Economic Growth and Public Indebtedness in the Last Four Decades: Is Portugal different from the other PIIGS' economies?

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Abstract

Portugal is a member of the group known by investors as 'PIIGS', countries characterised by having high public debt and weak economic growth. Using an extended time horizon, 1974–2014, this study seeks to empirically explore the relationship between economic growth and public debt in the PIIGS economies, particularly in the case of Portugal. Based on the estimation of linear regression models, it was concluded that in the last four decades there has been a negative relationship between economic growth and public debt in both cases, which is consistent with the literature. The negative relationship was even more pronounced in the case of the PIIGS than it was in the case of Portugal.

Keywords: Economic Growth, Portugal, 'PIIGS', Public Debt.

1 Introduction

Portugal belongs to the group of economies referred to as the 'PIIGS'.[1] Despite having attracted some controversy, the PIIGS acronym is commonly used in the world of international investors to refer to the peripheral and weaker economies of the European Union (EU). Whilst it is not possible to identify the creator of the acronym, it is known that it first originated in the 1990s, when the PIIGS were only the 'PIGS'.[2]

All these economies, with the exception of Italy, recently received financial assistance from the 'troika',[3] within a context of difficult access to funding in the capital markets, high public debt and weak economic growth (see Roubini & Mihm, 2011). In this regard, it should be noted that some studies have revealed

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[1] Portugal, Italy, Ireland, Greece, and Spain.

[2] Portugal, Italy, Greece, and Spain. Ireland was not yet considered to be part of the group. See Krouse (2012).

[3] The 'troika' is composed of the European Commission (EC), European Central Bank (ECB), and International Monetary Fund (IMF). In 2010, Greece and Ireland agreed to their respective adjustment programmes with the 'troika', followed by Portugal in 2011. Finally, in 2012, Spain agreed a financial assistance programme exclusively for the recapitalisation of its financial institutions. See European Commission (2013).

a negative relationship between public debt and economic growth.

One of the benchmark studies in the economic literature on the relationship between economic growth and public debt is that of Reinhart and Rogoff (2010). Using a sample of 44 countries, including Spain, the United States, France, Italy, and Portugal, and considering a time horizon of more than one hundred years, these authors concluded that higher levels of public debt correspond to a slower rate of economic growth.[4] Based on a sample of 12 countries from the Eurozone, including Germany, Spain, France and Portugal, Checherita and Rother (2012) also concluded that, from 1970 to 2010, there was a negative relationship between economic growth and public debt, with the latter accounting for between 90% and 100% of the GDP.

Similarly, the International Monetary Fund (IMF) found that high levels of public debt have a negative effect on economic growth (see IMF, 2013a).

> High and increasing levels of public debt can lead to higher interest rates and slower growth. High debt also makes public finances more vulnerable to future shocks, both by constraining the ability of governments to engage in countercyclical policies and by increasing the primary surplus needed to stabilize the debt ratio following an adverse shock to growth or interest rates. Indeed, when debt is high, there is a risk of falling into a bad equilibrium caused by self-fulfilling expectations. (IMF, 2013b, p. 6)

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[4] This study was revised and corrected in 2013 by the authors, who were able to confirm the validity of the conclusions obtained in the initial study.

However, neither the IMF nor the previous authors specifically discussed the relationship between public debt and economic growth either in the case of PIIGS in general or in the particular case of Portugal.

Thus, based on an extended time horizon for which data are available for all the peripheral countries of Europe (1974–2014), we empirically explore the relationship between economic growth and public debt, in the case of PIIGS in general as well as the particular case of Portugal. The aim is to answer the following questions: Is the relationship between economic growth and public debt negative in both cases, as the economic literature seems to suggest? In this relationship, are there any differences between the Portuguese economy and the PIIGS economies as a whole?

