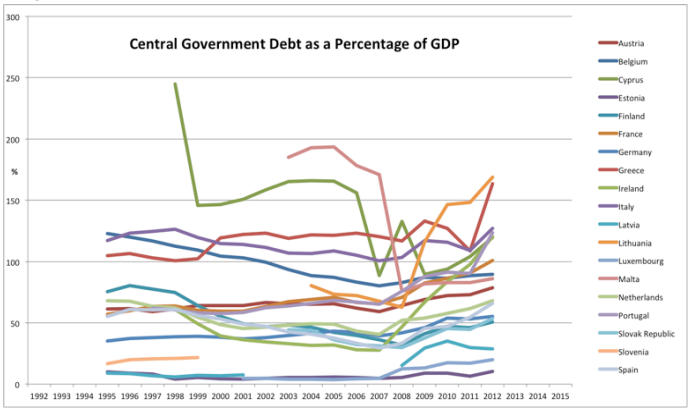


Figure 3

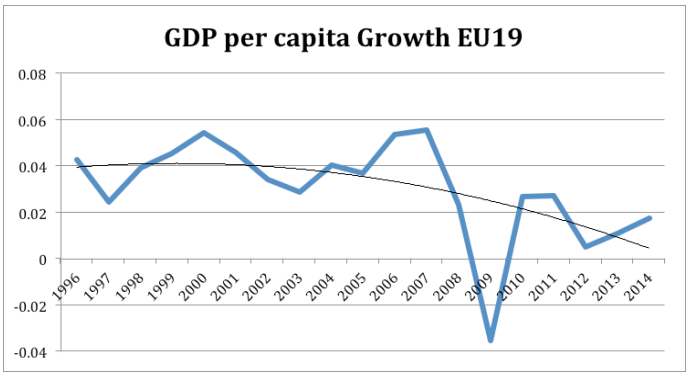
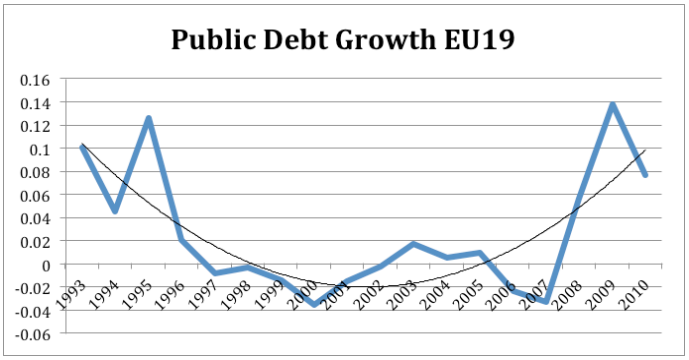


Figure 4



References

Checherita-Westphal, C., & Rother, P. (2010) The impact of high government debt on economic growth and its channels: An empirical investigation for the euro area. European Economic Review, 1392-1405.

Diamond. (1965). National Debt in a Neoclassical Growth Model. The American Economic Review, 55, 1126-1150.

Friedman, B. (1978). Crowding Out Or Crowding In? The Economic Consequences of Financing Government Deficits. NBER Working Paper No. 284.

"Government debt rose to 92.9% of GDP in euro area." European Commission. Eurostat, 22 Jul 2015. Web.<http://ec.europa.eu/eurostat/documents/2995521/6923259/2-22072015-AP-EN.pdf/bf173a0e-0eba-4ab9-878c-6db8d1f6452b>.

Herndon, T., & Ash, M. (2013). Does high public debt consistently stifle economic growth? A critique of Reinhart and Rogoff. Amherst, MA: Political Economy Research Institute

Modigliani, Franco. (1961). Long-Run Implications of Alternative Fiscal Policies and the Burden of the National Debt. The Economic Journal: 730. Print.

Mundell, Robert . "A Theory of Optimum Currency Areas." The American Economic Review. (1961): Print

Redlin, M., and T. Gries. Trade Openness and Economic Growth: A Panel Causality Analysis. Paderborn, 2015. Print.

Reinhart, C., & Rogoff, K. (2010). Growth in a time of debt. Cambridge, MA: National Bureau of Economic Research.

Rother, Philipp C.C. (2010). The Impact of High and Growing Government Debt on Economic Growth. European Central Bank