

# **PIGS Debt Crisis: Macroeconomic Factors**

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## **Abstract:**

Italy's public debt has seen large increases over the past few years, and as a result they were bailed out by other European Union members. Either their large trade deficits, inability to stimulate growth, or lack of tax revenues are all reason why Italy has fallen to such crisis. Other countries in the EU such as Portugal, Spain, and Greece have had similar debt problems and received a bailout as well. This paper will attempt to explain the relationship between the public debt to GDP ratio and some macroeconomic conditions using panel data from 1990 to 2010 for the countries Portugal, Italy, Greece and Spain. It will also compare and contrast the differing reasons as to why each country has faced these economic hardships.

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## 1.0 INTRODUCTION

In today's economy, it is extremely imperative that nations are able to provide a level of comfort to those investing within it. This is because of the level of trade and foreign investing has increased over the past few decades. The public debt to GDP ratio is one of the best tools to use in order to gauge this ability to pay off debt.

The public debt to GDP ratio is the ratio between a given country's debt and their GDP. It is most useful to investors because it gives them an indication as to how able a country is able to pay off its debt. With a higher public debt to GDP ratio, the less likely a country is able to pay off its bonds and other debts it incurs. The lower the ratio, the more likely investors will be more confident to spend within a given country, allowing for greater growth. So as a higher level of investing may allow for a greater growth in the GDP, it is extremely important to not only know the public debt to GDP ratio, but also to look at some macroeconomic indicators and see how they directly affect it.

There are a variety of economic factors that could lead to changes in the debt-GDP ratio. Such factors may include unemployment, inflation, the real GDP growth rate, the budget deficit or surplus, and the level of international trade. Other factors can also be held accountable for changes in the public debt such as consumer and business confidence levels, tax revenue by a country, and the interest rate a country promises in return for purchases of government bonds. Combined, all of these play a role in how a country's level of debt is determined, and how they pay off this debt.

This paper aims to look at which of those factors are the most important. It will attempt to enhance the understanding of how certain variables affect the debt ratio, as well as discuss if the variables that were selected are statistically significant. This will help lead to understanding

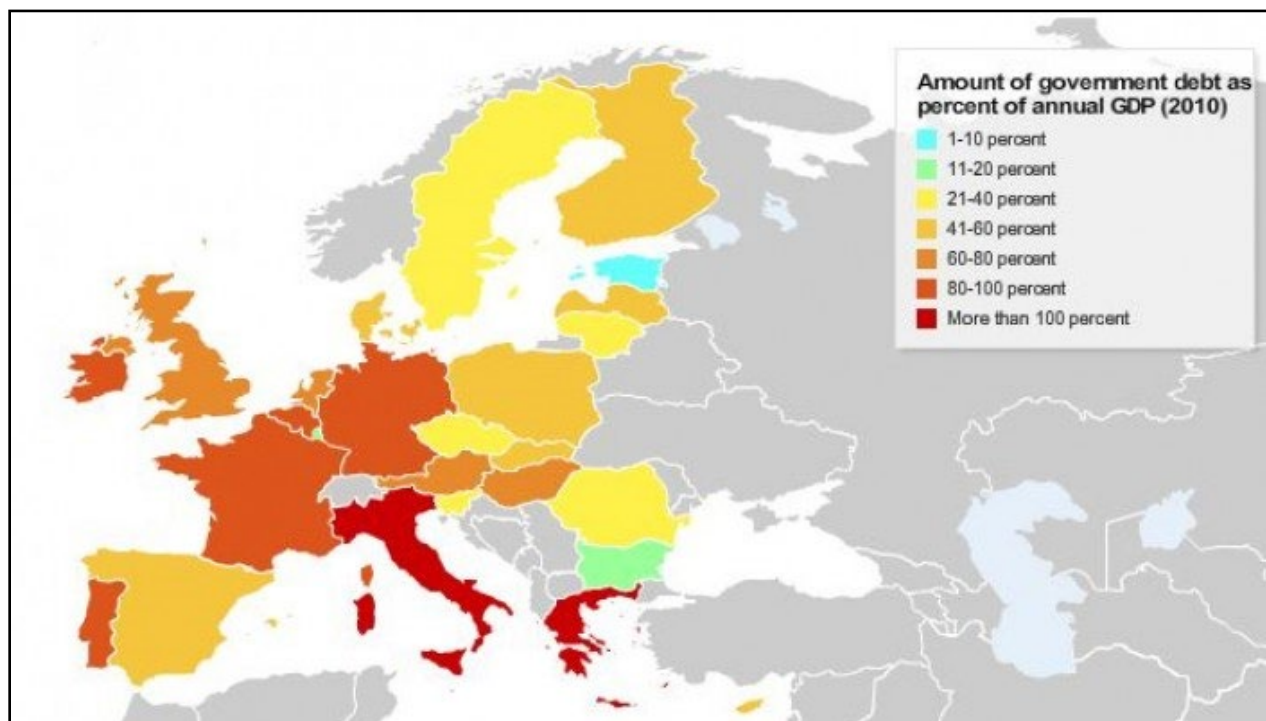
which variables more accurately portray how the debt to GDP ratio is formed. To test this, I have compiled a set of data from 1990 to 2010 for four different countries in Portugal, Italy, Greece, and Spain. These countries are also known as the PIGS of the European Union as they have all received bailouts from the European Central Bank because of their debt problems.