The work is divided into five sections. After the introduction, Section 2 presents a brief framework that allows us to understand the behaviours of economic growth and public debt in Portugal and in PIIGS as a whole. In Section 3, we describe the empirical methods used to explore the relationship between economic growth and public debt for Portugal and for PIIGS as a whole. In Section 4, we discuss the empirical results obtained. Finally, in Section 5, the main conclusions are presented.

2 Economic Growth and Public Debt: A brief outline

Figure 1 illustrates the behaviour of the average real growth rates of both the Portuguese GDP and the PIIGS' GDP over the last four decades (i.e., 1974–2014). In the period under analysis, both cases had higher economic growth before the 1990s.

Figure 1 Real growth rates of GDP (at 2010 prices), 1974–2014
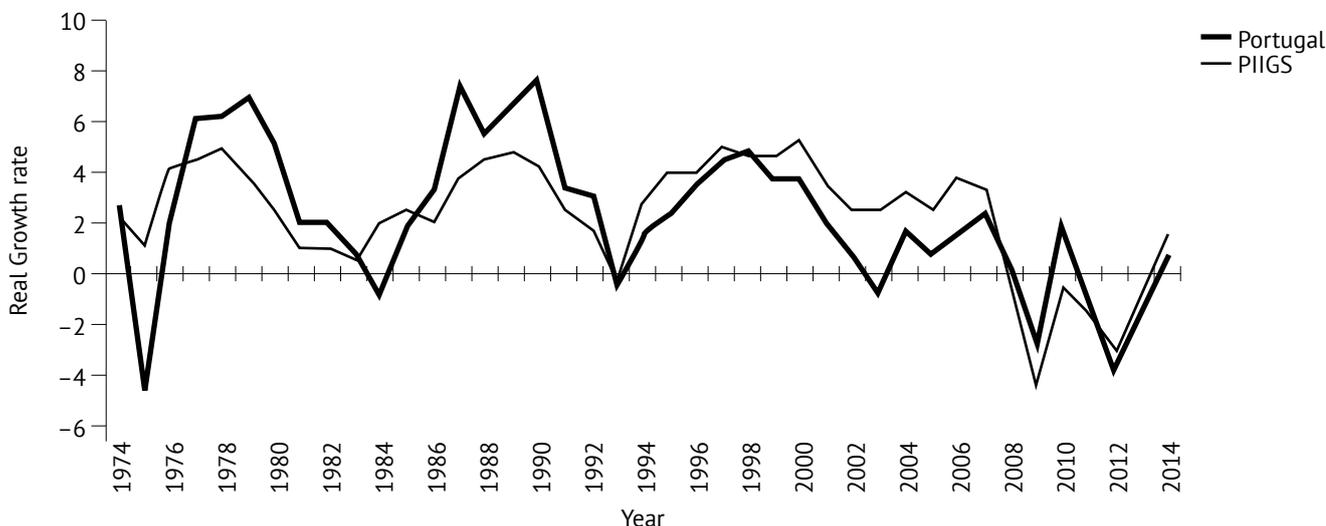
Source: AMECO (2015) and the authors' own calculations.

From the analysis of the real average annual growth rates of GDP presented in Table 1, it can also be concluded that the Portuguese economy grew in real terms over the past 41 years at an average rate of 2.2% per year, a lower value than the PIIGS' average. However, this figure is still higher than in several of the more developed economies, such as Spain, Sweden, and the United Kingdom.

The values presented in Table 2 paint a clearer picture of this reality. As can be seen, in the period under consideration, the growth of the public debt-to-GDP ratio was faster in Portugal when compared with the average ratio of the countries comprising PIIGS as well as when compared with some of the most developed countries, such as the United States and Japan.

Table 1 Real Average Annual Growth Rates of GDP (at 2010 prices), 1974–2014

Countries	Real Average Annual Growth Rates of GDP
Portugal	**2.2**
Italy	1.5
Ireland	4.2
Greece	1.4
Spain	2.1
Average of PIIGS	**2.3**
United States	2.8
Japan	2.3
United Kingdom	2.1
Sweden	2.0

Source: AMECO (2015) and the authors' own calculations.

