What happens to the relationship between public debt and economic growth in European countries?

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Abstract

The importance of public debt level is mainly related with its impact on economic growth. We analyze the relationship between public debt and economic growth in the core and periphery European countries. We find that higher levels of debt-to-GDP ratio have a negative impact on economic growth in all countries, with Belgium and Ireland being the most affected economies in each type of countries. Moreover, we obtain that economic growth reduces debt-to-GDP ratio and, consequently, economic growth is essential to reduce public debt and improves the general economic situation.

Keywords: public debt, economic growth, European countries
JEL Classification Codes: H63, O40

1. Introduction

The relationship between public debt level and macroeconomic variables represents one of the most widely debated topics among economists and policymakers in both developed and developing countries. The public debt level is also an issue on which the general public has been particularly concerned since it affects social life in general. News on this topic appears on the front pages of newspapers worldwide. The last global financial and economic crisis has led to an important increase in public debt in most economies. In particular, the great problems of Greek public debt have triggered the first major crisis of common currency in Europe.

The importance of public debt level is mainly related to its impact on economic growth. There is a large body of policymakers who consider that high levels of public debt give rise to a reduction in economic growth in the long-run,[1] which can lead to dire consequences for an

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[1] Carlo Cottarelli, Director of Fiscal Affairs Department at International Monetary Fund, indicated in his speech "Challenges of Budgetary and Financial Crisis in Europe" (London School of Economics and Political Science,

economy. Moreover, policymakers consider that public debt should act as a safe haven in times of economic stress.[2] Furthermore, theoretical studies highlight the negative impact of high levels of public debt-to-GDP ratio on the economy, although it could be a positive impact in the transition stage, depending on the type of goods/services financed out such a debt (see, *e.g.*, Saint Paul, 1992, and Aizenman *et al.*, 2007).

The empirical literature on the link between public debt and economic growth was sparse up to the second half of the 2000s and was mainly focused on developing countries. The analysis about the topic became important due to the sovereign debt problems emerged in 2008 and several authors have paid attention to the issue since then.[3] However, the empirical literature does not provide consensus about the relationship between public debt and economic growth. On the one hand, authors such as Reinhart and Rogoff (2010), Cecchetti, *et al.* (2011), Reinhart *et al.* (2012), Checherita-Westphal and Rother (2012), Baum *et al.* (2013), Mencinger *et al.* (2014) and Woo and Kumar (2015) show the existence of a negative impact of debt on economic growth once a "magic threshold of debt"/turning point is reached and "debt intolerance"[4] appears. On the other hand, Panizza and Presbitero (2014) do not find that public debt causes economic growth and they conclude that there is no evidence that high levels of public debt have a negative impact on economic growth in the medium-term for advanced economies. Moreover, Pescatori *et al.* (2014) indicate that the link between the two variables (public debt and economic growth) is notably influenced by the debt trajectory.

While most of the empirical studies have been focused on developing countries, only a few have paid attention to the effects of public debt on GDP growth in European countries (see Checherita-Westphal and Rother, 2012; Baum *et al.*, 2013; Mencinger *et al*., 2014).[5] Checherita-Westphal and Rother (2012) find evidence of a debt turning point at about 90-100% of GDP in twelve euro area countries. By considering the same countries, Baum *et al.* (2013) suggest that the short-run impact of debt on GDP growth is positive, but it decreases to close to zero and losses significance beyond public debt-to-GDP ratios about 67%. They also find that the impact of additional debt has a negative effect on economic activity when public debt-to-GDP ratio is above 95%. Finally, Mencinger *et al.* (2014) show a turning point between 80% and 94% for the old EU members and lower (around 50%) for new EU members.

This paper extends the existing empirical literature by analyzing the relationship between public debt and economic growth in Europe *by country*, distinguishing between the core (Belgium, France, Germany and the Netherlands) and periphery (Greece, Ireland, Italy, Portugal and Spain) countries, and the UK. Unlike the previous literature, this paper allows us both to study how these economies individually react to changes in public debt and economic growth and to shed light on whether there are differences in the reactions across countries.