This rest of this paper is divided into the following sections: section two discusses the current trends relating to the issue of this paper; section three gives a literature review of this topic and the previous research that has been done before; section four shows the data, empirical methodology used, and the empirical model; section five presents the results from said model; section six concludes the most significant variables and the policy implications they lead to.

## 2.0 TRENDS

Before examining each country individually, it is important to look at the European Union as a whole. This is because although each country operates on its own, and its public finances are their own, they still share a currency. The Euro could be extremely affected in a negative way if one or more countries experience too high of debt ratios. This is why when the Euro was first created, so was the Stability and Growth Pact. This pact first stated that no country could exceed a debt ratio of 60% to ensure the stability of the shared currency. With the recent debt crisis, there have been several reforms to this act to allow countries to break the deficit limit in order to create economic growth.

**Figure 1: European Union Public Debt by Country**



Source: CNN

To see how each country differs from the average. In a report conducted by Eurostat, the statistical office of the entire European Union, it showed that fourteen of the 27 member countries had a debt ratio exceeding 60%. Across the Union, the average ratio increased over five percent in 2010 from 74.4% in 2009 to 80%. Within the original euro zone, those numbers are even higher as debt increased to an average of 85.1% in 2011. The highest debt in the Union belongs to Greece as its public debt to GDP ratio grew to 142.8%, followed by Italy at 119%. The lowest public debt to GDP ratios belong to Estonia and Bulgaria at 6.65 and 16.2% respectively (CNN).