Table 2 Growth Rates and Changes in the Public Debt-to-GDP Ratio, 1974–2014

Countries	Average Annual Growth Rate of the Public Debt/GDP Ratio
Portugal	**5.9**
Italy	2.5
Ireland	2.0
Greece	5.6
Spain	5.5
Average of PIIGS	**3.3**
United States	2.4
Japan	6.9
United Kingdom	0,9
Sweden	1.3

Source: AMECO (2015) and the authors' own calculations.

Considering the evolution of public debt as a percentage of GDP during the same period (see Figure 2), we can also observe that in both Portugal and the PIIGS' economies as a whole, there was a trend towards an increase in their respective public debt-to-GDP ratios. It should also be noted that, before 2006, Portugal always had a lower ratio than the PIIGS' average. However, from that year onwards, this ceased to be the case.

In short, from the point of view of a simple statistical analysis, it can be concluded that, on average, for the period 1974–2014, real GDP growth rates were lower in Portugal when compared with the average of the PIIGS' economies. In contrast to this, however, the public debt-to-GDP growth ratios were higher in Portugal than the PIIGS' average.

In addition, and even more importantly, it can be observed that in Portugal, as well as in PIIGS as a whole, the public

Figure 2 Public debt-to-GDP ratios, 1974–2014

Source: AMECO (2015) and the authors' own calculations.

debt-to-GDP ratio grew more rapidly than the real GDP. However, the main questions still remain. Is the relationship between economic growth and public debt negative in both cases? In this relationship, are there any differences between Portugal and the PIIGS' economies as a whole?

3 Empirical Strategy

An efficient and effective way of testing the relationship between economic growth and public debt for the period 1974–2014 in Portugal and the PIIGS' economies as a whole is to estimate the following simple linear regression models:

$$yPI_t = \beta_0 + \beta_1 pdPI_t + e_t \tag{1}$$

$$yP_t = \alpha_0 + \alpha_1 pdP_t + u_t \tag{2}$$

In model (1), the explanatory variable $pdPI_t$ is the growth rate of the PIIGS' public debt-to-GDP ratio, the dependent variable yPI_t is the real growth rate of the PIIGS' GDP, β_0 is the constant, and e_t is an error term. In turn, in model (2), the explanatory variable pdP_t is the growth rate of the Portuguese public debt-to-GDP ratio, the dependent variable yP_t is the real growth rate of the Portuguese GDP, α_0 s the constant, and u_t is the error term.

Both models have their explanatory variables and dependent variables in growth rates, which will allow us to obtain better results in terms of stationarity. This is a very important condition in time series analysis (see, for example, Baffes, 1996).[5]

Under these circumstances, we first need to test the stationarity of the four variables: (i) growth rate of the PIIGS' public debt-to-GDP ratio; (ii) real growth rate of the PIIGS' GDP; (iii) growth rate of the Portuguese public debt-to-GDP ratio; and (iv) real growth rate of the Portuguese GDP. This can be done by applying two of the most widely used unit root tests: the Augmented Dickey-Fuller (ADF) and the Augmented Dickey-Fuller Generalised Least Squares (ADF-GLS) (see Dickey & Fuller, 1979; Elliott, Rothenberg, & Stock, 1999).[6] In both tests, the null hypothesis is the presence of a unit root — which means that the series is not stationary — and the alternative hypothesis is that there is no unit root, meaning that the series is stationary.[7]

After performing these tests, we can estimate both models and draw conclusions.

4 Empirical Results

In order to perform the unit root tests and estimate the models, we used the Gnu Regression, Econometrics and Time-Series Library (GRETL) software, an open-source software for econometric analysis (see GRETL, 2014), and the AMECO data source for all the variables used (see AMECO, 2015).