The results of this analysis may be valuable for policymakers in order to design policies (especially, fiscal policy) adapted to the particular reactions of each country.

London, United Kingdom, November 18, 2011): "[…] *This high level of public debt was seen by some as a drag on long-term growth by many, but most economists, and definitely financial markets based on the spreads prevailing at that time, thought that advanced countries could not be affected by open fiscal crisis, by a roll over crisis. Following events will show that this was not true.*"

[2] Mario Draghi, President of the European Central Bank, indicated in his speech "Stability and Prosperity in Monetary Union" (University of Helsinki, Helsinki, Norway, November 27, 2014): "[…] *There are in principle two ways to protect the safe haven status of sovereign debt: the first is a strong fiscal governance framework that is implemented in a credible manner. This means having sufficient buffers over the cycle to absorb exceptional shocks, and having public debt levels that are sufficiently low in good times that they can rise in bad times without disrupting market confidence. The second way is some form of backstop for sovereign debt.*"

[3] See Reinhart *et al.* (2012) and Panizza and Presbitero (2013) for surveys on this issue.

[4] See Reinhart *et al*. (2003).

[5] Cecchetti *et al.* (2011) and Panizza and Presbitero (2014) analyze the effects of public debt in OCDE economies.

The rest of the paper is organised as follows. Section 2 describes the data and econometric methodology. Section 3 presents the empirical results. Section 4 concludes.

2. Data and methodology

2.1 Data

We consider the historical public debt database from IMF (available at http://www.imf.org/external/pubs/ft/wp/2010/data/wp10245.zip) since it is the longest available dataset. This database provides annual data of debt-to-GDP ratio. The last year available is 2012, but we have updated it by applying the growth rate of debt-to-GDP ratio available in Eurostat.[6] The countries considered are four core euro area countries (Belgium, France, Germany and the Netherlands) and five periphery euro area economies (Greece, Ireland, Italy, Portugal and Spain), as well as the UK. Therefore, we have data over the period 1970-2014 for most countries except for Belgium, France, Germany and Greece whose samples start in 1982, 1980, 1977 and 1979, respectively.[7] Real GDP annual data come from IMF's *International Financial Statistics* and are available since 1970 except for Portugal, whose data start in 1978.

Figure 1 presents the debt-to-GDP ratio for the six representative dates. It is observed that Belgium is a country with a long tradition of high debt-to-GDP ratio, although such a ratio is nowadays lower than in the 1980s and 1990s. The UK has had a relative low debt-to-GDP ratio (around 50%) up to the global crisis, when the ratio was increased almost till the double. Ireland reduced its debt-to-GDP ratio in the 1990s due to its high economic growth, but such a ratio has increased since the 2008 global crisis. Greece shows a growing debt level mainly since the global crisis and despite the debt relief of 2012. France, Germany, Portugal and Italy show an increasing debt-to-GDP ratio over time. The Netherlands had a relatively high debt-to-GDP ratio in the 1990s. This ratio was reduced in the first years of the 2000s and increased from the second half of the 2000s on. A similar behaviour to the Netherlands is found for Spain.

Table 1 shows a strong positive relationship between the two variables for two core euro area economies (France and Germany) and for all periphery euro area countries but Ireland (where a negligible relationship is found). The relationship seems to be moderate for the Netherlands and the UK and strongly negative for Belgium.