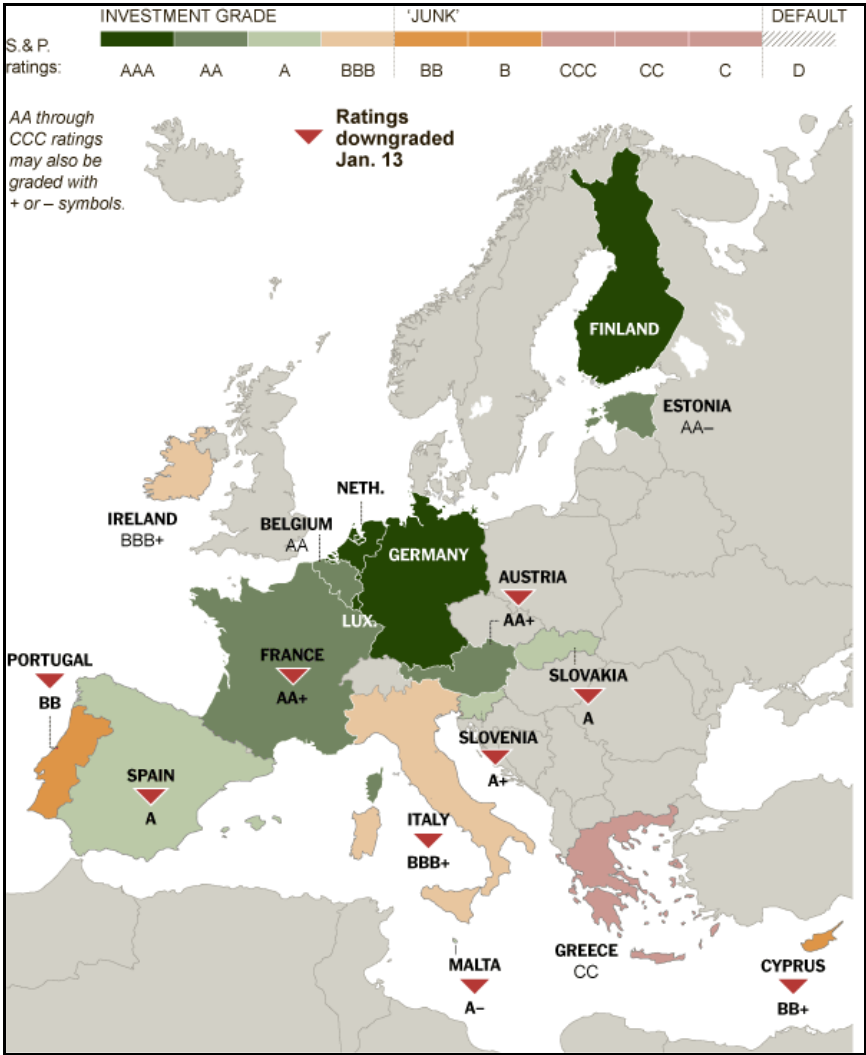
Greece, tested in this study, has the highest public debt to GDP ratio in the entire European Union. How is this so? Well, Greece has seen multiple problems over the past few decades which saw rise to the unbearable amount of debt. First, when Greece switched to the euro, many public sector jobs saw wage increases to what would ultimately be unrealistic levels. On top of this, retirement ages were low and benefits of pension packages were extremely generous.

Although these were issues, they were not the cause of this huge debt crisis. Instead, Greece has been plagued by chronic tax evasion. Greece had the lowest tax revenue as a percentage of GDP out of the four countries surveyed in this paper. As businesses and individuals both evaded taxes, eventually the government had to start borrowing money. Much like the subprime mortgages in the United States, those debts were bought and repackaged as complex commodities and were sold throughout the European Union (BBC News).

Greece then faced another problem as their credit rating was downgraded from A- to BBB+. At this point, the value of the euro was in jeopardy and it was time Greece needed a bailout following a period of tax raises and spending cuts. Greece would eventually receive a

bailout worth 110 billion euros, provided that the country takes action and even more stern austerity measures (Frangakis). This sent many up in arms as many trade unions and other protestors march in opposition of the austerity laws. Greece still could not get its finances on track and were given the opportunity to write-off 50% of their debt if they implemented even further austerity measures. Still this was not enough and Greece received a second bailout in 2012 worth 130 billion euros and they were downgraded even further to a CC credit rating, which spells severe risk for investors (Gatopoulos).

**Figure 2: European Union Credit Ratings by Country**



Source: NY Times

Italy is a slightly different case from Greece. Their debt woes are more due to long periods of stagnant growth and corruption. Italy's investors became more panicked that their slow growth and demanded higher interest rates in return for the risk they faced that the country may default on their loans. This became a phenomenon of self-fulfilling failure as interest rates became too high and Italy was spending as much as 16% of its budget on paying off interest alone.