As previously stated, the first step in our empirical analysis was to perform the unit root tests. Table 3 shows the results obtained with these tests.[8]

Thus, by analysing the p-values, the ADF test indicated that all the variables were stationary, with the exception of the real growth rate of the PIIGS' GDP. In turn, the p-values of the ADF-GLS test showed that all the variables were stationary, with no exceptions.

Because the ADF-GLS test has greater power and usually provides more robust results when compared with the ADF test, we chose the conclusion of this test for the real growth rate of the PIIGS' GDP instead of the conclusion of the ADF test. Thus, we assumed that all the variables were stationary.

Taking into account the results obtained with the unit root tests, we then sought to assess the relationship between the real growth rates of GDP and the growth rates of the ratios of public debt-to-GDP. Therefore, our objective was to estimate models (1) and (2) using the Prais-Winsten estimation method, because the OLS estimation revealed problems in terms of a serial correlation of errors.[9] Table 4 presents the results obtained, with the estimation of the first regression being made using the Prais-Winsten estimation method.[10]

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[5] A time series is stationary when it follows a stochastic process — that is, when its mean, variance, and covariance are constant in time.

[6] The ADF-GLS test "is similar to an (augmented) Dickey–Fuller t test […], but has the best overall performance in terms of small sample size and power, dominating the ordinary Dickey–Fuller test" (see Baum, 2000, p, 36).

[7] The unit root is a process that makes a series non-stationary and, consequently, causes problems in inference.

[8] In Figures A.1 and A.2 in the Appendix, it is possible to analyse the behaviour of all the variables from 1974 to 2014. As can be seen, they do not display any type of trend.

[9] We started by testing both models using the OLS method. From the analysis of the values shown in Table A1 and Table A2 in the Appendix, we can conclude that, although neither estimation reveals any problems of heteroscedasticity, they do present problems of a serial correlation of errors.

[10] In order to correct the problems of serial correlation revealed in the OLS estimations, we conducted some experiments. For example, we used the Newey-West estimator to overcome the auto-correlation problems. However, the results were not very favourable, contrary to what happened with the estimations made using the Prais-Winsten method, which is why we chose to use the latter. The Prais-Winsten method corrects the problems associated with serial correlation.

Table 3 Results of the ADF-GLS and ADF Tests – Annual Frequency

ADF				
Test with constant and without trend				
Variable	Lags	Test statistic	*p*-value	Conclusion
Real growth rate of the Portuguese GDP	1	3.21514	0.0191**	**S**
Real growth rate of the PIIGS' GDP	2	-2.13637	0.2304	**NS**
Growth rate of the Portuguese public debt-to-GDP ratio	2	-3.58692	0.0060***	**S**
Growth rate of the PIIGS' public debt-to-GDP ratio	1	-2.73277	0.0684*	**S**
ADF-GLS				
Test with constant and without trend				
Variable	Lags[11]	Test statistic	*p*-value	Conclusion
Real growth rate of the Portuguese GDP	1	-3.26649	0.0010***	**S**
Real growth rate of the PIIGS' GDP	2	-2.19968	0.0268 **	**S**
Growth rate of the Portuguese public debt-to-GDP ratio	2	-3.71021	0.0001***	**S**
Growth rate of the PIIGS' public debt-to-GDP ratio	1	-2.57366	0.0097***	**S**

Source: Output provided by GRETL (2014).

Note: *, ** and *** were used to represent the rejection of the null hypothesis of the ADF and ADF-GLS tests at a significance level of 10%, 5% and 1%, respectively. S = Stationary; NS = Non-Stationary. The main results are shown in bold in the Conclusion column.

Table 4 Estimation of Equation (1) using the Prais-Winsten Method

	Dependent variable: yPI_t			
Explanatory variables	Coefficient	Standard Error	*t*-stat	*p*-value
Constant	3.15796	0.565158	5.588	1.93e-06 ***
Growth rate of the PIIGS' public debt-to-GDP ratio	−0.173846	0.034269	−5.073	9.95e-06 ***
R-squared: 0,715571; **Adjusted R-squared**: 0.708278				
Durbin-Watson statistic (d)[12]: 2.042163				

Source: Output provided by GRETL (2014).