2.2 Methodology

We first analyze the order of integration by performing the Augmented Dickey-Fuller (ADF) tests. Once the order of integration is established and the case of non-stationarity in levels we perform the trace and maximum eigenvalue test statistics (see, *e.g.*, Johansen, 1995). We then follow the Toda and Yamamoto (1995) procedure to test for Granger causality between debt-to-GDP ratio and real GDP. Specifically, we study whether real GDP helps predicting the value of debt-to-GDP ratio and the other way around. Finally, when non-evidence of cointegration is found we consider a bivariate Vector Autoregression model with one lag:

$$Y_t = \alpha_0 + \alpha_1 Y_{t-1} + \varepsilon_t \tag{1}$$

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[6] Eurostat public debt data start in 1995 for most countries, but it starts in 2011 for Greece (a relevant country for our analysis).

[7] There is no data for Belgium in 1989. To solve this missing data, we have used the average between the previous and the following year.

where Y_t is a vector that contains the real GDP and the debt-to-GDP ratio in logarithms and ε_t is the generalization of a white noise process. We estimate by maximum likelihood and we obtain the generalized impulse response functions.[8] When cointegration is found, we use a bivariate Vector Error Correction model with one lag.

Table 1. Correlation coefficients.

	Core euro area				Periphery euro area				Others
BEL	FRA	GER	NDL	GRE	IRL	ITA	POR	SPA	UK
-0.72	0.95	0.95	0.30	0.67	0.02	0.92	0.59	0.73	0.36

Note: The entries refer to correlation coefficient between Debt-to-GDP ratio and real GDP.

Figure 1. Debt- to- GDP ratio. Core and peripheral European countries and the UK.
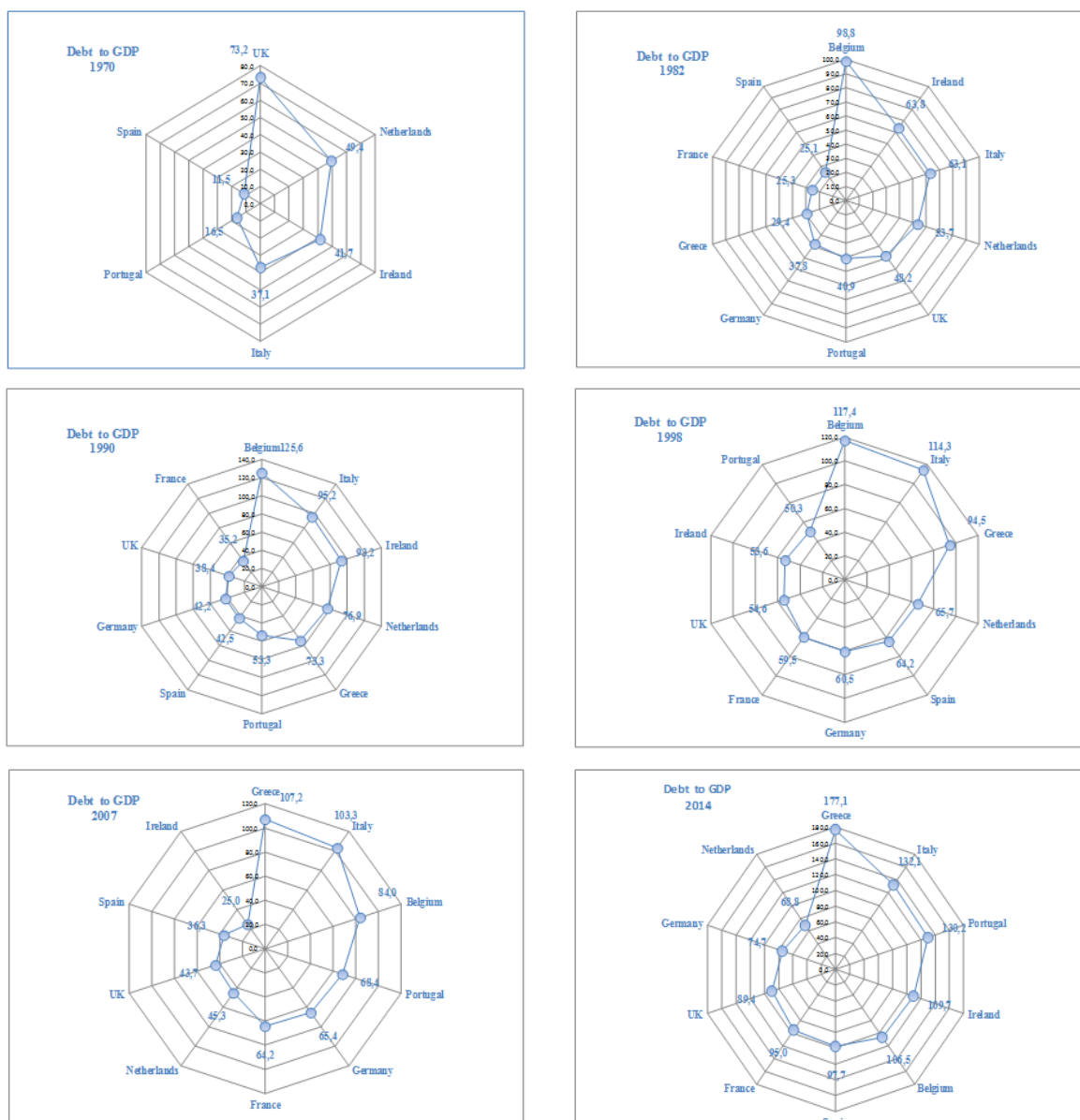
Source: IMF and Eurostat.