Italy was also plagued by corruption as Silvio Berlusconi did not do enough to prevent a debt crisis. The leader and three time prime minister had been accused of tax fraud, procuring underage sex, and corruption with Mafia links. He also had a case thrown away for bribery charges in which he allegedly paid a British tax lawyer 600,000 to withhold testimony to protect him. He stepped down from power at the end of 2011 and allowed Mario Monti, a former European Commissioner, to step in. Right before stepping down, Berlusconi proposed a \$75 billion deficit reduction package (NY Times).

Monti called for even further spending cuts and tax increases. He was highly disliked as this new proposition would also increase the retirement age. He believed these steps would ensure Italy's stabilization and eliminate the budget deficit by 2013. He believed this to be so because his proposition was meant to cut government costs, combat tax evasion, and generate economic growth.

Recently Monti has been quoted saying that Spain is the country that could reignite the euro crisis. This is because although he commends Spain on its austerity laws being updated, he believes they have not done enough to control their finances. Spain has recently changed its labor laws loosening work regulations in attempts to cutting their national budget. But how did Spain,

with the lowest public debt to GDP ratio out of the four countries observed, fall into this mess in the first place?

Spain, like the US and UK had a huge housing bubble that had burst right when the global economic crisis hit. Even worse than the US and UK, Spain saw housing prices increase 80% from 1990 to 2009. This was mainly due to relatively low interest rates and easy credit terms. Also, because of the property boom, Spain saw a large period of relatively low unemployment for them. This led to many foreign workers moving into Spain for jobs. Since the collapse, this influx of workers has only made matters worse for them. From 2007 to 2010 Spain saw its unemployment increase from 8.3% to a sky-high 20.1% (White).

Other problems for Spain are that they have not grown their export sector. The gap between their tradable goods and non-tradable goods has increased. This means that their productivity is being challenged and they are having problems staying competitive. They have increased the retirement age from 65 to 67, and along with cuts in spending, Spain thinks that this could have a large impact on their current situation (White).

Unlike the other countries being discussed, Spain has used its period of growth to pay off most of its public debt, making eliminating it theoretically easier. Although their public debt remains low, it is Spain's total debt that is their massive problem.

**Figure 3: Spain's Total Debt**

	Total Debt/GDP	Total GDP (in €trn)	Total debt	O/w Public Debt	Public Debt as a % of total
UK	380%	2.1	7,980	1,089	14%
Spain	342%	1.1	3,762	530	14%
France	308%	2.2	6,871	1,250	18%
Italy	298%	2.1	6,258	1,499	24%
Germany	274%	3.6	9,864	1,230	12%

Source: McKinsey, IMF, National Debt Management



Portugal was the third country in the EU to request a bailout after Greece and Ireland. Portugal received a bailout of 78 billion euros that will theoretically allow them time to create reforms to boost long term growth. Much like many countries during this time of crisis, Portugal's credit rating had slipped in the past few years. The Portuguese Treasury then reassured that their top concern was reducing the budget deficit.

The government had then taken austerity measures of reducing politician's wages, public employee wages, and increased taxes to hope for a speedy reduction in the budget deficit. With these reforms, it caused an uproar within their own government and resulted in Prime Minister Jose Socrates resigning. With uncertainty within its own governing body, Portugal has seen its credit rating drop even further down to junk status.

With a poor credit rating, and predictions of a double-dip recession, Portugal is facing a severe possibility of needing a second bailout. Unemployment is a big concern for Portugal as it reached 13.6% by the end of 2011. Therefore, most of the reforms that Portugal is trying to make are focused on getting people back to work, while it is also offering incentives for companies to hire (van de Velde). There have been talks of Portugal leaving the Euro, but they disagree with this and think that the solution to the problem is to become more productive in its exporting sectors to become more competitive globally.