Note: *, ** and *** represent the statistical significance of the regressor at the 10%, 5% and 1% level, respectively.

An analysis of the values shown in Table 4 — although the explanatory power of the model is not very high[13] — identified a negative relationship between economic growth and public debt. Thus, it can be concluded that an increase of 1 percentage point (pp) in the growth rate of the PIIGS' public debt-to-GDP ratio was associated, on average, with a reduction in the real growth rate of the PIIGS' GDP of about 0.17 pp between 1974 and 2014.

The results obtained with the estimation of the second regression (again using the Prais-Winsten method) are presented in Table 5 (again using the GRETL software).

The results for the particular case of Portugal also show a negative relationship between economic growth and public debt — again, despite the fact that the explanatory power of the model is not high (and even lower than in the first estimation).[14] More precisely, we can say that an increase of 1 pp in the growth rate of the Portuguese public debt-to-GDP

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[11] Number of lags for all tests selected automatically by GRETL (2014), for a maximum number of lags equal to 4.

[12] If $d < d_L$, the error terms are positively auto-correlated. If $d > d_U$, there is no evidence that the error terms are positively auto-correlated. If $(4-d) < d_L$, the error terms are negatively auto-correlated. If $(4-d) > d_U$, there is no evidence that the error terms are negatively auto-correlated. Taking into account that $d_L = 1.4493$ and $d_U = 1.5490$, this means that there is no evidence of serial correlation. We also confirm the absence of serial correlation in our model by drawing the correlogram of the residuals in GRETL (2014).

[13] The adjusted R-squared was approximately 0.71, which means that the explanatory power of the model is 71%; in other words, this model explains 71% of the behaviour of the real growth rate of the PIIGS' GDP. This is not a very high value, but we must take into account that there is only one regressor (excluding the constant) explaining the behaviour of the real growth rate of the PIIGS' GDP.

[14] The adjusted R-squared was approximately 0.52, which means that this model only explains 52% of the behaviour of the real growth rate of the PIIGS' GDP. This value is not high, but again we must take into account that there is only one regressor (excluding the constant) explaining the behaviour of the dependent variable.

Table 5 Estimation of Equation (2) using the Prais-Winsten Method

Explanatory variables	Dependent variable: yP_t			
	Coefficient	Standard Error	*t*-stat	*p*-value
Constant	2.98259	0.817909	3.647	0.0008 ***
Growth rate of the Portuguese public debt-to-GDP ratio	−0.134196	0.0315744	−4.250	0.0001 ***
R-squared: 0.532567; **Adjusted R-squared**: 0.521101				
Durbin-Watson statistic (d)[15]: 2.067848				

Source: Output provided by GRETL (2014).

Note: *, ** and *** represent the statistical significance of the regressor at the 10%, 5% and 1% level, respectively.

ratio was associated, on average, with a reduction of 0.13 pp in the real growth rate of the Portuguese GDP between 1974 and 2014.[15]

Hence, in light of the results obtained, it can be concluded that, in both PIIGS as a whole and Portugal specifically, the growth of the public debt was negatively associated with the growth of GDP. In the case of the PIIGS' economies as a whole, this association was even more negative than it was for Portugal, as evident from the analysis of the coefficients of the explanatory variables.[16]

4 Conclusion

All the PIIGS countries, with the exception of Italy, recently received financial assistance from the 'troika' within a context of difficult access to funding in the capital markets, high public debt and weak economic growth. In fact, in the PIIGS' economies, as well as in the particular case of Portugal, the public debt-to-GDP ratio grew more rapidly than real GDP in the last four decades (i.e., 1974–2014).