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[8] We include a step dummy (values equal to 1 from the reference year on, and equal to 0 otherwise) for Greece in 2012 in order to capture the Greek debt relief.

3. Empirical results

3.1 Unit root test and cointegration test

We analyze the order of integration by performing the Augmented Dickey-Fuller tests. The outcomes indicate that the variables are non-stationary in levels and stationary in first differences (see Table 2). Thus, the levels of real GDP and debt-to-GDP ratio are I(1) for all countries. Given the evidence of non-stationarity, we test for the existence of cointegration between the levels of debt-to-GDP ratio and real GDP by using the standard trace and maximum eigenvalue test statistics (see Table 3). The results indicate the lack of cointegration at the 5% significance level in all cases but Belgium, Italy and the UK. Therefore, in order to study how the economies individually react to changes in public debt and economic growth we consider a bivariate VAR model for all countries but these three cases (Belgium, Italy and the UK), where we use a bivariate VEC model.

Table 2. Unit root tests

			Model with constant and trend ADF	Model with constant ADF	Model without constant ADF
Belgium	Real GDP	Levels	-1.717	-0.417	7.088
		First differences	-6.290***	-6.362***	-2.166**
	Debt-to-GDP ratio	Levels	-1.679	-1.305	-0.668
		First differences	-3.015	-3.350**	-3.399***
France	Real GDP	Levels	-2.250	-1.178	3.012
		First differences	-4.960***	-4.929***	-2.747***
	Debt-to-GDP ratio	Levels	-2.424	0.167	2.225
		First differences	-3.637**	-3.611**	-2.466**
Germany	Real GDP	Levels	-1.948	-0.406	4.438
		First differences	-5.647***	-5.721***	-4.015***
	Debt-to-GDP ratio	Levels	-3.530	-1.025	1.380
		First differences	-4.053**	-4.107***	-3.565***
The Netherlands	Real GDP	Levels	-2.018	-0.414	2.436
		First differences	-4.128**	-4.179***	-2.811***
	Debt-to-GDP ratio	Levels	-1.643	-1.535	0.356
		First differences	-3.770**	-3.828***	-3.785***
Greece	Real GDP	Levels	-2.637	-1.642	0.301
		First differences	-3.041	-2.963**	-2.894***
	Debt-to-GDP ratio	Levels	-1.354	0.323	3.208
		First differences	-5.928***	-5.948***	-4.553***
Ireland	Real GDP	Levels	-2.137	0.086	1.652
		First differences	-3.020	-2.951**	-2.051**
	Debt-to-GDP ratio	Levels	-2.602	-2.637*	-0.564
		First differences	-2.824	-2.935**	-2.949***
Italy	Real GDP	Levels	1.317	-2.776	1.934
		First differences	-5.922***	-4.822***	-3.761***
	Debt-to-GDP ratio	Levels	-1.914	-0.849	1.487
		First differences	-3.592**	-3.652***	-3.043***
Portugal	Real GDP	Levels	-0.183	-1.423	1.328
		First differences	-3.863**	-3.556**	-3.011***
	Debt-to-GDP ratio	Levels	-1.245	0.219	1.700
		First differences	-3.717**	-3.599***	-3.020***
Spain	Real GDP	Levels	-1.889	-0.961	1.133
		First differences	-2.823	-2.857*	-2.239**
	Debt-to-GDP ratio	Levels	-2.485	-0.755	0.791
		First differences	-2.898	-2.849*	-2.507**