### 3.0 LITERATURE REVIEW

When deciding what variables to use in the model, I called upon previous research in order to see what others have done in the past. Bohn (1998) examined the behavior of U.S. public debt and deficits. The study analyzed how do governments react to the accumulation of debt, and do they take corrective measures when the debt-GDP ratio starts rising, or do they let the debt grow. The paper concludes that the U.S. government has historically responded to increases in the debt-GDP ratio by raising the primary surplus, or by reducing the primary deficit. It also shows that there is strong evidence that the U.S. fiscal policy has been sustainable in the sense of satisfying an intertemporal budget constraint for the sample period, despite rather frequent primary budget deficits.

de Haan and Sturm (1998) also studied the difference of public debt among OECD countries. Its data demonstrated the differences across countries of the share of public spending in GDP, and as data on government transfers is limited, they instead focused on total government consumption and investment spending. This is where I decided to include the gross capital fixed formation as a measure of investment spending in my own model; to capture government consumption I used the budget deficit as a percentage of GDP.

de Haan et al. (1999) revisit their research of the debt-GDP ratio and use variables such as the lagged change in debt-GDP ratio, debt servicing costs, the unemployment rate, and the real GDP growth rate to determine the differences across countries with different political schemes to see how they differ in spending. They concluded that countries with more than one governmental party has a significant positive impact on the public debt to GDP ratio, although it does not have any effect on fiscal performance.

Konstantinou and Tagkalakis (2010) utilized a model to determine if expansionary fiscal policy can boost consumer and business confidence. Their study analyzed quarterly data for nine OECD countries running from the first quarter in 1970 to the fourth quarter of 2007. The nine countries included in the study were Australia, Canada, Finland, Ireland, Japan, Netherlands, Sweden, UK, and US. The countries were selected based on the availability of data for consumer and business confidence indicators, as well as government spending variables all based on quarterly data.

Some of the variables included for measuring fiscal policy included government consumption and investment, as well as measures of both direct and indirect taxes. Other variables included were the unemployment rate, inflation, real GDP growth per capita and asset price movements. These variables were selected for multiple reasons; the first being that they would account for business cycle conditions for each country. They were also selected to detect any automatic response of tax revenues to changing economic conditions.

Overall the study's results proved the research question true, that expansionary fiscal policy will also boost both consumer and business confidence. It found that reductions in personal and business direct taxes have a positive effect on both confidence indexes, most likely leading to increased spending. They concluded that this was either because the tax cuts were received as temporary support, or that they help in liquidity. However, the study also concluded that government investment had negative effects on both consumer and business confidence. Aside from the direct stimulus it provided, they have negative long-run effects on private demand.

Alesina et al. (1989) conducted a study that looked at Italy specifically during the 1980's and tested to see the relationship between public confidence and the ability to pay off debt. They

asked if the public confidence was low, leading to them holding more foreign assets, would inevitably be a self-fulfilling debt problem. In other words, if the public did not think the government could repay its debt, that this would lead to the government's inability to roll over maturing debt and would be the cause for a debt crisis.

The study argues that if debt maturity is short, then a confidence crisis is much more likely; whereas if debt is long and evenly distributed, this would reduce risk and would be much less likely for a confidence crisis. The empirical findings concluded that they were correct in that the likelihood of a confidence crisis is reduced when debt is structured evenly over time.

Greiner (2011) tested the relationship between the sustainability of public debt and the debt to GDP ratio to the interest rate. Here, the author tests the different conditions in which public debt is sustainable based on conditions of the primary surplus. This study did not use statistics in determining how sustainable debt is under certain conditions; rather it used mathematical equations and calculus to determine the theoretical result to each condition.

## 4.0 DATA AND EMPIRICAL METHODOLOGY

### 4.1 DATA

This study uses annual data collected from 1990 to 2010. Data was obtained through the Organisation for Economic Co-operation and Development statistical database. This data is publically available on their website and can be found through searching for data by category and made specific to the countries Portugal, Italy, Greece, and Spain. A summary of the variables and their descriptions, expected signs, and significance is included in appendices A and B. Summary statistics for the data are provided in Table 1.