In order to study the relationship between economic growth and public debt in both the PIIGS' economies and in Portugal from an empirical point of view, we estimated simple linear regression models using the Prais-Winsten method. The main aim was to analyse whether a negative relationship existed between economic growth and public debt in both cases, as suggested in the economic literature.

Although the explanatory power of the models was not very high, it was possible to conclude that, in the case of the PIIGS' economies, an increase of 1 pp in the growth rate of its public debt-to-GDP ratio was associated, on average, with a reduction in the real growth rate of GDP of about 0.17 pp. In turn, in the case of Portugal, it was observed that an increase of 1 pp in the growth rate of its public debt-to-GDP ratio was associated, on average, with a reduction of 0.13 pp in the real growth rate of GDP.

In this context, the empirical results obtained show a negative relationship between economic growth and public debt for both the PIIGS' economies and Portugal. These results are consistent with the literature on the subject, which has shown that public debt can act as a drag on growth (see Reinhart & Rogoff, 2010; Checherita & Rother, 2012), and, in particular, they agree with the position of the IMF, which stated that "high and increasing levels of public debt can lead to (...) slower growth" (see IMF, 2013b, p. 6).

These findings highlight the need for the peripheral economies of the European Union to adopt responsible fiscal policies in order to ensure that the public debt will not increase significantly. Otherwise, economic growth could be compromised. To better understand this reality, and taking into account that our estimated models did not present a very high adjusted R-squared, it is our intention to consider the inclusion of more variables in future research in order to improve their explanatory power.

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[15] Taking into account that d_L = 1.4493 and d_U = 1.5490, this means that in this second regression there is also no evidence of serial correlation. We further confirmed the absence of serial correlation in our model by drawing the correlogram of the residuals in GRETL (2014).

[16] This seems to mean that other variables that are not in the models may have been more important in explaining the behaviour of Portuguese economic growth than in explaining the behaviour of the PIIGS' economic growth. This is an aspect that we intend to investigate in future research.

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Appendix

Figure A.1 Real growth rate of the Portuguese GDP (at 2010 prices) and growth rate of the Portuguese public debt-to-GDP ratio, 1974–2014
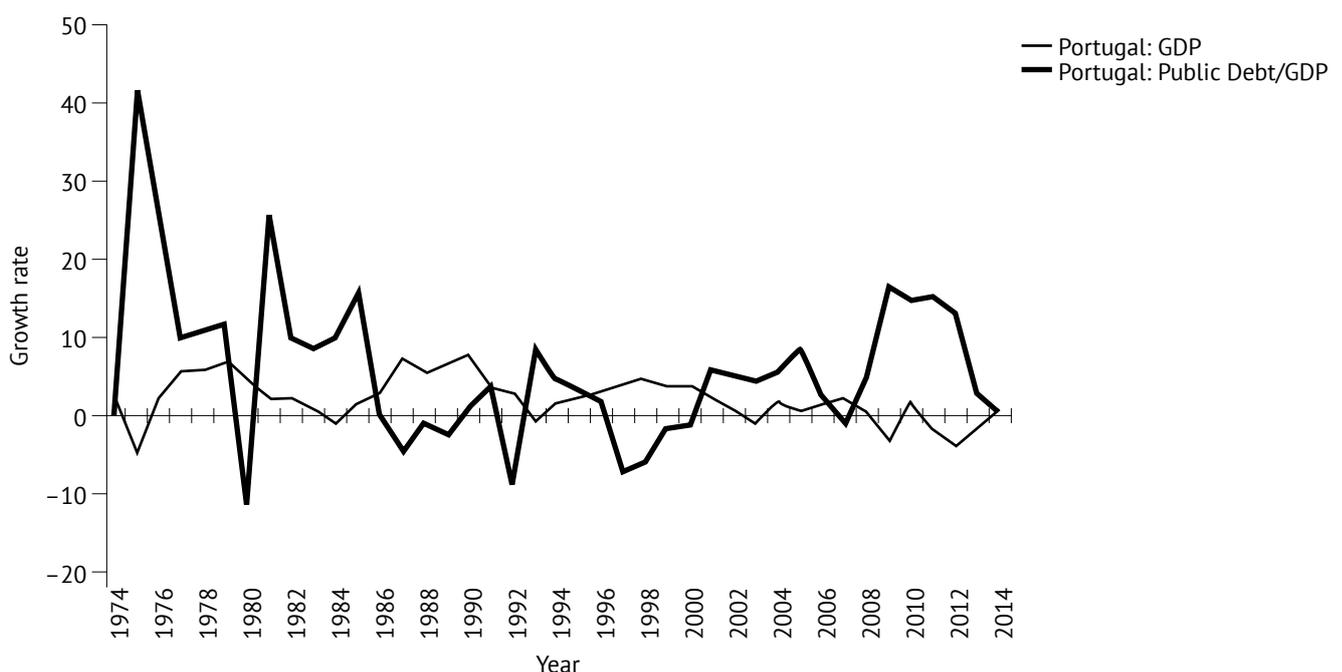
Source: AMECO (2015) and the authors' own calculations.