UK	*Real GDP*	*Levels*	-2.500	0.307	2.956
		First differences	-4.317***	-4.289***	-2.705***
	Debt-to-GDP ratio	*Levels*	-1.789	-1.466	0.413
		First differences	-3.275*	-3.058**	-3.022***

Note: One/two/three asterisks mean the rejection of the null hypothesis (the existence of a unit root) at a 10%/5%/1% critical level, respectively.

Table 3. Standard cointegration tests

	Core euro area				Periphery euro area					Others
	BEL	FRA	GER	NDL	GRE	IRL	ITA	POR	SPA	UK
Trace statistic										
None	21.586***	2.887	6.472	1.460	5.260	9.886	21.293***	9.425	6.067	17.063**
	(0.005)	(0.972)	(0.640)	(0.999)	(0.781)	(0.290)	(0.006)	(0.327)	(0.688)	(0.029)
At most 1	1.731	0.362	0.688	0.006	1.457	0.011	0.452	0.003	1.323	0.402
	(0.188)	(0.547)	(0.407)	(0.939)	(0.228)	(0.917)	(0.501)	(0.955)	(0.250)	(0.526)
Max-eigen statistic										
None	19.855***	2.525	5.784	1.454	3.803	9.876	20.840***	14.265	4.743	16.661**
	(0.001)	(0.973)	(0.641)	(0.998)	(0.880)	(0.220)	(0.004)	(0.253)	(0.774)	(0.021)
At most 1	1.731	0.362	0.688	0.006	1.457	0.011	0.452	0.003	1.323	0.402
	(0.188)	(0.547)	(0.407)	(0.939)	(0.228)	(0.917)	(0.501)	(0.955)	(0.250)	(0.526)

Note: For further details, see e.g. Johansen (1995). P-values appear in parentheses. One, two and three asterisks mean a p-value less than 10%, 5% and 1%, respectively.

3.2 Granger Causality

Table 4 indicates real GDP Granger causes debt-to-GDP ratio for Portugal and Spain at the 5% significance level and for Belgium, Greece and the UK at the 10% significance level. This Table also shows evidence of Granger causality from debt-to-GDP ratio to real GDP for Belgium, the Netherlands and Ireland at the 5% significance level. Therefore, we can conclude that the existence of Granger causality between real GDP and debt-to-GDP ratio (at least, in one direction) for seven out of ten economies considered.