**Table 1: Summary Statistics**

Variable	Observations	Mean	Std. Dev.	Minimum	Maximum
PUBDEBT	84	89.86991	27.69771	42.12315	147.324
INVEST	84	1.805769	6.479754	-16.52091	14.16607
DBYL	84	1.617435	5.08827	-6.17677	15.77212
iGOV	84	8.015595	5.269419	3.39	24.28
TAX	84	34.52628	4.746549	26.17759	43.76452
BCONF	84	99.84976	2.808203	91.68	105.03
CCONF	84	100.2006	2.760459	92.76	106.81
UNEMP	84	9.786905	3.487699	4.1	20.1
CPI	84	4.456618	3.791044	-.825	20.43349
GDPGROWTH	84	1.924684	2.230959	-5.21743	5.94379
BUDGDEF	84	-5.347231	3.601469	-15.59378	2.01608
TRADEDEF	84	-23.60156	30.84377	-139.4968	43.89672

### 4.2 Empirical Model

Following Bohn (1998), de Haan et al. (1999), and Konstantinou and Tagkalakis (2010) this model has been varied to see if these similar macroeconomic indicators have an effect on the

public debt to GDP ratio. I have also varied the model to adopt an annual data set not quarterly data. I have added other indicators that I believe are important to determining this such as the budget deficit and trade deficit run by these Eurozone countries. It has also dropped a few variables to make the model more specific to what my study aims to answer.

The model can be written as follows:

$$\text{PUBDEBT} = \beta_0 + \beta_1 \text{INVEST} + \beta_2 \text{DBYL} + \beta_3 i\text{GOV} + \beta_4 \text{TAX} + \beta_5 \text{BCONF} + \beta_6 \text{CCONF} + \beta_7 \text{UNEMP} + \beta_8 \text{CPI} + \beta_9 \text{GDPGROWTH} + \beta_{10} \text{BUDGDEF} + \beta_{11} \text{TRADEDEF} + \varepsilon$$

The dependent variable in this study is the country's public debt to GDP ratio. It is measured as a relationship between how much a country owes and what it produces. This acts as an indicator to how well a country can pay back its debts. It is measured annually for the four Eurozone countries from 1990 to 2010.

There are eleven independent variables included in this study. INVEST is the gross fixed capital formation for each country. DBYL measures the lagged change in the public debt to GDP ratio. iGOV is the interest rates on ten year government bonds for each country. TAX is the tax revenue collected by each country measured as a percentage of its GDP. BCONF and CCONF are confidence indices for both businesses and consumers alike. The data for these indices are given as monthly rates, which I averaged throughout the year to get a single average for each year. UNEMP is the yearly unemployment rate for each country. CPI is the consumer price index for each country. GDPGROWTH is the real GDP growth rate for each country. BUDGDEF is the budget deficit for each country. TRADEDEF is the trade deficit for each country.

## 5.0 Empirical Results

The empirical results are presented in Table 2. The empirical estimation shows the relationship between the dependent and independent variables in both regressions run. The first regression run shows the results from the fixed effects on the model, while the second regression ran allowed for random effects.

**Table 2: Regression Results**

	Public Debt to GDP Ratio	
	FE	RE
Constant	-162.2902*** (64.01562)	-411.6239*** (139.9867)
INVEST	-.4344492 (.2881431)	.3028723 (.7288119)
DBYL	.4235227 (.2699524)	.7709539 (.6539526)
iGOV	-1.642076*** (.4833736)	-3.970008*** (1.196712)
TAX	1.218702** (.6111371)	3.264868*** (.5811071)
BCONF	.7391518 (.5540808)	3.382258*** (1.302715)
CCONF	1.295169*** (.4900549)	.3981665 (1.123021)
UNEMP	1.478969*** (.5478505)	.1453204 (.658358)
CPI	1.024193 (.6742773)	4.172689*** (1.643241)
GDPGROWTH	-.8436612 (.8006977)	-1.727878 (2.004637)
BUDGDEF	-.9068421* (.5130237)	-5.676741*** (.9246002)
TRADEDEF	.105948* (.0540632)	.2484388*** (.0873734)
Sigma u	25.895482	-
Sigma e	6.8105173	6.8105173
Rho	.93530573	-
Observations	84	84

Note: \*\*\*, \*\*, and \* denotes significance at the 1%, 5%, and 10% level respectively. Standard errors in parenthesis.