Figure A.2 Real growth rate of the PIIGS' average GDP (at 2010 prices) and growth rate of the PIIGS' public debt-to-GDP ratio, 1974–2014
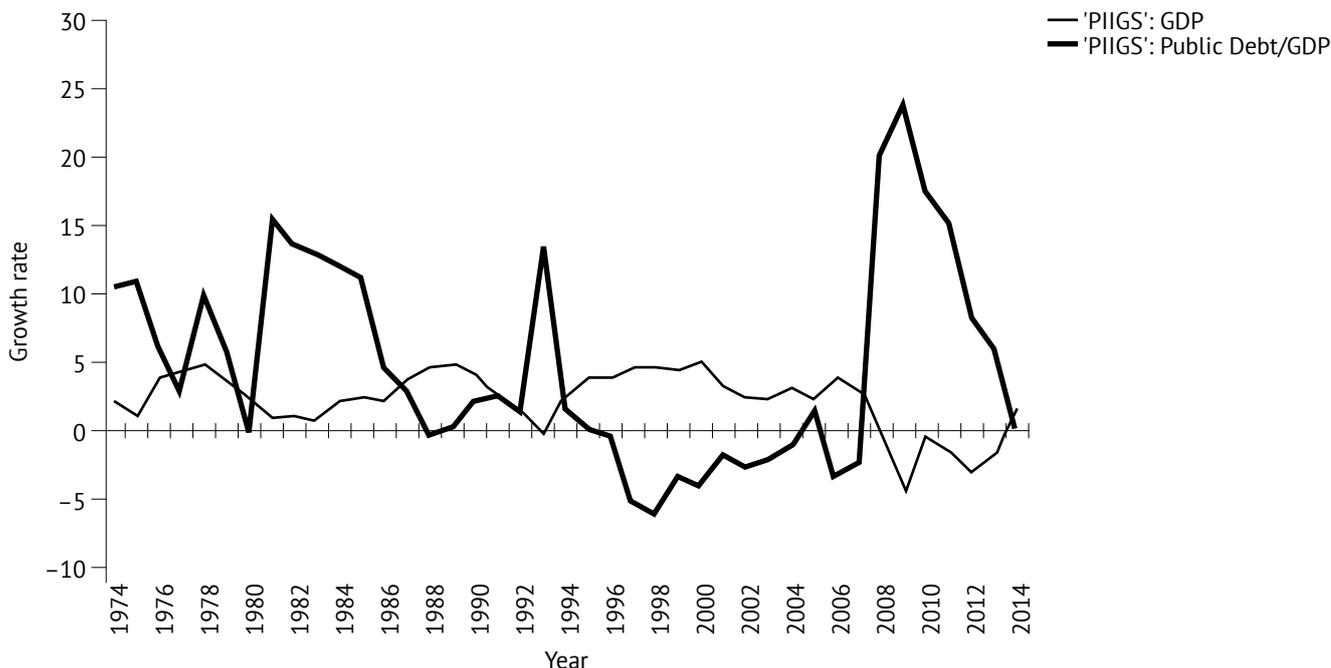
Source: AMECO (2015) and the authors' own calculations.