*Table 4.* Toda-Yamamoto Granger causality test

	Core euro area				Periphery euro area					Others
	BEL	FRA	GER	NDL	GRE	IRL	ITA	POR	SPA	UK
Null hypothesis: Real GDP does not Granger cause debt-to-GDP ratio										
χ^2-statitics	3.735*	0.617	2.165	0.251	3.104*	0.919	0.030	9.923***	16.393***	2.976*
(p-value)	(0.053)	(0.432)	(0.141)	(0.616)	(0.078)	(0.338)	(0.862)	(0.002)	(0.000)	(0.085)
Null hypothesis: Debt-to-GDP ratio does not Granger cause real GDP										
χ^2-statitics	6.031**	1.295	1.344	9.260***	0.484	12.481***	1.587	1.937	0.475	1.021
(p-value)	(0.014)	(0.255)	(0.246)	(0.002)	(0.486)	(0.000)	(0.208)	(0.164)	(0.491)	(0.312)

Note: The first entry for each country refers to the χ^2-statistic test whose the null hypothesis is that real GDP does not Granger cause debt-to-GDP ratio. The second entry for each country refers to the χ^2-statistic test whose the null hypothesis is that debt-to-GDP does not Granger cause real GDP. In the implementation of the test by using the Toda and Yamamoto (1995) procedure, the optimal lag length (p) is found to be one and the maximum order of integration (dmax) is also one (given that our variables are integrated of order one). P-values appear into parentheses. One, two and three asterisks mean a p-value less than 10%, 5% and 1%, respectively.

3.3 Impulse Response Functions

This section assesses the impact of an increase of a 1% in real GDP on debt-to-GDP ratio (Figure 2) and the effect of an increase of a 1% in debt-to-GDP ratio (Figure 3) across countries. In doing so, we consider the generalized impulse response functions obtained from either a VAR model or a VEC model (on the basis of the results of the previous subsection).