The first regression, accounting for fixed effects, returned some significant results for certain variables. According to the Hausman test, this regression is the accepted model. The independent variables that were positively related to the public debt to GDP ratio were TAX, BCONF, CCONF, UNEMP, CPI, and TRADEDEF. Of these, only TAX, CCONF, UNEMP and TRADE concluded in statistically significant results. CCONF and UNEMP were statistically significant at the one percent level; TAX was statistically significant at the five percent level; TRADEDEF was statistically significant at the ten percent level. UNEMP has the most significant positive impact on the debt-GDP ratio. As the level of unemployment increases by one percent, the debt-GDP ratio increases almost one and a half percent. This means that governments should have a high priority of getting its population back to work if it wants to decrease its public debt. As a policy maker, this proves to be more important to lowering the debt than other things.

The budget deficit as BUDGDEF was statistically significant at the five percent level and had a negative impact on the public debt to GDP ratio. At  $-0.9$ , this means that for one percent increase in the budget deficit, the public debt to GDP ratio will decrease just under one percent as well. This may seem counterintuitive that as the budget deficit increases, the debt-GDP ratio will decrease. This can be due to the fact that increases to the budget deficit may mean the country is paying off short term debt. It may be creating a higher debt for the long-term, but a limitation of this study is that it was conducted over a 20 year period and may not be long enough to capture the increases to long term debt. BCONF was positively related to the public debt to GDP ratio, but it is not significant; the same is true about CPI.

GDPGROWTH is negatively related to public debt, but is statistically insignificant. INVEST, iGOV, and BUDGDEF are negatively related to the public debt to GDP ratio. INVEST



and BUDGDEF are statistically significant at the five percent level, while iGOV is significant at the one percent level. This goes against my expectations for INVEST, as increases in investments actually decrease the public debt to GDP ratio. These investments could lead to long term growth and higher employment which is what would cause the debt ratio to fall. The rho value of this model is extremely high at .934. This means that 93 percent of the variance is due to differences across panels.

The second regression, accounting for random effects, returned similar results to the first. Although the Hausman test concluded that this model is not significant, we can still look at the results. Aside from the INVEST, all variables kept their positive or negative relationship to the public debt to GDP ratio. The major differences between the two regressions were which variables were significant and the values of the coefficients. iGOV remained statistically significant at the one percent level, and had a higher impact on the debt ratio. In this model, every one percent increase in the interest rates of government bonds, there is nearly a four percent decrease in the public debt to GDP ratio.

TAX went from being significant on a five percent level to a one percent level. BCONF and CPI both went from being statistically insignificant to being significant at the one percent level. Both CCONF and UNEMP went from being significant at the one percent level to being statistically insignificant. Both TRADEDEF and BUDGDEF saw increases in their statistical significance. DEF increased from the five percent level to the one percent level; TRADEDEF increased from the ten percent level to the one percent level.

## 6.0 Conclusion

In summary, there are links between the public debt to GDP ratio and many of the macroeconomic indicators used as variables. After conducting the Hausman test, I can reject the null hypothesis that both models are ok as there were too large of differences among coefficients between the regressions. We accept the fixed effect regression as our model of best fit.

The single most important variable in this study was the interest rates on government bonds. It was statistically significant at the one percent level in both models, and had one of the larger coefficients to affect the model. In both regressions, it showed that increases in the interest rates on government bonds helped lead to a lower debt-GDP ratio. The implication of this result is that as countries fall into deeper debt, the sustainability becomes an issue. As they are able to repay debt in the short term through the issuance of government bonds, they may ultimately face higher debt issues when higher interest rates are associated with those government issued bonds.