Table A1 Estimation of Equation (1) by OLS

Explanatory variables	Dependent variable: yPI_t			
	Coefficient	Standard Error	t-stat	p-value
Constant	3.42002	0.300356	11.39	5.71e-014***
Growth rate of the PIIGS' public debt-to-GDP ratio	−0.220433	0.0331688	−6.646	6.59e-08***
R-Squared: 0.531062; **Adjusted R squared**: 0.519038				
Durbin-Watson statistic (d)[17]: 0.779747,				
p-value of LM test (order 1)[18]: 5.08664e-005				
p-value of white test[19]: 0.160163				

Source: Output provided by GRETL (2014).

Note: *, ** and *** represent the statistical significance of the regressor at the 10%, 5% and 1% levels, respectively.

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[17] If $d < d_L$, the error terms are positively auto-correlated. If $d > d_U$, there is no evidence that the error terms are positively auto-correlated. If (4-d) < d_L, the error terms are negatively auto-correlated. If (4-d) > d_U, there is no evidence that the error terms are negatively auto-correlated. Taking into account that $d_L = 1.4493$ and $d_U = 1.5490$, this means that the model has problems of serial correlation.

[18] Null hypothesis: no serial correlation. Alternative hypothesis: serial correlation. The p-value obtained shows that we reject the null hypothesis.

[19] Null hypothesis: homoscedasticity. Alternative hypothesis: heteroscedasticity. The p-value obtained shows that we cannot reject the null hypothesis.

Table A2 Estimation of Equation (2) by OLS

Independent variables	Dependent variable: yP_t			
	Coefficient	Standard Error	t-stat	p-value
Constant	3.18901	0.476490	6.693	5.68e-08***
Growth rate of the Portuguese public debt-to-GDP ratio	−0.154270	0.0401687	−3.841	0.0004***
R-Squared: 0.274416; **Adjusted R-squared**: 0.255812				
Durbin-Watson statistic (d)[20]: 0.811849				
p-value of LM test (order 1)[21]: 3.59804e-005				
p-value of white test[22]: 0.11638				

Source: Output provided by GRETL (2014).

Note: *, ** and *** represent the statistical significance of the regressor at the 10%, 5% and 1% levels, respectively.

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[20] Taking into account that $d_L = 1.4493$ and $d_U = 1.5490$, this means that the model has problems of serial correlation.

[21] The p-value obtained shows that we reject the null hypothesis of no serial correlation.

[22] The p-value obtained shows that we cannot reject the null hypothesis of homoscedasticity.

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Gospodarska rast in javna zadolženost v zadnjih štirih desetletjih: je Portugalska drugačna od drugih PIIGS-gospodarstev?

Izvleček

Portugalska je članica skupine držav, investitorjem poznane kot PIIGS, ki jo označujeta visok javni dolg in šibka gospodarska rast. V tej raziskavi smo v razširjenem obdobju 1974–2014 empirično preverili povezavo med ekonomsko rastjo in javnim dolgom v gospodarstvih PIIGS in na Portugalskem. Na osnovi ocene linearnih regresijskih modelov ugotavljamo, da je v zadnjih štirih desetletjih v obeh primerih povezava med ekonomsko rastjo in javnim dolgom negativna, kar je skladno z literaturo. Negativna povezava je bila celo bolj izrazita v gospodarstvih PIIGS kot na Portugalskem.

Ključne besede: ekonomska rast, Portugalska, PIIGS, javni dolg