Figure 2. Response of debt-to-GDP ratio to a 1% increase in real GDP: core euro area countries and the UK (a) and periphery euro area countries (b).
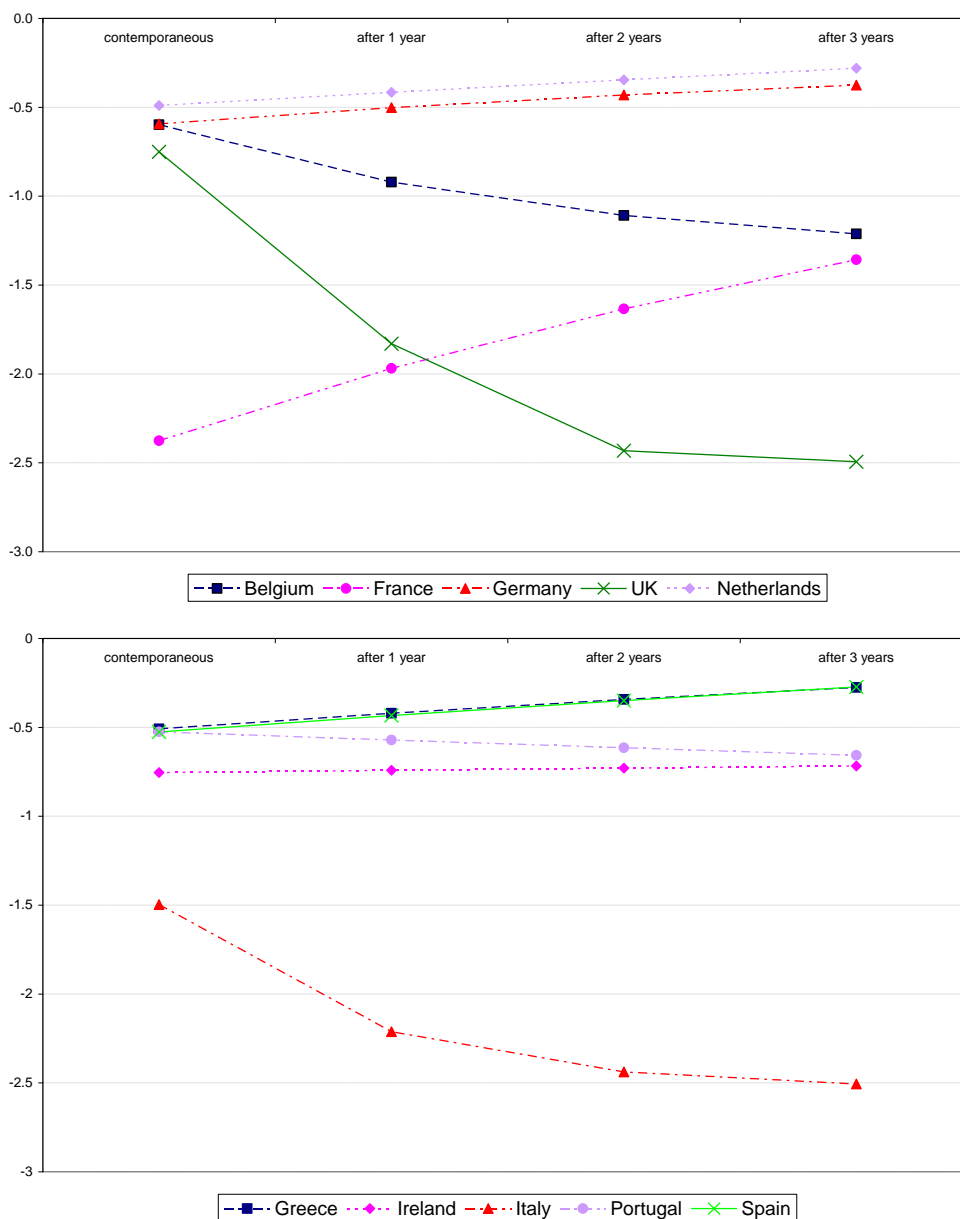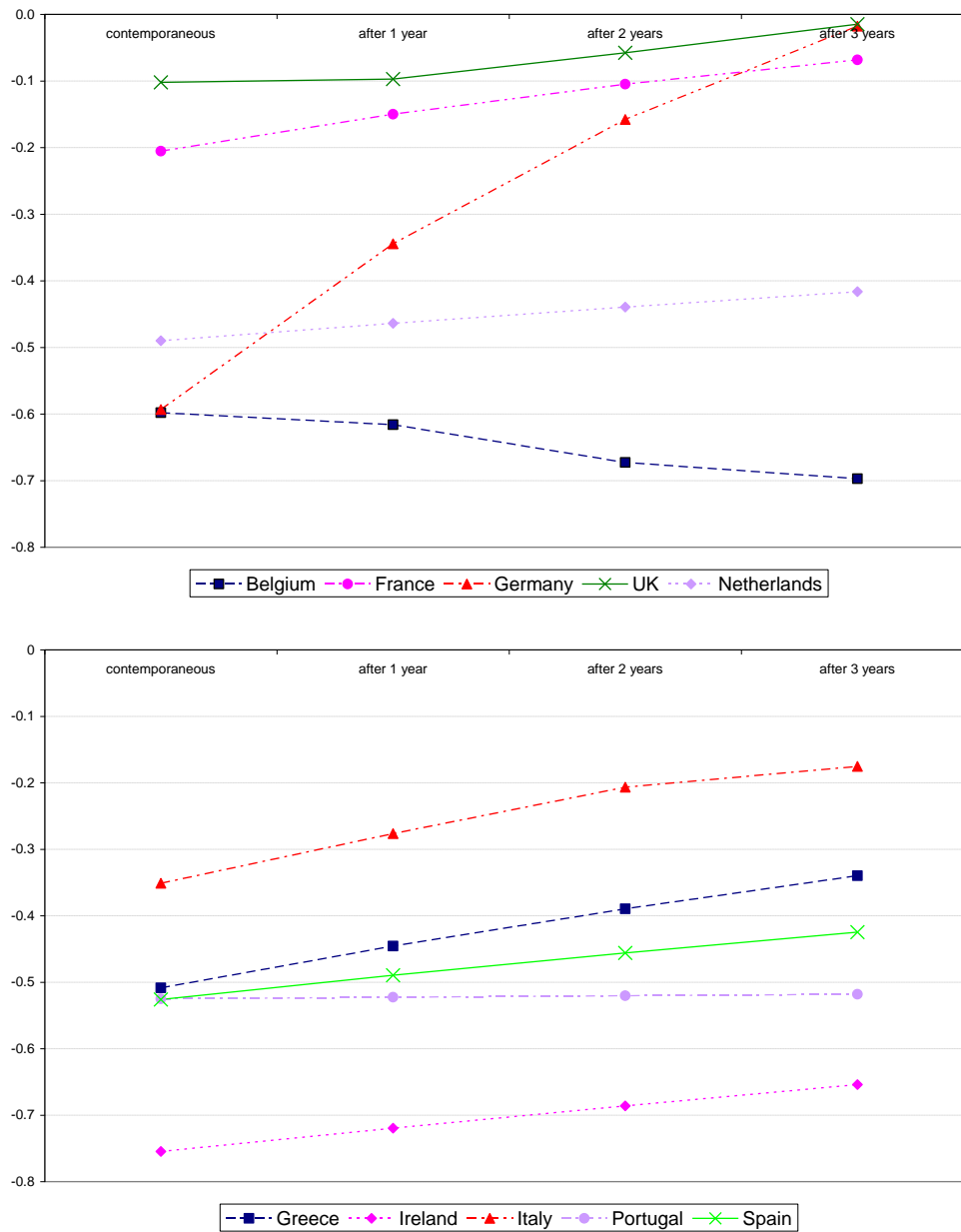