Another important variable throughout both regressions was the unemployment rate or UNEMP. In both regressions, the results show that a higher unemployment rate leads to a higher debt-GDP ratio. The implication of this result is that government should put a large focus more on getting its population back to work. It is more significant and has a larger impact than that of collecting taxes, running a deficit, or importing more than exporting.

The budget deficit is the most intriguing of these variables. This is because that as stated, in both regressions it was statistically significant and had a negative relationship on the public debt to GDP ratio. This again seems counterintuitive as you would think that as the budget deficit increases, so would too the public debt ratio. Other variables such as the confidence indicators and unemployment changed from being significant in one regression to being insignificant in the other.

This study can conclude that the most important measures the PIGS should take are getting their work force employed, and increased interest rates can also lead to higher levels of investment in the country. Employing a higher percentage of the work force allows for the country to have higher levels of commerce and may reduce tax evasion. Also with a higher number of workers, production may increase and GDP growth may increase. Having higher interest rates allows the country to pay off short term debt and structure its debt better for the future. The ability to pay off short term debt may lead to higher confidence by outside countries which will lead to higher levels of foreign investment.

One limitation to this study is that it was only analyzed over a 20 year period, which annual data was being collected. It is possible that a larger data set needs to be looked at. Possibly quarterly data could offer more insight to these countries and how to correct their public debt to GDP ratios. A study done over a longer period of time could also count for more business cycles letting the countries know the difference between a recession and an economic problem.

Another limitation to this study is that certain variables were either omitted or included that may have distorted the results. Omitting variables such as the number of political parties within each country may have agreed with de Haan et al. (1999) that the larger number of parties has an adverse effect on the debt-GDP ratio. Including variables that were insignificant in both regressions could also have distorted the coefficients and significance of other variables looked at within the model.

### Appendix A: Variable Description and Data Source

Acronym	Description	Data Source
PUBDEBT	The public debt to GDP ratio.	OECD
INVEST	The gross fixed capital formation	OECD
DBYL	The lagged debt-GDP ratio	Calculated using OECD data
iGOV	The interest rate of a 10 year government bond.	OECD
TAX	The tax revenue collected as a percentage of GDP	OECD
BCONF	Measures the degree of optimism on the state of the economy that businesses are expressing through their activities of savings and spending	Calculated using OECD data
CCONF	Measures the degree of optimism on the state of the economy that consumer are expressing through their activities of savings and spending	Calculated using OECD data
UNEMP	Number of unemployed as a percentage of the labor force.	OECD
CPI	Consumer Price Index is a measure of inflation for each country.	OECD
GDP	The real rate in which the economy grows for each country.	OECD
BUDGDEF	The budget deficit as a percentage of GDP.	OECD
TRADEDEF	The trade deficit in terms of \$ billions US.	OECD

### Appendix B: Variables and Expected Signs

Acronym	Variable Description	What it Captures	Expected Sign
INVEST	The gross fixed capital formation	A measure of the investment rates being made of each country	-
iGOV	The interest rate of a 10 year government bond.	The value of the interest rate on a 10 year government bond	-
TAX	The tax revenue collected as a percentage of GDP	The amount of tax being collected as a percentage of GDP for each country	+
BCONF	The average business confidence index	Measures the degree of optimism on the state of the economy that businesses are expressing through their activities of savings and spending	+
CCONF	The average consumer confidence index	Measures the degree of optimism on the state of the economy that consumer are expressing through their activities of savings and spending	+
UNEMP	Number of unemployed as a percentage of the labor force.	A measure of the performance of each country's economy.	-
CPI	Consumer Price Index is a measure of inflation.	How much consumers are spending.	+/-
GDP	The real rate in which the economy grows for each country.	How well the economy is able to grow each year	+/-
BUDGDEF	The budget deficit as a percentage of GDP.	Measures the difference between how much the government spends and collects.	-

TRADEDEF	The trade deficit in terms of \$ billions US.	Measures the difference in how much a country imports and exports.	-
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