Note: Based on authors' calculations.

Looking at Figure 2, we observe that an increase of a 1% in real GDP leads to a reduction in debt-to-GDP ratio in all countries, although the pattern of responses differs somewhat across type of countries. The contemporaneous pass-through is more than 1% for France (2.4%) and Italy (1.5%), but not for the remaining countries.[9] The response tends to reduce over time in all core economies but Belgium and the UK, where the impact is more persistent and higher than in all periphery economies (but Italy). The effects on periphery countries are very similar between them except for Italy,[10] whose behavior is more similar to that of Belgium and the UK.

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[9] The contemporaneous impact is around 0.5% for three core euro area countries (Belgium, Germany and the Netherlands) and three periphery countries (Greece, Portugal and Spain), and a bit larger (around 0.7%) for Ireland and the UK.

[10] It is worth noting that Italy has been a country with a traditional high debt, especially since the 1990s.

Figure 3. Response of real GDP to an 1% increase in debt-to-GDP ratio: core euro area countries and the UK (a) and periphery euro area countries (b).

Note: Based on authors' calculations.

Figure 3 shows that an increase in debt-to-GDP ratio has a negative impact on real GDP, although the pass-through is not complete. Moreover, the pattern of response is similar in periphery countries, with a decline of the effect over time. However, the pattern of response differs for core economies. The impact is very small for France and the UK (around 0.2% and 0.1%, respectively) and is reducing over time. The Netherlands behaves similar to periphery countries, with an effect of around 0.5%. Finally, whereas Germany quickly adapts to the new situation of higher debt, the effect is permanent in Belgium.

4. Concluding remarks

This paper provides new empirical evidence on the impact of public debt on economic growth in the European core and periphery countries, as well as new evidence on the effect of economic growth on public debt. The paper also assesses the similarities in the pattern of responses across countries. The results of this study may be relevant for policymakers in order to design the most appropriate policies (especially, fiscal policy) for each country given their reactions.

Our findings indicate that higher levels of debt-to-GDP ratio have a negative impact on economic growth in all countries, with the pattern of response being similar for periphery economies and different for core economies. Moreover, we obtain that economic growth reduces debt-to-GDP ratio (with relatively homogeneity for periphery countries and heterogeneity for core countries), which gives rise to second-round positive effects on the economy. Therefore, economic growth seems to be essential to reduce public debt and improves the general economic situation.

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